

1 UNITED STATES PATENT AND TRADEMARK OFFICE
2 BEFORE THE PATENT TRIAL AND APPEAL BOARD

3 MERCEDES-BENZ USA, LLC,

4 Petitioner,

5 DAEDALUS PRIME LLC,

6 Patent Owner

7 Case No.: IPR2023-01335

8 U.S. Patent No. 8,775,833

9 DEPOSITION OF

10 ROBERT W. HORST, Ph.D.

11 VIA ZOOM VIDEOCONFERENCING EQUIPMENT

12 MAY 14, 2024

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25 Reported by: Johnell M. Gallivan, CSR No. 10505

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11 DEPOSITION OF ROBERT W. HORST, Ph.D., taken by

12 Patent Owner, commencing at the hour of 8:57 a.m. on May

13 14, 2024 via videoconferencing equipment, before Johnell

14 M. Gallivan, Certified Shorthand Reporter No. 10505,

15 State of California.
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I N D E X

WITNESS: Robert W. Horst, Ph.D.

EXAMINATION

PAGE

By Mr. Fahmi

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1 E X H I B I T S

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3 (None Marked.)

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1 MAY 14, 2024; VIA VIDEOCONFERENCE; 8:57 A.M.

2 ---oOo---

3 THE REPORTER: Doctor, please raise your right
4 hand.

5 Do you so solemnly swear that the testimony you
6 are about to give will be the truth, the whole truth,
7 and nothing but the truth, so help you God?

8 THE WITNESS: I do.

9 THE REPORTER: Thank you.

10

11 ROBERT W. HORST, Ph.D.,
12 having been duly sworn testifies as follows:

13

14 EXAMINATION

15 BY MR. FAHMI:

16 Q. Good morning, Dr. Horst.

17 A. Good morning.

18 Q. Again, my name is Tarek Fahmi. I'm here
19 representing the patent owner, Daedalus Prime.

20 We're here today for your deposition in
21 connection with a matter pending before the U.S. Patent
22 and Trademark Office. It is Inter Parte Review Number
23 2023-01335. And that concerns the U.S. Patent
24 8,775,833.

25 Do you understand that?

1 A. Yes.

2 Q. And it's correct that you provided a
3 declaration in support of the petition in this
4 proceeding.

5 Is that right?

6 A. Yes, I did.

7 Q. I -- I know we spoke just a few days ago, in
8 connection with another patent.

9 Just as a reminder, since we are doing this by
10 remote videoconference, if you would continue to do as
11 you're doing, and -- and that is provide audible
12 answers, it will make the court reporter's job easier.

13 And, also, if you could please wait until I
14 finish asking the question before you begin your answer,
15 I'll try and make sure you finish your answer before
16 asking another question.

17 That way, the court reporter only has to take
18 down what one person is saying at a time.

19 Is -- is that okay?

20 A. Yes.

21 Q. Great. And if you need clarification or you
22 didn't hear a question, just let me know. I'll be happy
23 to repeat it. Or if it was unclear in some way, I'll --
24 I'll try and ask it so it is clear.

25 Is that okay?

1 A. Yes.

2 Q. Great. Just one final reminder that now that
3 we've started, you're not to have any conversations with
4 anyone, that would include counsel, regarding the
5 substance of your testimony until we finish with the
6 cross-examination portion of the deposition.

7 Do you understand?

8 A. Yes.

9 Q. Do you have any materials in the room with you
10 today, Dr. Horst?

11 A. Yes. I have the expert report, the '833
12 patent, and a binder with all of the exhibits of -- from
13 the declaration, which includes the prior art.

14 Q. Are there any markings or annotations on any of
15 those materials?

16 A. No.

17 Q. If you want to refer to those materials as
18 we're talking today, that's fine. I just ask that you
19 let us know if you're reading from something or
20 referring to anything in particular during one of your
21 answers.

22 Is that all right?

23 A. Yes.

24 Q. If you need to take a break at any time, just
25 let us know, I would be happy to pause. I just ask that

1 if there's a question pending at the time, please
2 provide an answer to that question before we take a
3 break.

4 Is that okay?

5 A. Yes.

6 Q. Anyone -- anyone else in the room with you
7 today?

8 A. Mr. Lewis is in the room with me here.

9 Q. And you're not in communication with anyone
10 else over a mobile phone panel, or anything like that?

11 A. No.

12 Q. Okay. Any reason why you can't provide us your
13 full, honest and complete testimony in this matter
14 today?

15 A. No.

16 Q. Let's turn, if you would, please, to
17 Exhibit 1029.

18 This is, I believe, your declaration.

19 A. Yes, I have it.

20 Q. Wait a moment. We can bring a copy up on the
21 screen file, please.

22 Do you recognize this exhibit, Dr. Horst?

23 A. Yes. This is my declaration in this case.

24 Q. When is the last time you had a chance to
25 review it?

1 A. Yesterday, and a little this morning.

2 Q. Let's turn to Paragraph 30, please. I think
3 it's on Page 22.

4 A. Yes, I'm there.

5 Q. In Paragraph 30 you're providing us a
6 description of a person of ordinary skill in the art
7 with respect to this patent.

