

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MERCEDES BENZ USA, LLC
Petitioner,

v.

DAEDALUS PPRIME LLC
Patent Owner

IPR2023-01343
Patent 8,898,494 B2

Record of Oral Hearing
Held: November 13, 2024

Before WILLIAM V. SAINDON, THOMAS L. GIANNETTI,
and GREGG I. ANDERSON, *Administrative Patent Judges*.

APPEARANCES:

ON BEHALF OF THE PETITIONER:

SCOTT HUGHES, ESQUIRE
Hogan Lovells Us LLP
555 13th Street NW
Washington, DC 20004
(202) 637-3659
scott.hughes@hoganlovells.com

ON BEHALF OF THE PATENT OWNER:

TAREK FAHMI, ESQUIRE
Ascenda Law Group
2150 N First Street, Suite 420
San Jose, CA 95131
(866) 877-4883
tarek.fahmi@ascendalaw.com

The above-entitled matter came on for hearing on November 13, 2024, commencing at 2:00 p.m., via video teleconference.

P R O C E E D I N G S

- - - - -

JUDGE GIANNETTI: All right, well good afternoon, everyone. We're here for our second argument of the day. This is Case IPR-2023-01343. The caption of the case is Mercedes-Benz USA vs. Daedalus PPrime LLC.

It involves Patent 8,898,494. I am Judge Giannetti. I will be presiding today. With me on the panel, Judge Saindon and Judge Anderson. Let's get our appearances. Who is appearing for the Petitioner?

MR. HUGHES: This is Scott Hughes from Hogan Lovells on behalf of Petitioner, Mercedes-Benz USA, LLC.

JUDGE GIANNETTI: Scott Hughes. Is that right, Mr. Hughes?

MR. HUGHES: Yes. That's correct.

JUDGE GIANNETTI: Okay, Mr. Hughes. And who is appearing for the Patent Owner?

MR. FAHMI: Good afternoon, Your Honor. It's Tarek Fahmi on behalf of the Patent Owner.

JUDGE GIANNETTI: All right, Mr. Fahmi. Any other lawyers or clients present for either the Petitioner or the Patent Owner?

MR. HUGHES: Is there, we may have Jacob Felicetty up. He's with me in the room just helping assist on the slides.

JUDGE GIANNETTI: All right, but you'll make, be making the presentation, Mr. Hughes?

MR. HUGHES: That's correct.

JUDGE GIANNETTI: Okay, well I'll go over some of the

1 guidelines I went over this morning for the benefit of our new counsel here
2 and also for the record. Please when you're not speaking, please mute your
3 microphone so we don't hear background noise.

4 If you haven't spoken for a while, please identify yourself before
5 you speak. We have the record, the complete record so you don't have to,
6 you don't have to share your screen unless you want to do that. You're
7 certainly free to do that if that's what you prefer.

8 But if you do make references to the record, please give us a paper
9 number, exhibit number so that we can follow along in our copies. And the
10 same is true also for the use of demonstratives. You are free to share those
11 with us.

12 Or just give us the slide numbers, but either way, give us the slide
13 numbers so that the record will reflect which demonstratives you're referring
14 to. Any technical problems, our staff is here to help you, but please let us
15 know right away.

16 We want to make sure that you have an opportunity to be heard.
17 We have public lines today so I don't expect that you'll be getting into any
18 confidential material, but that's something to keep in mind. Each party has
19 60 minutes.

20 Each party may reserve time for rebuttal or for sur-rebuttal in the
21 case of the Patent Owner. You can reserve a reasonable amount of time up
22 to half of your initial time for rebuttal. The order of events will be first the
23 Petitioner's presentation, followed by Patent Owner's rebuttal, then the
24 Petitioner's rebuttal, and then the Patent Owner's surrebuttal.

25 I'm going to ask you to stay on the line afterward. We have a court
26 reporter, Ms. Gibson, who will be preparing a transcript of the proceedings.

1 We want to make sure that she has an accurate record so please stay on the
2 line after the argument is over in case she has any spelling problems.

3 The panel will not stay on the line, but I would ask counsel to
4 remain on the line so that she can make sure that she has a good record of
5 the proceedings. I think that's it from our standpoint. Yes, please any
6 questions from the Patent Owner?

7 MR. FAHMI: No, Your Honor. We're ready for the Patent
8 Owner.

9 JUDGE GIANNETTI: Okay. And anything from the Petitioner?

10 MR. HUGHES: No, Your Honor. We're ready as well.

11 JUDGE GIANNETTI: All right, Mr. Hughes, whenever you're
12 ready, you may proceed.

13 MR. HUGHES: Okay. Good afternoon, Your Honors. We're here
14 for IPR 2023-01343 related to U.S. Patent No. 8,898,494. And I'm Scott
15 Hughes on behalf of Petitioner, Mercedes-Benz USA. Going onto Slide 2,
16 I'm going to go through what we're going to talk about today.

17 First, we'll give an introduction including of the '494 Patent and
18 some of the limitations and the claims. And then we're going to go through
19 some of the disputes between the parties. The first dispute is whether our
20 reference to Bose discloses a balancing control limitation in the '494 Patent.

21 The second dispute is whether a reference to White discloses a
22 core workload monitor and the third dispute we'll talk about is whether
23 White discloses receiving workloads based on an integrated circuit limit.
24 I'm going on to Slide 4. This is an overview of the '494 Patent.

25 JUDGE GIANNETTI: Mr. Hughes, may I just, I neglected to ask
26 you whether you were reserving time for rebuttal and how much.

1 MR. HUGHES: Yes, Your Honor. We'll reserve at least ten
2 minutes for rebuttal please.

3 JUDGE GIANNETTI: Okay, thank you much and you can
4 proceed.

5 MR. HUGHES: Okay. So the '494 Patent discloses an apparatus,
6 method and system for balancing performance and power between
7 components of an integrated circuit and it does this based on measured
8 workloads. Now if the component is identified as a bottleneck, it's
9 performance may be an increased to resolve that bottleneck.

10 Now if the integrated circuit is already operating at a power or
11 thermal limit, the increase in performance is counterbalanced by a reduction
12 or cap in another component's performance. Going on to Slide 5, we can see
13 Claim 1 of the '494 Patent which is one of the two independent claims we'll
14 be talking about today.

15 Claim 1 of the '494 Patent is related to an integrated circuit and it
16 recites a first core, a cache memory, a communication bus that connects the
17 first core in the cache memory, a core workload monitor to determine a
18 workload for the first core, a bus workload monitor that determines the bus
19 workload for the communication process and then there's balancing control.

20 And this balancing control is going to tune the power allocation
21 between the first core in the communication bus and it does this by
22 comparing workloads to workload thresholds and checking capacities.
23 Going on to Slide 6, this is the other independent claim that we were talking
24 about which is independent Claim 4.

25 It has some common elements with Claim 1 and Claim 4, again,
26 really recites receiving a bus workload and a first processing element

1 workload, determining if the processing element is a performance
2 bottleneck, determining if the communication bus is able to accommodate
3 the bus workload and then it, there's capping and bus frequency of the
4 communication bus.

5 And the second processing element and it does that when that first
6 processing element is a performance bottleneck and the communication bus
7 is able to accommodate the bus workload and then there's increasing a cap
8 on the bus frequencies of the communication bus and it does that in response
9 to determining that the first processing element is a bottleneck and that the
10 communication bus is not able to accommodate the bus workload.

11 Going on to Slide 7, we can see here on the right-hand side Figure
12 9 of the '494 Patent which lays out some of these components that were
13 recited in the claims. As we can see, Figure 9 depicts an integrated circuit
14 that dynamically balances power between cores.

15 And these cores are 910 and 905 and the communication bus
16 which we see is 950. Now we have GPU cores 910 or graphic processing
17 units and CPU cores 905. And those are associated with workload monitors.
18 We have a GPU workload monitor 911, and a CPU workload monitor 935.

19 And similarly, we have a communication bus workload monitor
20 951 and that's going to monitor the workload of that communication bus
21 950. And in this system here, power is bounced among the components
22 based on those workloads that are measured by these workload monitors.

23 Going on to Slide 8, we're going to go through what is workload in
24 the context of the '494 Patent. And it's important to see that the '494 Patent
25 broadly describes what a workload is. It broadly describes determining a
26 workload to include any known method for determining activity or any other

1 metric for determining use of those elements.

2 And the '494 Patent further explains that there are a multitude of
3 potential workload measurements and that the components used to measure
4 workload may vary. And we can see this on the right-hand side of Slide 8
5 where we have an excerpt of Column 9 from the '494 Patent.