8 Is that right?

9 A. Yes. In Paragraphs 29 and 30.

10 Q. How did you decide that this would describe a
11 person of ordinary skill in the art with respect to this
12 patent?

13 A. This -- this was a description submitted by Dr.
14 Mudge. I adopted his description as meeting the
15 requirements for this '833 patent.

16 Q. You disagree with what Dr. Mudge said --
17 described as a person of ordinary skill in the art in
18 any way?

19 A. No. I -- I agree that the person would have
20 required at least a bachelor's degree and two years'
21 experience in the research, design, development, or
22 testing of electronic circuits or components for
23 software, for controlling electronic circuits or
24 components, or the equivalent.

25 Q. Why would that describe a person of ordinary

1 skill in the art for this patent?

2 A. This patent involves electronic circuits and
3 computer systems and software. And that the person, as
4 described here, would have had experience in those
5 areas.

6 Q. I -- I notice the description says at least two
7 years of experience.

8 Do you see that?

9 A. Yes.

10 Q. So that would encompass people with much more
11 than two years of experience, wouldn't it?

12 A. Yes.

13 Q. If a person had the requisite undergraduate
14 degree and let's say ten years of experience, would that
15 person be someone with more than just ordinary skill in
16 the art?

17 A. That would be a person with at least ordinary
18 skill in the art.

19 Q. But that same person could have more than
20 ordinary experience, correct?

21 MR. LEWIS: Objection. Asked and answered.

22 THE WITNESS: I -- I didn't analyze how much
23 more experience a person like that would have had.

24 BY MR. FAHMI:

25 Q. So when you did your analysis, were you

1 considering just a person with two years' experience in
2 the indicated fields, or did you also include people
3 with more than two years' experience?

4 A. I did my analysis, assuming the two years of
5 experience.

6 Q. What kind of things would a person with just
7 the two years of experience have learned?

8 A. That person would have learned about the design
9 of systems and how to analyze the systems, and would
10 have understood the basics of the electronic circuits
11 and software and components.

12 Q. What do you mean by "the basics"?

13 A. Would have understood, at least in one context,
14 how a system like that is designed.

15 Q. What sort of systems are you talking about?

16 A. The -- as it says, the electronic circuits or
17 components or software for controlling electronic
18 circuits or components.

19 Q. Other than the education and experience that
20 you provide here in Paragraphs 29 and 30, would the
21 person of ordinary skill in the art have any other
22 skills?

23 A. The person of ordinary skill would be familiar
24 with all of the literature, all of the references in the
25 prior art at the time of the inventions.

1 So that person would -- would have the
2 knowledge of -- of all of that background material.

3 Q. It's sort of a hypothetical base, right? I
4 mean, would you expect a person with a bachelor's degree
5 and just two years of experience to have read all of
6 these particular references that you cite in your
7 declaration?

8 MR. LEWIS: Objection to the extent it
9 mischaracterizes testimony.

10 THE WITNESS: My understanding of one of
11 ordinary skill is that that person would have this
12 background, as well as -- as a knowledge of all of the
13 prior art.

14 BY MR. FAHMI:

15 Q. So it's your understanding that that's the
16 legal construct for the person of ordinary skill; is
17 that right?

18 MR. LEWIS: Objection to the extent it calls
19 for a legal conclusion.

20 THE WITNESS: That's my understanding of the --
21 of the -- of the legal definition of a person of
22 ordinary skill.

23 BY MR. FAHMI:

24 Q. Thinking about the technology involved in the
25 '833 patent, is that something that's covered in an

1 undergraduate program in one of the fields that is
2 listed here in Paragraph 30?

3 A. The undergraduate courses may not include the
4 specifics of the '833 patent, but the person that's
5 capable of understanding systems with two years of
6 experience would have been able to understand the patent
7 just by reading and studying the patent itself.

8 Q. Further down on Page 22 in your declaration,
9 beginning at Paragraph 32, and then carrying over
10 through Paragraph 34, you provide some comments about
11 claim construction.

12 Is that right?

13 A. That's right.

14 Q. You did not set forth any sort of constructions
15 for any of the terms in the claim.

16 Is that right?

17 A. That's right.

18 Q. Why not?

19 A. In this case I used the ordinary and customary
20 meaning, and it's understood by one of ordinary skill in
21 the art.

22 Q. Is that true for all the terms in the claims of
23 the '833 patent?

24 A. It's -- it's true of all the claims, although
25 the ordinary meaning is also in light of the

1 specification.

2 So there is -- is one term in the patent that
3 has a definition in the -- the '833 patent itself, and I
4 use that definition to guide my understanding of what
5 one of ordinary skill would understand for that term.