6 As we see at the top, it specifically calls out that determining the
7 workload includes any known method for determining activity or any other
8 metric for determining use and then again indicates that the measurement of
9 workload can be any of a multitude of potential measurements. It's not any
10 one specific thing.

11 So now going on to Slide 9, we're going to get into the first
12 dispute. And this is whether the reference to Bose discloses the balancing
13 control limitation. First, on Slide 10, we have an overview of Bose. Now,
14 Bose, like the '494 Patent discloses the system and method for controlling
15 power and performance in a microprocessor system.

16 Particularly, Bose discloses that its system includes a power
17 performance monitoring and control unit which it calls a PMCU. And this
18 PMCU can dynamically manage chip power between the components to
19 meet the power limit with the expectation of increased system performance.

20 And Bose indicates at Column 4, lines 30 to 32 that one objective
21 of the PMCU is to address the challenge of reducing power by exploiting the
22 variability within a workload and between different workloads. Going on to
23 Slide 11, we see here Figure 1 of Bose which shows the components and as
24 you'll see, these are very similar to the components recited in the claims that
25 we, of the '494 that we just talked about.

26 In particular, '494, the Figure 1 of Bose is depicting a high-level

1 overview of this PMCU organization. And we can see that there's
2 processing cores 112-1 through 112-R. There's an interconnect 108 and that
3 would be the communication bus.

4 We can see that in the middle. I see on the slide it says 116 there,
5 but as we can see in the figure, the interconnect or the bus is 108 and 116 is
6 going to be its monitor. Now, there's also an L2L3 cache hierarchy 106 and
7 then there's local PMCUs.

8 And we can see that there's local PMCUs 118 associated with the
9 cores 112 at the bottom of the figure there and those are going to monitor the
10 activities of those cores 112. There's also a PMCU 116. We see that in the
11 interconnector communication bus 108.

12 That's going to similarly monitor the activity of that
13 communication bus and finally we have a local PMCU 114 and that's
14 associated with the cache hierarchy up at the top at 106 and again, it's going
15 to monitor the activity of that component.

16 Now in addition, there's a global PMCU 110 and this global
17 PMCU is going to dynamically adjust the power mode for each element
18 based on various considerations that we'll talk about. And importantly, this
19 global PMCU is going to be monitoring and adjusting the power for the
20 entirety of the system in order to optimize overall system performance.

21 Going on to Slide 12, we're going to look at this balancing control
22 limitation from Claim 1. And we see it here on the screen. Claim 1 recites
23 balancing control adapted to receive the bus workload from the bus
24 workload monitor and to dynamically tune power allocation between the
25 first core and the communication bus based on a power limit for the
26 integrated circuit and a comparison between the bus workload and a bus

1 workload threshold.

2 Going on to Slide 13, Bose discloses monitoring workload. Now,
3 what Bose discloses is that these PMCUs monitor performance statistics.
4 Like instructions per cycle. And then, the global PMCU receives these from
5 the local PMCUs and stores those monitored performance statistics
6 including the instructions per cycle and a phase history table 213 and it's
7 going to later use them when adjusting the power modes.

8 Looking at the right-hand side of Slide 13, we have an excerpt
9 from Bose at the top from Column 6. And again, this is indicating that
10 there's local PMCUs monitoring the activities including of the interconnect
11 108 which is the communication bus.

12 And those performance statistics that they're monitoring include
13 things such as cache miss rates, branch-misprediction rates, instructions per
14 cycle and other things. Now those, at least those instructions per cycle are
15 an indication or are a workload of those components.

16 And even Patent Owner's expert Dr. Brogioli agreed with this
17 when he was asked at deposition as we see at the bottom of the slide if
18 instructions per second would be a workload. He said, so that may be
19 something that falls under workload that I talk about.

20 Going on to Slide 14. Bose also discloses the claimed workload
21 threshold. In Bose, there's a predicted power and performance for these
22 different modes. And the predicted power and performance represents a
23 workload threshold for giving component working in the associated power
24 mode as was explained by Petitioner's expert, Mr. Wyatt at paragraph 53 of
25 his declaration which was Exhibit 1003.

26 Now we see on the right-hand side of Slide 14 we have an excerpt

1 from Bose at Column 7 on the top and this indicates that the global PMCU
2 chooses appropriate power optimization for each core element and that they
3 could be packaged into different power modes based on the power
4 performance trade-off characteristics.

5 And at Column 8, it indicates that the power performance trade-off
6 table 206 includes predicted power and performance for each power mode.
7 So that is for each power mode that this may be in, this global PMCU is
8 determining what the predicted power and performance or the available
9 power for that entire mode may be that it could assign out in that mode.

10 Going on to Slide 15, Bose, in fact, discloses a comparison of
11 workload-to-workload threshold.

12 JUDGE GIANNETTI: Mr. Hughes, let me address you. Let me
13 interrupt you briefly here. What would be an example of a power mode?

14 MR. HUGHES: So a power mode we can see there's and we can
15 see here, for example, I can give an example looking at Column 9 of Bose
16 which you have on the right-hand side of Slide 15, the different power
17 modes are different modes that these could operate at.

18 So you have an overall power budget and then you may want to
19 put different power up, put different cores or elements into these different
20 modes. So you can have a lower power mode for some and then you can
21 increase to a higher power mode.

22 For example, like it says here if the cores are exceeding whatever
23 their budget was, you can move them into a higher power mode. So there's
24 these different modes that you can operate, the different, you know, parts of
25 the system at and by balancing among those different modes or signing out
26 those different modes, you can make sure that power has increased to

1 components that will need it.

2 And power can be decreased to components that don't need it to
3 balance the overall power for the system.

4 JUDGE GIANNETTI: Do those modes change over time?

5 MR. HUGHES: So the modes assigned to any particular core can
6 change over time. And what the system is doing is it's determining what
7 these power modes may be. And it's doing that and then assigning them out
8 and we can see it here where it says it, you know, state 311 this would be,
9 you know, that little PMCU assigning out a certain power mode.

10 So if your question is, you know, can the power mode assign to a
11 certain core change over time, you know, the answer is yes and it's doing
12 that based on what's being monitored.

13 JUDGE GIANNETTI: Okay, thank you.

14 MR. HUGHES: So as I mentioned, Bose is going to assign power
15 mode based on a couple of things. One of them is the real time statistics and
16 the other is power performance trade offs for each of those modes. Now the
17 real time statistics that we talked about earlier come from there's local
18 PMCUs that are monitoring the activity of the components.

19 Those are stored in the power history table 213 and those include
20 those monitored statistics including the monitored workload activity. Now
21 the power performance tradeoff for each mode is stored in a power
22 performance trade-off table 206.

23 And that is the predicted power and performance which is our
24 workload threshold. Now here we see by comparing the monitored
25 workload, there's real time statistics on the workload. With that workload
26 threshold, you know, the predicted power and performance for that power

1 mode, the global PMCU determines whether it needs to assign a new power
2 mode and adjust accordingly. Now on the right-hand side of Slide 15 --

3 JUDGE GIANNETTI: Mr. Hughes, where is that comparison
4 performed?

5 MR. HUGHES: Yes, Your Honor, I'm getting to that now. As
6 we --

7 JUDGE GIANNETTI: Okay, go ahead. Just go ahead with your
8 argument then, but just keep in mind my question.

9 MR. HUGHES: Yes. And your question was where is that
10 comparison at?

11 JUDGE GIANNETTI: Yes.

12 MR. HUGHES: And you can see it here at Column 9. We see that
13 when this global PMCU is in state 311, and it's going through and it's
14 actually doing this balancing and assigning out the power budget and the
15 power modes, it's doing it with consideration of, if you see in the beginning
16 of the highlighted there, so it's doing it with consideration of certain things.

17 And one of those towards the middle is the real-time statistics
18 which are stored in that base history table and another is the power
19 performance trade off of each mode for each thread and each core which are
20 stored in the power performance trade-off Table 206.

21 So again, it's specifically telling us here that when it's doing this,
22 it's taking into consideration both of those.

23 JUDGE GIANNETTI: Well, what is it comparing? What exactly
24 is being compared here?

25 MR. HUGHES: So what's being compared here is you have the
26 predicted power and performance for that given power mode. Then you're

1 looking at the real time statistics. And that predicted power and
2 performance, and Bose talks about this including at Column 8 and Columns
3 12, that can indicate how much power you may have available to assign out.

4 So when it's looking at the monitor activity here, what's the real,
5 you know, real time statistics on power and performance, it's comparing that
6 to the power budget or what's available in the threshold for those predicted
7 power and performance for that mode.

8 JUDGE GIANNETTI: So it's comparing the actual performance
9 against the budget? Is that what you're saying?

10 MR. HUGHES: Yes. It's comparing the actual performance
11 against that predicted power and performance in those trade-off tables.

12 JUDGE GIANNETTI: And where is that said? I'm looking at this
13 yellow thing here.

14 MR. HUGHES: So here --

15 JUDGE GIANNETTI: Where would you point to in that statement
16 there that indicates that the comparison is being made?

17 MR. HUGHES: So here in this statement we have that it's doing it
18 with consideration of. We can see that right at the top here. So it's assigning
19 the power budget and the power mode with consideration of those real time
20 statistics and the monitored performance.

21 And if we look at Column A of Bose, the power of performance
22 table, this is at lines 35 to 44, Bose indicates that the power performance
23 trade-off table includes the predicted power and performance for each power
24 mode or the global PMCU controller reads through connection to assist in
25 calculating the power modes and power budgets for each core. And it --

26 JUDGE GIANNETTI: Okay.

1 MR. HUGHES: -- updates that trade-off table.

2 JUDGE GIANNETTI: How frequently is that comparison taking
3 place?

4 MR. HUGHES: So that comparison would be taking place as it's
5 doing, you know, when it's into the state 311, that's what it's going through.
6 So and it's this is continuing. Oh, it says here like we see here at the actual
7 power is not below or equal to, there's this loop.

8 So we've got this loop that's continuously transitioning through
9 these different states and when it gets to state 311, it's going to do this
10 assignment out of the power budget and the power modes and that's when
11 it's going and taking into consideration with the real-time statistics and the
12 information that's in that power performance trade-off table. And that's --

13 JUDGE GIANNETTI: Okay.

14 MR. HUGHES: -- including the predicted power and
15 performance.

16 JUDGE GIANNETTI: Thank you.

17 JUDGE SAINDON: Counsel, while we're on this topic, this is
18 Judge Saindon, this Slide 15 you have this quote from Column 9 of Bose. Is
19 this what's shown in Figure 3 or I suppose Figure 4 is also close, but is this
20 the comparison in Item 303 of Figure 3?

21 MR. HUGHES: So this is included in Figure, it actually comes
22 from right here. We've got, looking at Figure 3 here, let me get to just pull
23 up the Bose reference just real quick. If we look at Figure 3 of Bose, we
24 have this 311 here, command assign power budget mode to satisfy overall
25 power budget and update decision history table and you can see it's looking
26 at power modes and power budgets at step 310.

1 And 311 was that assignment there. So yes, this is what's, what
2 we're talking about here is what's depicted in Figure 3. And then Figure 4 is,
3 again you know, something similar where we're doing the same thing and
4 we can see, for example, at step 4 or 5, we're also assigning the power
5 budget and modes again and maintaining the history and the trade-off tables
6 and predictor as the software structure.

7 JUDGE GIANNETTI: So I'm looking, I'm sorry, go ahead. Go
8 ahead, Judge Saindon.

9 JUDGE SAINDON: I was just going to ask: so this item 303, is
10 this the claimed comparison between the bus workload and the bus workload
11 threshold?

12 MR. HUGHES: So item 303 here is a state where we're looking at,
13 we see here that it's checking, it's the actual total power below so we're
14 checking, you know, predicted power total power max. We're looking there,
15 you know, from that. It's going to move on.

16 So that state 303 is in fact, you know, that's the actual total power
17 and the power budget. Now again, the power budget is what we have
18 overall. And the predicted power and performance go into that.

19 Because those, the predicted power and performance for those
20 modes that are assigned, that's what's indicating what the total power budget
21 can be. For example, if you need to change power, the only way to know
22 how much power is available is to look at the predicted power and
23 performance trade off.

24 We can see that, for example, in Column 12 at lines 42 to 45 where
25 it indicates that the amount of such change in power or performance is
26 available from the power performance trade-off table maintained in the

1 system.

2 JUDGE SAINDON: So Counsel, based on your answer, does
3 Figure 3 not have the comparison part of the limitation shown?

4 MR. HUGHES: Well as shown? No, it doesn't, the one thing is
5 Bose doesn't use the work compare here, but we do see in the figure where
6 checking predicted power in Step 303, you know, we are checking predicted
7 against the actual.

8 And then we have in step 311, you know, there is this assignment
9 of the power budget mode to satisfy the overall power budget and the
10 optimal performance. And as we see here in Column 9, it's within that step
11 there that we have these considerations being taken, that are taking place.

12 We have the consideration of the real time statistics. We have the
13 consideration of the, you know, predicted power and performance levels. So
14 it's within these steps that the comparison is being done as the system goes
15 through this loop.

16 JUDGE GIANNETTI: So just to put a fine point on it, Mr.
17 Hughes, 303 is not the comparison that you're relying on. The comparison
18 that you're relying on takes place in Box 311, Figure 3. Is that right?

19 MR. HUGHES: That's what we're showing here.

20 JUDGE GIANNETTI: All right, thank you.

21 MR. HUGHES: And I will just say, you know, again, that overall
22 predicted power is part of this overall process. So, you know, is that also a
23 comparison? Yes, you know, we now do the and do the predictive power
24 performance, tradeoffs going to that.

25 You know, they do, but like I said, we're looking at specifically
26 where it talks about that predicted power and performance is within this step

1 here.

2 JUDGE GIANNETTI: Step 311?

3 MR. HUGHES: Yes.

4 JUDGE GIANNETTI: Okay, thank you.

5 MR. HUGHES: And now, the next question is, does Bose disclose
6 that workload threshold? Now Patent Owner argues that the predicted
7 power and performance does not represent workload threshold because it's
8 dynamically updated over time.

9 And so it can't be a threshold which according to Patent Owner it
10 needs to be a singular or fixed value. But there's nothing in the '494 Patent
11 to support that. The '494 Patent gives no indication anywhere in the claims
12 or specification that a threshold has to be a singular fixed value.

13 And if anything, you know, while the predicted power and
14 performance may be dynamically updated, this in no way precludes it from
15 being used as a threshold. If anything, you may just have a dynamically
16 changing threshold that you're comparing to as you go through that loop.

17 Going on to Slide 17, Patent Owner also argues that Bose has no
18 need for any comparison of workload-to-workload thresholds because direct
19 information about the power levels is available in various tables.

20 But remember we have a global PMCU here that's determining and
21 assigning out the power for the overall system. And that global PMCU
22 needs to determine when a higher or lower power mode is required which is
23 done by comparing the monitor, power and performance, i.e., the monitor
24 workload to that predicted power and performance of the workload
25 threshold.

26 And we can see here, you know, at Column 9 minus 25 to 30

1 where in Bose it's talking about doing that. This is, again, that state 311 and
2 we're going to be assigning these power modes. So, you know, the idea that,
3 you know, there's direct information about power levels available, it still
4 needs to do the comparison to determine what the available power is and to
5 make these changes so that you don't exceed, you know, everything fits into
6 the overall power budget.

7 Now going on to Slide 18, we're now going to get into disputes
8 regarding the White reference that was used. And the first dispute as we can
9 see here on Slide 18 is whether White discloses a core workload monitor.

10 And this is going to be with respect to independent Claim 1 and
11 some of its dependent claims. Now, first on Slide 19, we have an overview
12 of White. White discloses a system and method for operating components of
13 an integrated circuit at independent frequencies and/or voltages.

14 In particular, White discloses that there can be multiple logic cores
15 and these can be configured to operate at frequencies and voltages
16 independently of each other. And, again, the operating frequency and
17 voltage of a logic core may be independently adjusted for various reasons
18 including power management and temperature control.

19 And that temperature control is also related to the power
20 management. If your temperature is getting close to a maximum, you need
21 to decrease the power in the system to bring the temperature down so the
22 system continues to function.

23 Here on Slide 20, we have Figure 1 of White on the left. And we
24 can, again, see that this includes those same elements we saw in Claim 1 of
25 the '494 Patent. We have this high level block diagram of the integrated
26 circuit in White and it includes logic cores 120A and 120B.

1 There's a common bridge logic 110 which is a communication bus
2 and there's memory subsystem 170. While it's not shown on this figure,
3 other figures in White also indicate that there's an L2 cache memory within
4 the system as well.

5 Going on to Slide 21, White does in fact disclose a core workload
6 monitor as we see in Figure 2A on the left-hand side of the slide. There's
7 power management logic 200 in White and Figure 2A is depicting a multi-
8 core integrated circuit in which the operating voltages and frequencies for
9 each of multiple logic cores are controlled by power management logic.