6 Q. Do you recall what that term was?

7 A. That term is domain.

8 Q. Let's take a look at the '833 patent. This is
9 Exhibit 1001.

10 A. Yes, I have it.

11 Q. Do you recognize the exhibit, Dr. Horst?

12 A. Yes.

13 Q. Do you recognize it as U.S. Patent 8,775,833?

14 A. Yes.

15 Q. You provided testimony concerning the '833
16 patent as part of your declaration.

17 Is that right?

18 A. That's right.

19 Q. If you turn to Column 1 in the paragraph that
20 begins at about Line 56 or so.

21 MR. LEWIS: Is there a question?

22 BY MR. FAHMI:

23 Q. Just waiting for Dr. Horst to indicate if he's
24 got that in front of him.

25 A. Yes, I have that.

1 Q. The second sentence says: As used herein, the
2 term "domain" is used to mean a collection of hardware
3 and/or logic that operates at the same voltage and
4 frequency point.

5 Do you see that?

6 A. Yes. That's the definition I was referring to
7 earlier.

8 Q. Let's turn to the claim in the patent. They
9 begin in Column 11 at about Line 25 or so.

10 A. Yes, I have them.

11 Q. If you want to read Claim 1 to yourself, just
12 to refresh your memory, and then let me know when you're
13 ready.

14 A. Yes, I'm ready.

15 Q. Claim 1 uses the phrase "independent voltage
16 and frequency."

17 Do you see that?

18 A. Yes.

19 Q. I understand from your earlier testimony that
20 you used the ordinary and customary meaning of that
21 phrase when you analyzed this claim.

22 Is that right?

23 A. Yes.

24 MR. LEWIS: Obj -- oh.

25 BY MR. FAHMI:

1 Q. What was the person of ordinary skill
2 understand as the ordinary and customary meaning of that
3 phrase?

4 A. In that context of -- of these claims,
5 independent voltage and frequency would mean that each
6 domain could have a different voltage and frequency than
7 the other domain.

8 Q. Claim 1 also uses the phrase "runtime."
9 Do you see that?

10 A. Yes.

11 Q. What would the person of ordinary skill
12 understand is the ordinary and customary meaning of
13 runtime as it's used in this claim?

14 A. Runtime would indicate that the dynamic
15 allocation can change while a program or a system is
16 running, so that it -- rather than a single static
17 allocation that that allocation could change over time.

18 Q. You mentioned "dynamic," and the claim uses the
19 term dynamically.

20 Do you see that?

21 A. Yes.

22 Q. What would the person of ordinary skill
23 understand is the -- meant by dynamically in the claim?

24 A. Dynamically means that the allocation changes
25 over time. Dynamically is the opposite of the static,

1 so in -- it -- it would change while the processor is
2 running.

3 Q. Claim 1 also uses the phrase "user-level
4 software."

5 Do you see that?

6 A. Yes.

7 Q. What would the person of ordinary skill
8 understand is the ordinary and customary meaning of that
9 phrase?

10 A. User-level software would be software that --
11 that runs on the system. And in this case the -- the
12 user-level software can control the sharing policy.

13 Q. So the claim also uses the term "sharing policy
14 value."

15 Do you see that?

16 A. Yes.

17 Q. Did you provide a instruction for that term in
18 your declaration?

19 A. I didn't provide a specific instruction, but I
20 analyze that term in each of the prior art references.

21 Q. Can you take a look at Column 4, the first
22 couple of paragraphs in Column 4.

23 I'll give you a chance to read those, and let
24 me know when you're ready.

25 A. I read it.

1 Q. Do the first couple of paragraphs in Column 4
2 explain what a sharing policy value is?

3 A. These paragraphs explain, in various
4 embodiments, for what the sharing policy could be.

5 Q. Would a person of ordinary skill in the art
6 reading the '833 patent understand what a sharing policy
7 value is from having read these passages?

8 A. A person of ordinary skill would understand
9 that these are examples of -- of -- of the sharing
10 policies and -- and would understand, along with reading
11 the whole patent, what a sharing policy is.

12 Q. What would the person of ordinary skill in the
13 art understand the sharing policy value is?

14 MR. LEWIS: Madam Court Reporter, can you
15 repeat the question please?

16 (Record read as follows: Question: What would
17 the person of ordinary skill in the art understand the
18 sharing policy value is?)

19 MR. LEWIS: Object to the form.

20 You may answer.

21 THE WITNESS: The -- in my expert report I
22 analyze this for each of the in- -- individual prior art
23 references.

24 And I could go to that in my report to give you
25 an understanding of how I understand sharing policy.

1 BY MR. FAHMI:

2 Q. Well, right now, Dr. Horst, I'm just concerned
3 with the '833 patent.

4 And my question really is: Having read the
5 '833 patent, what would the person of ordinary skill in
6 the art understand the sharing policy value is?

7 A. In around Line 21 in Column 4, it says: These
8 two values, referred to as policy values, an example of
9 Table 1 can be 5-bit values, can be used to determine
10 how a package power budget is to be shared between these
11 two mains -- two domains.

12 So I understand the sharing policy as policy
13 values as values that are used to determine how to
14 budget the power among different domains.

15 Q. And we're told in the previous paragraph, that
16 is the first paragraph in Column 4, that these values
17 can be set as configuration information by software.