10 And we can see that White explains this, including at Column 14,
11 lines 32 to 38 where this power management logic 200 is configured to
12 monitor and adjust the operating frequency and/or voltages of the different
13 portions of the integrated circuit including the logic cores and that common
14 bridge logic 110 which is the communication bus.

15 Going on to Slide 22, we see here on the left Claim 1 again recites
16 a core workload monitor configured to determine a core workload for the
17 first core. Now, again, as we discussed earlier, the '494 Patent specification
18 itself explains that this determination of a workload is something very broad.

19 It includes any known method for determining activity or any other
20 metric for determining use. Going on to Slide 23, White discloses power
21 management logic that monitors and adjusts the operating frequency and/or
22 voltage of the various components to adjust their power consumption.

23 An operating voltage and frequency of a component reflect the
24 workload of that component. So again, where this control power
25 management logic is monitoring and adjusting the operating frequency and
26 voltage, it is in fact monitoring their workload.

1 The more workload, the more frequency, the more voltage. If you
2 have less workload, you can reduce the frequency voltage so these are
3 indications or metrics used that can tell you about the activity or use of the
4 different components.

5 And if we go to Slide 24, Petitioner's expert, Mr. Wyatt explained
6 this including a paragraph 103 of this declaration which was Exhibit 1003.
7 He says a POSITA would have understood that the power management logic
8 in White monitoring the operating voltages and frequencies of the logic core
9 120A and common bridge logic 110 is monitoring the workload of those
10 components.

11 It was well understood that operating frequency and voltage of a
12 component reflect the activity and use or workload of that component.

13 JUDGE SAINDON: Counsel, I have a question. This is Judge
14 Saindon again. So looking at the operating frequency and voltage, we heard
15 this morning that these are basically the drivers of the power. You know,
16 there's a physical relationship there.

17 What I am seeing here is that you're controlling the power, which
18 is to say the frequency and voltage, those are the levers you have to control
19 the power. It seems almost circular to say that you are controlling the power
20 by controlling the power.

21 Isn't the workload something other than the power that you then
22 use? And the power is just your throttle, so to speak? But you need to
23 monitor how it's being used to know: do I increase the throttle or decrease
24 the throttle? Can you speak to that?

25 MR. HUGHES: Yes, and like you said, you know, power is
26 related to workload. If a component has a higher workload, it's going to

1 need more power. You're going to need to assign more power to it. You
2 know, the Patent talks about that, you know, including within these claims
3 that one thing to do is to increase or decrease the frequencies here because
4 of, you know, for this workload management.

5 Now, you know, and like you said, it's kind of these are the levers,
6 but as you know, White explains, if you're changing the operating frequency,
7 for example, you can't just do that for a component and assume it's going to
8 work. So you have to monitor what is the frequency of these components?

9 It's monitoring that. If it changes, then needs to see do we have a
10 compatible voltage or do we need to change the voltage for that component?
11 If we're going to do that, do we need to go and adjust the frequency and
12 voltage of the other components so that the overall power management of
13 the system is done?

14 So even if the system is kind of using frequency and voltage like
15 you said to control the power, anytime that there is a change in that
16 frequency or voltage that we're going to see because White's monitoring that,
17 we then need to go and check everything else to make sure that we've got
18 compatible frequencies and voltages and make adjustments throughout the
19 system.

20 JUDGE SAINDON: Well, Counsel, I guess to use an analogy, say
21 I have a lawnmower and I have it at some throttle setting and I'm listening to
22 it and I go to a thick patch of grass and I hear the engine bogging so I have
23 to increase the throttle.

24 Now it sounds to me like in this example, the workload is, you
25 know, the RPMs of the engine and the throttle is what I'm controlling in
26 order to manage my workload and it seems to me in the claims, the

1 frequency and voltage, which are the drivers of the power, is what you're
2 setting, but you need to know how to set it by monitoring something other
3 than that.

4 You know, if you're setting, you know, the power to level X and
5 you need to know whether to change it, well you've already set it to X so
6 you need to look at something else to know whether you should set it X plus
7 1, X minus 1, whatever. So anyway, could you, could you speak to that?

8 MR. HUGHES: Yes, so it's looking at both. And I think that's
9 important. You know, in your situation where we have the throttle, that
10 throttle is set at one level and that's it. Here we're looking at both operating
11 frequency and voltage.

12 And we can see including in Figures 3 and 4, there's checks that
13 needs to be done to determine if, for example, we have a new frequency.
14 We need to increase the power so we've got a new frequency. What we have
15 to check is that compatible?

16 And if it's not, we may need to determine a new frequency and
17 similarly, you know, we can see in claim, in our Figure 3 here we may need
18 to do the same thing with voltage. So we're monitoring these continuously
19 and if we see that change in frequency and voltage, you know, that can
20 indicate that okay, that component's now going to have more activity or use.
21 So what do we need to do?

22 Well, we see we got an increase in frequency or voltage going to
23 this component, we've now got to go and check what the power is and make
24 sure we can balance frequency and voltage throughout the other
25 components. So there's two, you know, on like the situation where we just
26 have a singular throttle, here even if you do set one or the other, you do need

1 to monitor, check what that is.

2 That is indicating there's going to be, you know, a different use or
3 activity level for that component, but then there's additional steps that this
4 needs to do to go through and balance the frequency and voltage across the
5 system.

6 JUDGE SAINDON: So to follow up on that, if a power level is
7 set, you're saying that independent of that setting, the system could change
8 frequency or voltage and that would indicate over or under use?

9 MR. HUGHES: Well if you, what this is doing is it's checking to
10 see, you know, do we need to change the operating frequency of a
11 component? And then if it's going to do that, we now have a new frequency.
12 It's continuously monitoring these frequencies.

13 And similarly on the voltages. So when it detects that change,
14 what it's going to do is say oh, we've got a change in frequency here. This
15 new frequency is indicating this component's going to be doing different
16 activity level. Okay?

17 There's going to be different workload here. What do we need to
18 do to make sure we're setting the appropriate corresponding voltage or do we
19 have that? And what are we doing to set the frequency and voltage of the
20 other components within our overall power budget?

21 JUDGE SAINDON: Okay. I think I understand your point.

22 JUDGE GIANNETTI: Mr. Hughes, I have a question --

23 MR. HUGHES: Yes.

24 JUDGE GIANNETTI: -- Judge Giannetti again. Doesn't
25 workload have a time factor involved in it whereas what you're talking about
26 is monitoring the instantaneous frequency and voltage? Don't you have to

1 look at those over time to see what the workload really is?

2 MR. HUGHES: Well it depends on what, you know, your
3 definition of workload is going to be. You know, we saw here in this Patent
4 the way that they've described it is very broad. And the specification itself
5 tells us that determining workload includes any method for determining
6 activity or any metric for determining use.

7 So if you do look at something instantaneously, we do have a
8 change in frequency where we see a component's going to be going to a
9 much higher frequency. You know, that's telling us there's going to be a
10 new workload. And we're expecting that to have a new workload. That is a
11 metric for determining the use.

12 It's a method for determining the activity. It doesn't, the Patent is
13 definitely not limited to just, you know, like we see here, and I'll get into this
14 going back to Slide 25 here. You know, it's not limited to just cycles per
15 second. The Patent itself indicates that we're much broader than that.

16 You know, Patent Owner argues we see on Slide 25 that
17 monitoring these operating characteristics like voltage and frequency is not
18 the same as monitoring workload itself. But again, like we just saw, the
19 '494 Patent itself broadly says that any method, any metric for determining
20 activity or use is workload.

21 And the Patent even indicates that frequency can be monitored as
22 an indication of workload. So we see that in the '494 Patent itself at Column
23 10 which we have here on Slide 25. If the workload module determines that
24 a GPU 505's frequency is below a threshold, i.e., not working consume
25 maximum capacity, then the frequency cap or limit is increased to cause
26 more production.

1 So we see even within the '494 Patent itself it's relating a checked
2 frequency of a component to the workload of that component.

3 JUDGE GIANNETTI: And you take that to mean instantaneous
4 frequency measurement rather than over a period of time?

5 MR. HUGHES: I think it could be either. I don't think it says one
6 way or the other. So it's just if it's determining that this frequency is more of
7 the threshold, it's relating that to what the work, you know, the working or
8 consuming of that component is.

9 But I don't see here it saying one way or another if it's, you know,
10 just doing an instantaneous track or maybe looking at that over time.

11 JUDGE GIANNETTI: Okay, thank you.

12 MR. HUGHES: So the last dispute that we'll talk about is whether
13 White discloses receiving workloads based on an integrated circuit limit.
14 And this is going to go to Claim, independent Claim 4 and its dependent
15 claims.

16 Going on to Slide 27, we see this limitation from Claim 4 which is
17 receiving a bus workload for communication bus and a first processing
18 element workload for a first processing element based on an integrated
19 circuit reaching a limit.

20 Now Patent Owner argues that operating voltage and frequency
21 again cannot reflect workload. But as we've already talked about, this is
22 incorrect. They do reflect for our measurement of that workload. Patent
23 Owner also argues that receiving workload is different than monitoring.

24 And that receiving workload requires receiving the actual activity
25 level and cannot be anything that reflects the workload of a component. But
26 activity level is only one of the potential ways the '494 Patent itself says you

1 can measure workload.

2 We saw that earlier when we were looking a Column 9. And we
3 see it again here on Slide 28 at Column 9, lines 57 to 67 on the '494 Patent.
4 There are a multitude of potential workload measurements and the
5 components to measure workload may also vary.

6 And then it even indicates here that for further discussion, it's just
7 assumed that the workload is measured as a number of active cycles over a
8 period of time. So one example of these multitude different ways you can
9 measure workload is going to be this activity cycles over time.

10 It is not the only way and the '494 Patent is clear on that. Going
11 on to Slide 29, White discloses receiving workload based on an integrated
12 circuit limit. Now in White, there's two integrated circuit limits. We have a
13 battery power limit as compared to a wall powered limit.

14 And then there's also temperature controlling logic and the overall
15 system as a temperature limit that is also related to the power. If you get to
16 the maximum temperature, you need to reduce power or else you'll go over
17 your temperature limit and the system will no longer work.

18 Now Patent Owner argues that White does not disclose receiving
19 workload based on this because White does not mention battery powered
20 limit and only temperature-controlled logic is configured to request changes
21 in operating characteristics based on that temperature.

22 But as we see in White, battery power does indicate a power
23 supply limit. White adjusts the operating characteristics of components to
24 reduce the overall power consumption when the system is on battery power.

25 That is when it has a power limit because it's on battery power, it's
26 going to adjust things. Because the system can increase the frequency of

1 logic cores when transitioning from battery power to wall power, that's
2 another indication that battery power indicates a power supply limit.

3 We can see this in Column 15 on the right-hand side of Slide 30
4 where it's talking about transitioning from battery power to wall power and
5 again, it says when it transitions from battery to wall power, you can have a
6 higher frequency to take advantage of the fact that the system is no longer on
7 battery power.

8 It doesn't have that power supply limit any more. Going on to
9 Slide 31, as we were just talking about, the power management logic in
10 White detects when the system is on battery power and is going to adjust the
11 operating frequency of the logic core.

12 What's it going to do there? That's when it's going back through
13 and it's doing those changes and comparisons that we were just talking about
14 earlier. So the power management logic receives workload information
15 based on the integrated circuit reaching that power limit.

16 Going on to Slide 32, in addition, like we talked about, there's also
17 the temperature limit for that integrated circuit. And White discloses
18 temperature control logic that can check this. And we see that temperature
19 control logic 210 in Column 14 of White on the right-hand side of the slide.

20 Now White indicates that the temperature control logic and the
21 power management logic may be part of a single logic set. And that single
22 logic set can be configured to monitor and adjust the operating frequency
23 and voltage of the various portions of circuit as we've discussed previously.

24 So that single power management logic with these combined can
25 also request the changes in operating characteristics of the cores based on
26 the temperature information or the temperature limit. And going on to Slide

1 33, we see that, in fact, White expressly discloses that an integrated circuit
2 may have a pre-determined maximum operating temperature or limit.

3 We can see that in Column 2 of White at the top of this slide here.
4 And the operating characteristics of the components may be adjusted to
5 lower the operating temperature. So again, the power management logic
6 receives that workload information to do this adjustment based on the
7 integrated circuit reaching this thermal design limit.

8 And that's all. I'll stop there, Your Honors, and if you have any
9 further questions, I'd be glad to answer them now. If not, I can answer them
10 during rebuttal.

11 JUDGE GIANNETTI: I don't have anything further. Judge
12 Saindon? Anything?

13 JUDGE SAINDON: No.

14 MR. HUGHES: Thank you, Your Honors.

15 JUDGE GIANNETTI: Anything else from the panel?

16 JUDGE ANDERSON: No.

17 JUDGE GIANNETTI: Let's get my notes out here. Bear with me.
18 Okay, I guess we proceed now with the presentation from Patent Owner.
19 Mr. Fahmi, are you ready to proceed?

20 MR. FAHMI: I am, Your Honor. Thank you.

21 JUDGE GIANNETTI: Okay, whenever you're ready you may go
22 forward.

23 MR. FAHMI: Thank you. May it please the Board, I would like
24 to reserve 15 minutes please for the surrebuttal.

25 JUDGE GIANNETTI: Okay.

26 MR. FAHMI: And provide the slides about, not sure how much

1 we'll actually be using them. There's two items I think I would like to
2 address with you today. The first relates to the Petitioner's contention that
3 Bose's predicted power in performance in the power performance trade-off
4 table represents a workload threshold.

5 And I think here I'll refer to our Slide No. 11. We don't think the
6 volumes that are stored in the table are workload thresholds. You heard
7 from my learned friend earlier that within the hierarchy that Bose describes,
8 it's the local PMCUs that monitor things like instructions per cycle.

9 Not the global PMCU which is the actual unit that ends up using
10 the power performance trade-off table. All right. The values that are scored
11 in the predicted power performance trade-off table are just optimizations.

12 The things that have been set to provide certain levels of
13 performance when the power at a certain level is made available and there
14 was a very prescient I think sort of discussion around Bose's Figure 3 and
15 Figure 4 about just where is this comparison to a threshold, a workload
16 threshold being made?

17 If you look at Figure 3 or Figure 4 of Bose, you'll see that there is
18 no such comparison of a workload threshold. There is a comparison, but it's
19 a power comparison. Elements 303 and 408 are comparisons or
20 determinations about whether certain power levels are present.

21 And it's based on those power levels that the table is consulted and
22 the power mode selected. Yes, there is consideration of other things. That's
23 how the table is put together. But when the actual change or the selection of
24 a power mode is made, it's just based on power. It's not based on any
25 comparison with a workload threshold.

26 There was a question from the panel about, you know, just which

1 part of this diagram in Figure 3 is showing the comparison and Petitioner's
2 counsel finally indicated that it's step 311. But step 311 is an assignment of
3 a power load.

4 By this time, the only comparison that's taking place, the power
5 comparison has already been done and this step is merely the assignment of
6 the power load based on that power comparison. Well, Claim 1 requires a
7 comparison of workload threshold and that workload threshold comparison
8 simply isn't being made in Bose.

9 JUDGE GIANNETTI: So Counsel, so you distinguish between
10 power and the workload. Is that correct?

11 MR. FAHMI: Yes, Your Honor. I think there is a distinction.
12 We're told --

13 JUDGE GIANNETTI: What's your, what's your definition then
14 of --?

15 MR. FAHMI: So Dr. Brogioli actually testified to this and I think
16 I can refer you to our Slide No. 4. Dr. Brogioli testified that a person of
17 ordinary skill in the art would understand workload to mean an amount of
18 activity over a quantum or a period of time and Mr. Wyatt agreed.

19 And you can see on Slide 4, this an excerpt from Mr. Wyatt's
20 deposition. I asked him, you know, would a person of ordinary skill
21 understand workload to be referring to an amount of activity over a period of
22 time and he says, yes.

23 There's lots of definitions and specifically I think '494 is trying to
24 do here to define how they measure it and how they quantify it. But he
25 agrees that it's activity over time and I think one of your own earlier
26 questions, Your Honor, indicated that or was probing to see when we're

1 talking about workload isn't there a time activity?

2 And even in the Petitioner's presentation, we heard a lot about how
3 measuring workload can be accomplished in many different ways. But the
4 workload itself is that idea of an activity over time? Or I think the other
5 term that was used was a use which also implies a time-based consideration.

6 Power is not activity over time. Power, you know, is a current and
7 voltage relationship and really depends upon the applied voltage to the
8 processing element and the amount of current that would be used by the
9 processing element and that would be reflected by its operating frequency.

10 So yes, we do distinguish between the two. Dr. Brogioli, in his
11 declaration, I think it was also made the point that the '494 Patent indicates
12 that there's a decoupling, almost, of workload from just frequency.