18 Is that right?

19 A. It says the control can be exposed by way of
20 configuration information that could be set by such
21 software.

22 Q. Is -- is that describing the sharing policy
23 value?

24 A. That part is describing how the -- at least one
25 way the -- the sharing policies can be set.

1 Q. Okay. Let's go back to the claims, please.

2 And this time if you take a look at Claim 13.

3 It's in Line 12, begin -- or excuse me,

4 Column 12, begins around Line 52.

5 And I'll give you a chance to read it, and let

6 me know when you're ready, please.

7 A. Yes, I've read it.

8 Q. Claim 13 also uses the phrase "dynamically."

9 Do you see that?

10 A. Yes, a power sharing logic to dynamically

11 allocate a variable power budget.

12 Q. Does dynamically, as used in Claim 13, mean the

13 same thing as dynamically used in Claim 1?

14 A. Yes, I understand that to -- to mean the same

15 thing.

16 Q. Claim 13 also uses the phrase "power sharing

17 value."

18 Do you see that?

19 A. Yes.

20 Q. What would a person of ordinary skill in the

21 art understand is meant by the phrase power sharing

22 values in Claim 13?

23 A. The -- the power sharing value is a -- a value

24 that's used to determine how much power is to be shared

25 among the different domains.

1 Q. Let's turn to Exhibit 1005, please.

2 This is the Finkelstein or Finkelstein
3 reference?

4 A. Yes, I have it.

5 Q. Do you recognize Exhibit 1005, Dr. Horst?

6 A. Yes.

7 Q. And if I refer to it as Finkelstein, you
8 understand I'm talking about U.S. Pre-Grant
9 Publication 2010/0115304?

10 A. Yes.

11 Q. And I believe you offered testimony concerning
12 Finkelstein as part of your declaration.

13 Is that right?

14 A. That's right.

15 Q. When is the last time you had a chance to
16 review this reference?

17 A. Yesterday, and a -- a bit this morning.

18 Q. If you turn to Paragraph 9, please.

19 And I'll give you a chance to review that to
20 refresh your memory.

21 And let me know when you're ready.

22 A. Okay. I'm ready.

23 Q. So in Paragraph 9 Finkelstein mentions
24 throttling techniques.

25 Do you see that?

1 A. Yes. It says: One or more throttling
2 techniques may be utilized locally (on a per core basis)
3 for one or more process reports.

4 And then it goes on.

5 Q. Are those throttling techniques the form a
6 power management?

7 A. Those throttling techniques are referring to
8 changing the voltage and frequency to change the power
9 dissipation.

10 Q. And that's done at the level of the processing
11 core.

12 Is that right?

13 A. That is done at, in Finkelstein it -- it calls
14 them planes, which correspond to the domains in the '833
15 patent.

16 And the planes can be per core or a plane can
17 include multiple cores.

18 Q. Right. So also in Paragraph 9 Finkelstein says
19 that in designs with multiple power planes, power may be
20 distributed among different power planes under
21 energy-based definition in accordance with one
22 embodiment.

23 Do you see that?

24 A. Yes, I see that.

25 Q. Do you know what's meant by energy-based

1 definition in this context?

2 A. Energy-based definition is referring to the
3 power over a period of time. Power over time is energy.

4 Q. If we take a look at Paragraph 34, and at the
5 end of Paragraph 34 there's Equation 2.

6 Do you see that?

7 A. Yes.

8 Q. Is Equation 2 an energy-based definition that
9 Finkelstein was referring to in Paragraph 9?

10 A. Yes, that -- that equation is an energy-based
11 equation.

12 Q. So Equation 2, as "E" to the -- " E_k " being
13 equal to " W ," I think it's the case of " I " times " E " to
14 the " K ".

15 Is that right?

16 A. That's right.

17 Q. And in that equation, I think Finkelstein tells
18 us in the previous part of Paragraph 34, that " K " is
19 some kind of constraint.

20 Is that correct?

21 A. That's right.

22 Q. And that it's a thermal design power
23 constraint.

24 Is that right?

25 A. Yes.

1 Q. What -- what is the thermal design power
2 constraint?

3 A. That -- that is a constraint for the -- for the
4 system.

5 For instance, in a battery powered system there
6 may be a certain power limit when you're running with
7 the battery and when you're running on AC power there
8 would be a different constraint.

9 This is the overall constraint for the power
10 budget that they're talking about.

11 Q. And then also in Equation 2, "W" is actually a
12 vector.

13 Is that correct?

14 A. Yes. As it says "W" sub "K" of blank "M" such
15 that "I" corresponds to the portion of the budget that
16 goes to Power Plane I.

17 Q. So if I understand that correctly, each
18 component of the vector, "W" sub "K," is a portion of an
19 overall power budget that correspond to a particular
20 power plane for the system.

21 Is that correct?

22 MR. LEWIS: Objection to the extent it
23 mischaracterizes the document.

24 THE WITNESS: Yes, although it's -- it's in
25 terms of energy instead of power, but it is effectively

1 used the same way.