13 And let me just see if I can get to the point because it's this part of
14 the '494 Patent I think was discussed in my colleague's presentation. He
15 referred to the bottom of Column 10 beginning at line 65 to the top of
16 Column 11 at line 2 and the '494 Patent says that if a workload module
17 determines that GPU's frequency is below a threshold that is not working or
18 consuming at a maximum capacity, then CPU frequency cap or limit can be
19 increased to cause more production such that the GPU core's workload
20 increases accordingly.

21 So frequency is as was pointed out earlier, one of these throttles
22 that can be adjusted, but the workload is independent of the frequency so
23 you're bringing the frequency up to meet the workload.

24 JUDGE GIANNETTI: Counsel, how do you explain the rather
25 broad definition of workload that we see in Column 9 in the '494 Patent?

26 MR. FAHMI: Yes, so I think that broad definition is indicating

1 how workload might be measured. There are many ways to measure it. But
2 it's not saying there are many different definitions of a workload.

3 JUDGE GIANNETTI: Well, would you agree that if one of those
4 measurements was compared to some threshold, that would be sufficient
5 under your claims?

6 MR. FAHMI: No, I don't think so, Your Honor.

7 JUDGE GIANNETTI: Why is that?

8 MR. FAHMI: Because the claim is very specific about comparing
9 a workload to a threshold. So it's the activity that's being compared, not
10 some other metric. It doesn't say comparing frequency or comparing
11 voltage. It says comparing workload so that's the actual thing that is
12 required to meet the --

13 JUDGE GIANNETTI: Well without a measurement, isn't
14 workload just an abstraction?

15 MR. FAHMI: I'm not sure what you mean. I mean --

16 JUDGE GIANNETTI: Well --

17 MR. FAHMI: -- a workload is a measurable quantity. You can
18 measure --

19 JUDGE GIANNETTI: That's right.

20 MR. FAHMI: -- instructions per cycle.

21 JUDGE GIANNETTI: And what this paragraph tells you are these
22 are various ways of measuring workload. Isn't it?

23 MR. FAHMI: Yes.

24 JUDGE GIANNETTI: So why wouldn't any one of those
25 measurements be in effect a proxy for the actual workload, and why
26 wouldn't the comparison of that proxy be sufficient under your Patent?

1 MR. FAHMI: Because that's not what the claim requires. The
2 claim requires comparing workload.

3 JUDGE GIANNETTI: But the only way you can compare it is by
4 measuring it. You can't compare an abstract idea. You have to measure it.

5 MR. FAHMI: Well I'm not, mainly I don't agree that workload is
6 abstract. Workload is a thing. Workload is an activity for time. The experts
7 have told us --

8 JUDGE GIANNETTI: It's a definition. Okay? It's a definition.
9 The question is, how do you measure it? And what this paragraph tells you
10 is that you can measure it in various ways.

11 MR. FAHMI: Yes, you can measure it in various ways.

12 JUDGE GIANNETTI: And that's what you have to have for the
13 comparison is the measurement.

14 MR. FAHMI: No, Your Honor.

15 JUDGE GIANNETTI: It's --

16 MR. FAHMI: No. No, --

17 JUDGE GIANNETTI: Why is that?

18 MR. FAHMI: You're fundamentally wrong on that point. If I
19 compare frequency to frequency, I haven't compared workload. If I compare
20 voltage to voltage, I haven't compared workload. To compare workload, I
21 need to compare workload to workload.

22 Some activity over time versus another activity over time. It's not
23 an abstract concept. You cannot compare frequency to workload and get
24 any kind of meaningful result. That's not going to tell you anything about
25 what's, you know, whether or not you've met a threshold, a workload
26 threshold or not.

1 The claim is very specific that it requires comparison of workload
2 to that threshold. Not a proxy for workload.

3 JUDGE GIANNETTI: Let me ask you, just going back to this
4 paragraph in Column 9, doesn't the first sentence equate workload with
5 activity of hardware? Workload includes determining workload includes
6 any known method for determining activity of hardware.

7 What is, isn't this saying that that's how you measure workload by
8 determining activity of hardware?

9 MR. FAHMI: That's exactly the point I've been trying to make,
10 Your Honor. Activity --

11 JUDGE GIANNETTI: Then it goes on to say --
12 (Simultaneous speaking)

13 MR. FAHMI: -- if --

14 JUDGE GIANNETTI: -- but then it goes on to say how you do
15 that. I think it's for --

16 MR. FAHMI: It says right here --

17 JUDGE GIANNETTI: -- the activity.

18 MR. FAHMI: -- for the activity.

19 JUDGE GIANNETTI: So why wouldn't it be sufficient for one of
20 those measurements of activity to be compared to a threshold? Workload
21 doesn't -- in order to make a comparison of workload, you have to first
22 measure it.

23 MR. FAHMI: I don't disagree with that point, Your Honor.

24 JUDGE GIANNETTI: And this is telling you how to do that.

25 MR. FAHMI: I agree. We can measure it in many ways.

26 JUDGE GIANNETTI: All right, so why wouldn't anyone --

1 MR. FAHMI: However, --

2 JUDGE GIANNETTI: -- why wouldn't any one of these results of
3 measuring workload --

4 MR. FAHMI: Your Honor, --

5 JUDGE GIANNETTI: -- be amenable to a comparison against the
6 threshold?

7 MR. FAHMI: You Honor, where the Petitioner wants you to go
8 and where I don't want you to go is to say that if all I do is measure
9 frequency, that's sufficient in a compare frequency. And that's not good
10 enough.

11 JUDGE GIANNETTI: Well, what about one of the examples
12 given in this paragraph?

13 MR. FAHMI: I'm not sure which examples you're referring to,
14 Your Honor, but the Patent is saying the workload is activity over time.
15 Now, I can measure workload in any of several ways. All right? But what I
16 need is that number that activity over time quantity.

17 That's what I'm going to use for the comparison that's recited in
18 Claim 1. So I can use a counter, I can use an accumulator associated with
19 the cores. I can track activity cycles. I can do any of those things in, you
20 know, at the bottom of Column 9, but at the end of the day, I need to
21 compare what I've decided the workload is based on that measurement to a
22 workload threshold in order to meet the claim.

23 JUDGE GIANNETTI: How do you determine that without using
24 one of these methods?

25 MR. FAHMI: Your Honor, you seem to think that I'm arguing that
26 you don't measure workload. I'm not. I mean, the claim itself says we're

1 measuring workload. I'm not really sure how we got down this track.

2 JUDGE GIANNETTI: Well, I think what I'm saying is let's say for
3 example the claim says measuring voltage. Well I suspect that there are
4 various ways of measuring voltage and it seems to me any one of those
5 would be sufficient.

6 You might use a volt meter, you might use some other type of
7 device. It seems to me any one of those results would be a measurement of
8 voltage. Wouldn't it?

9 MR. FAHMI: Yes, I suppose there are several ways you could
10 measure voltage, Your Honor, but I'm really not sure what your point is.

11 JUDGE GIANNETTI: All right, well I don't think we're getting
12 anywhere. You haven't really satisfied me with your answers, but let's just
13 go forward. I don't want to spend all of your time on this.

14 MR. FAHMI: Your Honor, I want to spend time here. It's
15 important. I want to make sure that I'm being as clear as I can. But I'm not
16 arguing that the '494 Patent doesn't require some specific way to measure
17 workload. That's not our argument.

18 Our argument is the '494 Patent requires comparing workload to a
19 workload threshold. How we --

20 JUDGE SAINDON: Counsel, if I could jump in here. This is
21 Judge Saindon. I think what Petitioner is trying to say is that the bottom of
22 Column 10 onto Column 11, which you briefly mentioned before, it talks
23 about the GPU frequency. Right?

24 So there's frequency, and it's talking about, the whole paragraph, is
25 a base assumption of potential bottlenecks that allows the process to be
26 simplified. And it talks about if the GPU, it's basically talking about—does

1 it have any head room left? That is my interpretation.

2 I was wondering your interpretation and whether this is explaining
3 that frequency is one of these workload metrics, because here is the
4 workload module checking it and then making adjustments based on it.

5 MR. FAHMI: Your Honor, the way I'm reading this paragraph is
6 that the GPU has a given workload that it's trying to process. And one of the
7 ways that it can get to a level of productivity in order to process that
8 workload is to adjust its frequency.

9 And I think that's in line with your lawn mower analogy. This is
10 one of the levers that can be used in order to meet the requirement. But it's
11 not saying, you know, I compare frequency. I mean, it's not speaking to the
12 limitation in the claim about comparing the workload to the workload
13 threshold.