2 BY MR. FAHMI:

3 Q. A moment ago you explained a TDP constraint to
4 me.

5 Do those constraints change over time?

6 A. Which specific constraints are you referring
7 to?

8 Q. So you gave an example, I think, of if a system
9 is on battery power versus AC power, is it the
10 constraint itself that changes or just the condition
11 that the system is operating under that are --

12 MR. LEWIS: Objection.

13 THE WITNESS: I believe both changing over
14 time, but, in particular, this Vector W K, which
15 allocates power to the various units, would be changing
16 over time.

17 BY MR. FAHMI:

18 Q. I see.

19 So the value of "W" for a given power plane
20 could be different at different times.

21 Is that right?

22 A. That's correct.

23 Q. And I know it's written in terms of energy, but
24 if we're talking about a unit time it would essentially
25 be describing power, Equation 2, that is.

1 Is that right?

2 A. Yes, it's the power in terms of joules is -- if
3 this equation is evaluated for one second, then a joule
4 equals a lot second, so you can use this to determine
5 the power allocation for that second.

6 Q. So whatever the power budget is for a given
7 operating condition, that power budget would be divided
8 up between the different power planes according to the
9 respective weights or "W" values.

10 Is that right?

11 A. Yes. The "W" values would be allocating the
12 power to different power planes.

13 Q. And you -- as you just told me that the value
14 of those weights might change over time, correct?

15 A. That's correct.

16 Q. But for a given operating condition, the
17 portion of the power budget that's going to be assigned
18 to a given power plane depends on the weight coefficient
19 for that plane, correct?

20 MR. LEWIS: Madam Reporter, can you repeat the
21 question, please?

22 (Record read as follows: Question: But for a
23 given operating condition, the portion of the power
24 budget that's going to be assigned to a given power
25 plane depends on the weight coefficient for that plane,

1 correct?)

2 THE WITNESS: That's -- that's -- assuming the
3 constraint "K" doesn't change, then that would be true.

4 BY MR. FAHMI:

5 Q. Let's look at Paragraph 28 in Finkelstein,
6 please.

7 Paragraph 28 includes Equation 1.

8 Do you see that?

9 A. Yes.

10 Q. Equation 1 is defining an energy budget in an
11 iterative fashion.

12 Is that right?

13 MR. LEWIS: Objection to the extent it
14 mischaracterizes the document.

15 You may answer.

16 THE WITNESS: Yes, this shows how the energy
17 changes over a Delta T interval.

18 BY MR. FAHMI:

19 Q. I think this is also indicating that for each
20 time integral Delta T there's a corresponding thermal
21 design power limit, TDP.

22 Is that right?

23 MR. LEWIS: Objection to the extent it
24 mischaracterizes the document.

25 You may answer.

1 THE WITNESS: Yes. It -- it says: TDP,
2 Sub "N" is the thermal design power, TDP, power limit on
3 Step "N".

4 BY MR. FAHMI:

5 Q. Similarly, there's also a "P" sub "N"
6 representing the amount of power that is actually used
7 during that time integral Delta T, Sub "N".

8 Is that right?

9 A. That's right.

10 A "P" sub "N" is the amount of power actually
11 used.

12 Q. And the expression in parentheses, TDP Sub "N"
13 minus "A" Sub "N", that represents some kind of power
14 difference.

15 Is that correct?

16 A. Yes, that's -- that's the amount of available
17 power that's not being used in that time step.

18 Q. I think, if I followed you correctly, that
19 power difference, it gets multiplied by Delta T Sub "N,"
20 so we're left with an energy term.

21 Is that right?

22 A. That's right.

23 Q. The other energy term is Alpha E Sub "N," and
24 that gets added to the energy term that we -- we just
25 looked at, correct?

1 A. Yes, that's correct.

2 Q. And alpha is described as the decay component.

3 Is that right?

4 A. Yes.

5 Q. What's meant by a "decay component" in that
6 context?

7 A. The decay component is looking at some
8 percentage of the power from the previous -- from one
9 time step that can be applied on the next step -- time
10 step.

11 The -- the decay relates to how power is
12 dissipated, and the power or the temperature of the
13 components will gradually decrease as the -- or decay
14 after a spike in power.

15 Q. I see. So over time, after a power spike and
16 the temperature decreases, a device might be able to use
17 more power because it's under its thermal design power
18 constraints.

19 Is that right?

20 A. Yes, that's essentially correct.

21 Q. Further down in the same page in Paragraph 32,
22 there's a set of equations at the end of that paragraph.

23 Do you see that?

24 A. Yes.

25 Q. And it's my understanding that that equation is

1 defining a controller budget.

2 Is that right?

3 A. This is not a part of the Finkelstein that I
4 used in my analysis. So I'll need to read this more
5 carefully to understand it.

6 Q. Let's us know when you're ready to proceed.

7 A. Okay. I have now read it.

8 Can you repeat the question?

9 Q. Sure. So this set of equations for, I think
10 it's F to the Gamma of E is defining a controller
11 function.

12 Is that correct?

13 A. It's -- it's calling it a controller budget.

14 Q. And if I understand it correctly, each power
15 plane in the system will have a different controller
16 function.

17 Is that right?

18 A. This equations have "I," which is the
19 references to different controller planes. So each of
20 these could potentially be different.

21 Q. So collectively this set of equations is
22 mapping an energy budget for a power plane onto a set of
23 discrete power states.

24 Is that right?

25 A. Yes. These are the discrete power states,

1 which is a range from "P" Sub "N" to "P" zero.

2 Q. So in that case there would be some dependence
3 on how much a core could throttle, for example, based on
4 voltages and frequencies of the other cores because of
5 the controller budget.

6 Is that right?

7 A. For this embodiment, this controller function
8 maps the -- the power states.

9 Q. Right. And -- and because of that mapping, how
10 one core is effected is going to determine how another
11 core is effected.

12 Is that correct?

13 MR. LEWIS: Objection to the extent it
14 mischaracterizes the document.

15 You may answer.

16 THE WITNESS: If this shows that when one core
17 is, or one power plane is increased, that another one
18 could decrease.

19 BY MR. FAHMI:

20 Q. Okay. Let's turn to Exhibit 1007, please, the
21 Nussbaum reference.

22 A. Okay. I'm there.

23 Q. Do you recognize this exhibit, Dr. Horst?

24 A. Yes.

25 Q. I think you offered testimony concerning

1 Nussbaum as part of your declaration.

2 Is that right?

3 A. Yes.

4 Q. When is the last time you had a chance to
5 review it?

6 A. Yesterday.

7 Q. Okay. Well, as -- as we've done in the past,
8 if you need to take time to -- to read anything, you
9 know, please feel free to do so, as we go through it.

10 Let's turn to Paragraph 19, please.

11 A. Yes, I have read it.

12 Q. So in Paragraph 19, if I understand correctly,
13 Nussbaum is summarizing some problems with prior
14 approaches for what he says are homogenously increasing
15 power to all cores. And instead he's proposing
16 selectively distributing power among active cores or
17 other computational units based on frequency
18 sensitivity.

19 Is that correct?

20 A. Here -- here it is describing selectively
21 disputing power among the active cores based on
22 frequency sensitivity, although in other -- other parts
23 of Nussbaum, it has other approaches for distributing
24 power among the active cores.

25 Q. Which other approaches are you referring to?

1 A. In my expert report, Paragraph 114, it
2 says that -- sorry I was --

3 MR. LEWIS: Madam Court Reporter, can you
4 repeat the question for, please.

5 (Record was read as follows: Question: Which
6 other approaches are you referring to?)

7 MR. FAHMI: Can you repeat the question he gave
8 before that, please?

9 (Record read as follows: In my expert report,
10 Paragraph 114, it says that -- sorry I was --)

11 MR. FAHMI: Okay, I meant the answer before
12 that.

13 (Record read as follows: Here -- here it is
14 describing selectively disputing power among the active
15 cores based on frequency sensitivity, although in other
16 -- other parts of Nussbaum, it has other approaches for
17 distributing power among the active cores.)

18 THE WITNESS: Okay. I -- I found the part of
19 my report I was looking for, which is Paragraph 131,
20 which says: Nussbaum discloses reallocation under the
21 power from idle or less active components to the busy
22 components by adding more power allocated to busy ones.
23 BY MR. FAHMI:

24 Q. Okay. And are you saying that that does not
25 use frequency sensitive?

1 MR. LEWIS: Objection to the extent it
2 mischaracterizes testimony.

3 You can answer.

4 THE WITNESS: That may use frequency
5 sensitivity, but doesn't require frequency sensitivity.

6 BY MR. FAHMI:

7 Q. So in Paragraph 131 of your declaration, you
8 copied Table 1 from Nussbaum, correct?

9 A. Yes.

10 Q. Table 1 shows up at the bottom of Paragraph 21
11 in Nussbaum.

12 Do you see that?

13 A. Yes.

14 Q. Table 1 is itemizing allocated paragraphs?

15 MR. LEWIS: One second, Tarik. One second,
16 Tarik. I'm sorry.

17 Can we take a quick break before you ask the
18 next question?

19 MR. FAHMI: Yeah, sure, it's a good time for a
20 break. Thanks.

21 THE WITNESS: Okay.

22 MR. LEWIS: I'm sorry, Tarik. Somebody was
23 lost and also came in and interrupted us.

24 MR. FAHMI: Yeah, it's not a problem.

25 Do you want take ten minutes?

1 THE WITNESS: Yeah.

2 MR. FAHMI: Sure. Off the record.

3 (Recess.)

4 MR. FAHMI: Back on the record, please.

5 BY MR. FAHMI:

6 Q. Dr. Horst, during our break, did you discuss
7 the substance of your testimony with anyone?

8 A. No.

9 Q. We were looking at Nussbaum. And let's take a
10 look at Table 1 at the bottom of Paragraph 21, please.

11 As I understand it, that table is providing an
12 example of power budget allocation.

13 Is that right?

14 A. That's right.

15 Q. So allocation is describing a limit on the
16 amount of power an associated component can use.

17 Is that right?

18 A. Yes. It's given the maximum power allowed to
19 be used by each unit.

20 Q. A component may or may not use its maximum
21 allocated power.

22 Is that right?

23 MR. LEWIS: You may answer.

24 THE WITNESS: The -- the patent, I don't
25 believe goes into detail on when it uses its allocated

1 power or if it always uses its allocated power. But
2 these are numbers that it's not allowed to exceed.