14 JUDGE SAINDON: I guess the issue here is that it uses the words
15 "workload module," "frequency" and "threshold" so it sounds very close. If
16 you could explain how that's actually not the workload module using it as a
17 workload threshold?

18 MR. FAHMI: Yes, I agree. It's using those words, Your Honor,
19 but let's look at the entire context in which that comes up. Right? So a little
20 higher up in Column 10 beginning at line 60. Oh, sorry. Let's start at line
21 55.

22 So as an exemplary base assumption, it's assumed that when the
23 GPU cores are operating at a maximum, i.e., fully occupied, then the GPU
24 cores are the performance bottleneck. In other words, they're working as
25 fast as it can under the current limits.

26 It's not completing the work fast enough. So as a result of the

1 assumption, if the GPU cores are operating over a workload/activity
2 threshold, it's considered to be a bottle neck. So the frequency of the GPUs
3 increase. This is what I was saying. Right?

4 So one of the levers we have is, you know, if your workload
5 comparison is such that the threshold isn't being met, you can increase the
6 frequency. And then the sentence goes on and says if the power limit is
7 reached, then you have to counterbalance by capping the CPU frequency.

8 But if the, but so now we're looking at the opposite case. If the
9 workload monitor determines the GPU frequency is below the threshold, i.e.,
10 it's not consuming at the maximum capacity, then its frequency cap can be
11 increased.

12 So it's, you know, basically saying if I was wrong, if I'm not
13 working at my workload threshold, then I can still increase the frequency.
14 So I think the whole context here is that the comparison is still workload to
15 workload threshold and then I make adjustments to the frequency depending
16 on the outcome of that comparison. And that's in line with the claim.

17 JUDGE SAINDON: So if I understand this "however" sentence
18 on line 65, the "frequency is below a threshold," this is talking about the
19 GPU has some maximum frequency you can look at, and it has the
20 frequency it's operating at now. So there's head room in its operation. But
21 this isn't the workload step.

22 That's already been done somewhere else. This is just saying that
23 we have room to increase the GPU, so go ahead and do it. Is that correct?

24 MR. FAHMI: I think that's right. I think that's right. So, Judge
25 Giannetti, I'm not sure if you're satisfied or not with what --

26 JUDGE GIANNETTI: Well why don't you move on and I'll come

1 back to it again if I'm still puzzled.

2 MR. FAHMI: Okay. Sure.

3 JUDGE GIANNETTI: All right.

4 MR. FAHMI: Let me go on and talk about the issues surrounding
5 the challenges based on why both White by itself and White in combination
6 with Simeral and let me start with the challenge based on White alone and
7 that comes up in the context of Claim 4, the second independent Claim.

8 And I'll refer to our Slide No. 19. So the Petitioner's argument is
9 that the person of ordinary skill in the art would have understood that the
10 operating voltage or frequency reflects that activity under use and, i.e., the
11 workload of a component and therefore Claim 4 is obvious in view of White.
12 But Claim 4 is pretty specific.

13 Claim 4 has a step of receiving a bus workload. So it's not
14 receiving some proxy for the workload. It's actually receiving the workload,
15 the measure, however you do it, activity over time. And White's focus on
16 the operating voltages or the operating frequencies is not sufficient to meet
17 this claim.

18 In other words, these are not activity levels themselves. And for
19 that reason, Petitioner's argument fails. There's another problem with the
20 challenge based on White and this gets to the idea of this battery power limit
21 that Mr. Hughes was discussing with you.

22 The idea in White is that, yes, the system can detect whether it's
23 running on battery or running off of the wall power and therefore it can
24 adjust the frequency of the cores to take advantage of the sort of
25 inexhaustible wall supply. But this again, is not receiving workload.

26 If anything, it's we're back to receiving power or some indication

1 of a power source, but we're not receiving workload. So as to Claim 4, we
2 think the challenge is based on the White both fail. The other challenge
3 that's involved looking again, just briefly in Slide 5 is a combination of
4 White and Simeral and that's with respect to Claim 1 that we were looking at
5 with respect to Bose.

6 This is addressed on our Slide No. 18. The Petition's argument
7 here is that again, White's monitoring of the operating voltages and
8 frequencies of the logic core means that there's a workload monitor. But
9 here again, we think they're wrong.

10 And that while the power management logic might control the
11 cores by adjusting voltage and frequency, it's doing so based on a table of
12 compatible voltage frequency pairs and there's no actual mention of
13 monitoring the core workload itself, no activity over time is being
14 monitored.

15 It's the individual metrics, the voltage and/or the frequency that are
16 being monitored and for the same reasons we've been discussing, one is not
17 the other. They're not workload. And so they don't meet the requirements of
18 the claim and there's no, yes, there's no showing that it would have been
19 obvious to modify White or Simeral.

20 The Petition doesn't make any argument that a modification would
21 have been made. Are there other items I can address for you, Your Honors?

22 JUDGE ANDERSON: I guess everybody has said something.

23 JUDGE GIANNETTI: Yes, I --

24 JUDGE ANDERSON: I want to ask one thing or two things
25 actually. Would you have --

26 JUDGE GIANNETTI: Go ahead, Judge Anderson.

1 JUDGE ANDERSON: -- proved that the statement about
2 determining workload at Column 11 of the '494 Patent is a definition of
3 workload?

4 MR. FAHMI: Where in Column 11 are you looking at?

5 JUDGE ANDERSON: Let me get to that. I think it's line 47.
6 Column 9.

7 MR. FAHMI: Oh, Column 9. Sorry. I heard Column 11.

8 JUDGE ANDERSON: That's Column 9, line 47 through 51, 48,
9 49, 50. I'm sorry.

10 MR. FAHMI: Right.

11 JUDGE GIANNETTI: Column 9?

12 MR. FAHMI: So I don't think this is a definition of workload,
13 Your Honor. I think the definition of workload is the one the two experts
14 agreed on and that is an activity over time. I think what this paragraph in
15 Column 9 is discussing is methods for determining workload.

16 In other words, measuring. Excuse me. Yes. It's how you would
17 determine activity.

18 JUDGE ANDERSON: Okay and the other question I have is with
19 respect to this comparison business. In your response to the Petition, I'm
20 going to read it all just for context. I'm at Page 1, your introduction.
21 "Contrary to the allegations in the Petition, the power versus performance
22 tradeoffs which are characterized in a power performance trade-off table do
23 not represent a workload threshold for a given component working in an
24 associated power mode.

25 Indeed, inasmuch as the power performance, excuse me, indeed --
26 I'm going to get to that, oh, I've got to find my place. Do not represent --

1 okay, so, do not represent this power performance trade-off table, did not
2 represent a workload threshold for a given component workload and an
3 associated power mode.

4 Indeed, inasmuch as the power performance values change over
5 time, a person of ordinary skill in the art would recognize these values are
6 algorithmic in nature." What do you mean they're algorithmic in nature?

7 MR. FAHMI: Right. So these are, this is something Dr. Brogioli
8 testified to in his declaration, Your Honor. And the point here was that
9 they're not thresholds because they're not workload limits.

10 They are optimizations that for given power modes a certain
11 amount of work has been determined to be an optimal amount of work. But
12 it's not necessarily a limit on the amount of work that can be done. That's
13 the point that I think that Dr. Brogioli was trying to make.

14 JUDGE ANDERSON: I don't understand what you mean by
15 algorithmic in nature. To be --

16 MR. FAHMI: Well they're computational, they're used as
17 computation numbers or determined in computational fashion. They're,
18 since they're being updated periodically over time. In other words, the
19 values of the tables can change over time.

20 And so they're the results of some algorithmic process that
21 determines a particular optimization at a particular point in time.

22 JUDGE ANDERSON: And so that's not a specific number?

23 MR. FAHMI: Well it is at any one time a specific number, but the
24 point is, it's not a threshold. In other words, it's not a limit.

25 JUDGE ANDERSON: Okay.

26 MR. FAHMI: You know, you've reminded me of something, Your

1 Honor, that I should address just before I cede the floor here. And the '494
2 Patent itself describes and we've talked about this idea of threshold
3 comparisons.

4 But it also describes other ways that could be done that, in fact, is
5 what Bose uses. I mean, Bose uses this table to look up what power mode I
6 should be in. The '494 Patent in Column 14 and this is beginning in line 39,
7 so the '494 Patent says as one example, such determination and this is
8 determination about whether the GPU is a bottleneck or not based on
9 workload activity, is one example.