3 BY MR. FAHMI:

4 Q. And in Paragraph 22, we're told that an
5 allocation is a limit that defines the highest nominal
6 operational point in terms of frequency and voltage of a
7 component.

8 Is that right?

9 A. Yes. It defines the highest nominal
10 operational point frequency and voltage of the various
11 unit.

12 Q. So the power budget allocation sets a limit on
13 the operating point, but it doesn't actually set the
14 operating point in terms of frequency and voltage for
15 the component.

16 Is that correct?

17 A. It -- it gives a maximum and, in many cases,
18 the units would utilize all of their maximums. So at
19 least in some cases, they would actually be specifying
20 the power that those units are using.

21 Q. But how the unit chooses to use that power, in
22 other words, what frequency it operates at, and what
23 voltage it operates at, there could be many
24 combinations, even if it's using the maximum power.

25 Is that right?

1 A. At the maximum power, it would be set at a
2 specific frequency, and that frequency and at a specific
3 voltage.

4 So in most cases, the power limit also
5 specifies the voltage and frequency.

6 Q. Where does Nussbaum say that the power limit
7 specifies the voltage and frequency?

8 A. If you look in Table 2 in the remarks column --
9 scroll up just a little bit. It says: Core can run at
10 a higher F, V to fill the new power head room.

11 So if I understand, that can mean that when
12 it's setting a power limit, it's also setting a voltage
13 and frequency limit.

14 Also, in the following paragraph, in Paragraph
15 24, it's -- it's -- it describes operational points as
16 frequency voltage combinations, which are used to
17 allocate -- in this paragraph, it's talking about Core0
18 and Core0 being allocated to the 16.75 watts. So the
19 operation points are the frequency and voltage that set
20 that 16.75 watt limit.

21 Q. The operation point, the frequency and the
22 voltage, can be adjusted within that 16.75 watt power
23 limit.

24 Is that right?

25 A. If you adjusted the frequency and voltage then

1 you would get a different power limit. So I understand
2 that to be the frequency and voltage that sets the limit
3 at 16.75 watt?

4 Q. So are you saying that for a given component,
5 there is only one operational point in terms of
6 frequency and voltage that can use a specified power
7 limit?

8 MR. LEWIS: Objection to the extent it
9 mischaracterizes testimony.

10 You may answer.

11 THE WITNESS: That's my understanding, is that
12 that each power limit corresponds to one voltage and
13 power.

14 BY MR. FAHMI:

15 Q. Further down on the page in Paragraph 25,
16 Nussbaum explains the concept of boost sensitive.

17 Is that right?

18 A. Yes. This is the beginning of the discussion
19 of boost sensitivity.

20 Q. Is that the same as the frequency sensitivity
21 we spoke about earlier?

22 A. I believe the two are related. I'm not sure
23 that they're described exactly the same way in the
24 specification.

25 Q. So the boost sensitivity that's discussed here

1 in Paragraph 25 is -- pardon me -- determined on a
2 computational unit basis.

3 Is that correct?

4 A. That's right.

5 Q. And beginning in Paragraph 25, and then
6 carrying on in Paragraph 26, Nussbaum is describing
7 tests that can be performed to determine a component's
8 boost sensitivity.

9 Is that right?

10 A. Yes, this is describing how to determine the
11 boost sensitivity.

12 Q. I think Nussbaum is indicating that some
13 components might have different boost sensitivity than
14 other components.

15 Is that correct?

16 A. I'm not sure if it described it in this
17 paragraph, but it does indicate that different
18 components can have different boost sensitivity.

19 Q. That boost sensitivity is it the measure of how
20 the component will respond to a change in an operational
21 parameter? For example, the frequency?

22 A. It -- it relates how a frequency change can be
23 translated into a performance change.

24 Q. I'm sorry. You said how a frequency change can
25 be translated into a component change?

1 A. No. I said performance change.

2 THE REPORTER: Excuse me. "Change" or "chain"?

3 THE WITNESS: Change.

4 THE REPORTER: Thank you.

5 BY MR. FAHMI:

6 Q. The boost sensitivity result from the test are
7 tabulated, correct?

8 MR. LEWIS: Objection. Form.

9 THE WITNESS: Yes, the result of tests are
10 saved.

11 BY MR. FAHMI:

12 Q. And in Paragraph 26, towards the bottom of the
13 paragraph, we're told that the boost sensitivity tables
14 scores a numerical difference between A and B. Earlier
15 in the paragraph, there is an explanation of what A and
16 B are. And then also for the core number being analyzed
17 and the process context number running on the CPU core
18 during the analysis.

19 Do you see that?

20 A. Yes.

21 Q. What is the process context number in -- in
22 that statement?

23 A. That would refer to an indicator of what
24 process was running at the time that performance
25 analysis was taken.