10 Such is determined on whether the base of the graphics workload
11 activity is greater than the graphics activity threshold. Okay? This is getting
12 at what's recited in Claim 1. A few lines further down, line 45, however,
13 such comparisons of activity through a threshold are not required.

14 For example, workloads may be directly compared. So the '494
15 Patent is saying, look, comparison to a threshold is one way of doing it.
16 Right? And that's the one that's claimed. But you can also do these direct
17 comparisons.

18 And that's what Bose is describing when he's talking about his
19 power performance look-up table and values. And that was the point that
20 Dr. Brogioli made is that the direct information is available so no
21 comparison is required.

22 This is, I think, summarized in our Slides on Slide No. 12. No
23 comparison of the bus workload to the bus workload threshold is needed
24 because direct information concerning the actual power level decreases or
25 increases for the different power levels is available from the power
26 performance trade-off table.

1 So the question had reminded me of that. I don't think I discussed
2 that particular failing of Bose earlier and I wanted to make sure I had a
3 chance to do so.

4 JUDGE GIANNETTI: Mr. Fahmi, one more question before you
5 close out your presentation. Is it your position that a threshold must be a
6 fixed quantity and can't be something that changes dynamically?

7 MR. FAHMI: No, I don't think that would be reasonable, Your
8 Honor. I think thresholds can change dynamically. And if we gave the
9 impression that they can never change, I apologize for that. The point I
10 think that we were trying to make is that those values actually are not
11 thresholds.

12 JUDGE GIANNETTI: Okay, so you're not relying on that
13 argument to distinguish the art that's been cited here?

14 MR. FAHMI: No. No, we're not.

15 JUDGE GIANNETTI: All right, thank you.

16 MR. FAHMI: Thank you, Your Honors.

17 JUDGE GIANNETTI: Anything further from the panel? Okay,
18 Mr. Hughes, you may proceed with your, with your, I guess it would be your
19 rebuttal case. Yes, thanks, Mr. Hughes. Whenever you're ready.

20 MR. HUGHES: All right, thank you, Your Honor. I just have a
21 few points to make on rebuttal and I'd like to start with Bose. Now we heard
22 some talk here that in Bose there is no comparison of workload to a
23 workload threshold. And this is incorrect.

24 Again, what's monitored in Bose is the performance. Right? It is
25 the workload so there's no question that Bose is monitoring activity levels.
26 It's monitoring workload. And again, this relates to the comparison to those

1 predicted power and performance levels, again, on the activity levels.

2 Now there were some questions earlier about where the
3 comparison takes place. And I think we heard Mr. Fahmi say that in Step
4 311 this is just an assignment of a power mode. So any comparisons would
5 have already taken place. But that's not correct.

6 As we saw in Column 9, where it specifically discussing this, Bose
7 is very clear that within that assignment step 311, there is first consideration
8 of numerous things. Including those actual monitored performance statistics
9 and there's consideration of those predicted power and performance levels.

10 JUDGE GIANNETTI: Could you give us a, can you give us a
11 page, column and line cite for that?

12 MR. HUGHES: Yes. So this would be Column 9, lines 14 to 30.
13 Again, we have in state 311 there is an assignment of a power mode, but that
14 assignment is done with consideration of numerous things so within that
15 assignment step, you first have to take into account these considerations.

16 You first have to do these comparisons including of the real time
17 statistics of the monitored workload and those predicted power and
18 performance statistics there.

19 JUDGE GIANNETTI: Yes.

20 MR. HUGHES: And again, Your Honor, you know, there is talk
21 about well is it power? Is it performance? You know, what's going here is
22 Bose even indicates, for example, at Column 2, lines 50 and 51, these two
23 are related and we see it in the predictive power of performance. Power and
24 performance are related to each other.

25 You're going to adjust the power to achieve maximum
26 performance. Again, the performance metrics are of the workload. The

1 power performance things here we have are related. So we have this
2 predicted power performance table.

3 That is directly relating the power and the performance together.
4 These are measurements of the workload. Now, I'd also like to state that
5 there is some talk, you know, here well is frequency actually a
6 measurement? And I just wanted to point out again that Bose is clear that it
7 is monitoring activity level.

8 We have Bose monitoring those instructions per cycle so Bose is
9 clear that it itself is monitoring this. There can be no question that Bose is
10 doing activity level. And then lastly, there is some talk of Column 14 of the
11 '494 Patent and some direct workload comparisons.

12 And we heard from Mr. Fahmi that allegedly Bose does these
13 direct comparisons as well. Now that's not the case. As we've talked about,
14 Bose does not directly compare one monitor workload to another. What
15 Bose is doing is comparing the monitor to actual workload levels not to
16 another actual workload.

17 But to these predicted power and performance levels from that
18 table. That's all, Your Honor, unless anyone has any other questions or
19 issues they would like us to address.

20 JUDGE GIANNETTI: Judge Anderson, anything further from
21 you?

22 JUDGE ANDERSON: I think I'm okay. Thank you.

23 JUDGE GIANNETTI: Okay, Judge Saindon? You okay?

24 JUDGE SAINDON: Yes.

25 JUDGE GIANNETTI: All right. Thank you, Mr. Hughes. Sur-
26 rebuttal?

1 MR. HUGHES: Thank you, Your Honors.

2 JUDGE GIANNETTI: Yes, thank you, Mr. Hughes. Sur-rebuttal,
3 Mr. Fahmi?

4 MR. FAHMI: Thank you, Your Honor. I'll be brief. Counsel
5 wants to read the statement in Column 9 between lines 14 and 30 of Bose as
6 consideration must mean comparison. Where does the Patent say that?
7 Answer, it doesn't.

8 It's their burden of proof. It hasn't been met. Bose does not teach
9 Claim 1. Happy to take any questions, Your Honor, otherwise we'll submit
10 the case for your consideration.

11 JUDGE GIANNETTI: Let me try one more time on my question.
12 Several times in your presentation, and I think it was in connection with
13 Claim 4, you talked about receiving the workload. How can that be? At
14 best, you can receive a measurement of the workload, but you can't actually
15 receive the workload.

16 When I was talking about it being an abstract idea, it's just a
17 definition until it's measured. So maybe you could help me on that. But I
18 don't see how one can receive the workload. One can receive a
19 measurement of the workload, but not the workload.

20 MR. FAHMI: Okay. I, thank you, Your Honor. I understand the
21 question. I understand where I may not have been clear. I agree. When the
22 claim says receiving the bus workload, sure, it has to be some measure of the
23 workload.

24 JUDGE GIANNETTI: Yes.

25 MR. FAHMI: That's the quantity. I agree.

26 JUDGE GIANNETTI: And I guess Patent Owner's or Petitioner's

1 position is that Column 9 tells you how to make that measurement. Column
2 9 of Bose. As I understand it and that's --

3 MR. FAHMI: Sure, Column 9 of --

4 JUDGE GIANNETTI: Yes, that's why when we were going back
5 and forth about, you know, well it doesn't tell you what the workload is. It's
6 a measurement of the workload. That's what they're talking about.

7 MR. FAHMI: Well, yes. It's a measurement of activity, yes.

8 JUDGE GIANNETTI: And activity is equated with workload.

9 MR. FAHMI: Yes.

10 JUDGE GIANNETTI: Okay. All right well I understand your
11 position and I don't have anything further. Anything from the panel?

12 JUDGE SAINDON: No.

13 JUDGE GIANNETTI: All right, thank you very much. We've all
14 worked pretty hard today on this case. And the other case and I appreciate
15 your efforts. You've been very forthcoming with your answers and I think
16 you've helped us understand the case.

17 Thank you very much for your presentations. The case is
18 submitted. I will ask counsel to stay on the line with the Court Reporter to
19 deal with any type of spellings or other matters that need to be clarified. The
20 panel will sign off and the hearing is adjourned. Thank you all.

21 (Whereupon, the above-entitled matter went off the record at 3:28
22 p.m.)

IPR2023-01343
Patent 8,898,494 B2

PETITIONER:

Celine Crowson
Joe Raffetto
Scott Hughes
Helen Trac
Ryan Stephenson
Nicholas Rotz
HOGAN LOVELLS US LLP
celine.crowson@hoganlovells.com
joseph.raffetto@hoganlovells.com
scott.hughes@hoganlovells.com
helen.trac@hoganlovells.com
ryan.stephenson@hoganlovells.com
nicholas.rotz@hoganlovells.com

PATENT OWNER:

Tarek Fahmi
Jonathan Tsao
ASCENDA LAW GROUP
tarek.fahmi@ascendalaw.com
jonathan.tsao@ascendalaw.com