1 Q. I see.

2 So the boost sensitivity that is determined is
3 with respect to a particular process that's being run on
4 the core, for example.

5 Is that right?

6 A. Yes, the boost sensitivity for different
7 processes may be different.

8 Q. And in Paragraph 30 we're told that the boost
9 sensitivity for each core is tied to the current
10 processor context, correct?

11 A. Yes, it -- yeah, that's what it says in the
12 paragraph. I believe here it is referring to boost
13 sensitivity for processor cores where elsewhere in the
14 report it talks about boost sensitivity for the GPU.

15 Q. Okay. But in Paragraph 30 it's making
16 reference to processor context, and in Paragraph 26 it
17 was process content running on the CPU.

18 Are -- are those different?

19 A. These are both referring to processes running
20 on the cores.

21 Q. And then, as I understand it, in this
22 particular embodiment, the information in the boost
23 sensitivity table is used to determine how to allocate a
24 power budget in the system.

25 Is that right?

1 A. The boost sensitivity can be one factor that's
2 used for an allocated power budget, yeah.

3 Q. In Paragraph 33, at the bottom of the
4 paragraph, we have Table Number 3.

5 Do you see that?

6 A. Yes.

7 Q. Table 3 is showing different performance states
8 for a process report.

9 Is that correct?

10 A. It's showing performance states, operational
11 points, power dynamic, and static consumed, and then it
12 has a remarks column.

13 Q. So each performance state has an associated
14 operational point and an associated power, correct?

15 A. Yes, that's what it shows.

16 Q. At the bottom of the table the performance
17 state that's titled Deep Cstate.

18 Do you see that?

19 A. Yes.

20 Q. And the operational point there is clocks off,
21 slash, power off, correct?

22 A. Yes.

23 Q. If the clock is off and the power is off that
24 means the processor is off.

25 Isn't that right?

1 A. Yes, effectively, the processor isn't executing
2 anything in that state.

3 Q. If we look at Paragraph 46, there's reference
4 to a CPU-bounded or compute-bounded application.

5 Do you see that?

6 A. Yes.

7 Q. And in parentheses we're told that's an
8 application limited by the performance of one or more
9 processing cores, correct?

10 A. Yes.

11 Q. In that case, where a CPU-bounded application
12 is being executed, cores that are less sensitive, the
13 frequency increases or decreases may be throttled to
14 provide extra margins to the other cores, correct?

15 A. Yes, I see that.

16 Q. And Nussbaum is describing a situation where
17 you might adjust the amount of power budget available to
18 be allocated, correct?

19 A. Yes, it's showing a way of moving power between
20 the different groups of core.

21 Q. And this is dependent upon the frequency
22 sensitivities of those cores, correct?

23 A. Yes, it's talking about frequency sensitivity
24 here.

25 Q. Let's turn to Exhibit 1006, please.

1 This is the Conroy reference.

2 A. Yes, I have it.

3 Q. Do you recognize this exhibit, Dr. Horst?

4 A. Yes.

5 Q. And I believe you offered testimony concerning
6 the Conroy reference as part of your declaration.

7 Is that right?

8 A. That -- that's right.

9 Q. When is the last time you had a chance to
10 review Conroy?

11 A. Yesterday.

12 Q. If we look at Paragraph, I think, 5 -- yeah, 5
13 and 6, please.

14 I'll give you a chance to read those.

15 A. Yes, I got it.

16 Q. So Conroy is discussing power management for a
17 data processing system, correct?

18 MR. LEWIS: Objection to the extent it
19 mischaracterizes the document.

20 You may answer.

21 THE WITNESS: Yes, it's talking about power
22 management for a data processing system.

23 BY MR. FAHMI:

24 Q. And that power management is based on what
25 Conroy called a load profile, correct?

1 A. The load profile is -- is one of the factors
2 that can be used for the allocation.

3 It also uses -- discusses the utilization
4 factor, for instance.

5 Q. Right.

6 And as I understand it the load profile
7 compares the different utilization factors of the
8 subsystem.

9 Is that right?

10 A. The load profile is a way of comparing the
11 different subsystems in terms of their workload.

12 Q. And in this power management process, the power
13 is allocated in order to account for the different
14 workloads of the subsystems.

15 Is that right?

16 MR. LEWIS: Madam Court Reporter, can you
17 repeat the question, please?

18 THE REPORTER: Counsel, can you repeat your
19 question?

20 MR. FAHMI: Sure.

21 BY MR. FAHMI:

22 Q. In the power distribution systems that Conroy
23 described, power is allocated amongst the subsystems
24 according to their workload.

25 Is that correct?

1 A. The workload is -- is one of the factors that
2 this whole paragraph that describes the whole process of
3 the allocation.

4 Q. Within each of the subsystems, does it matter,
5 in terms of Conroy's process, as to how power is
6 managed?

7 MR. LEWIS: Objection. Vague.

8 THE WITNESS: I don't -- I don't understand the
9 question.

10 BY MR. FAHMI:

11 Q. Let me see if I can rephrase it for you.

12 Is it fair to say that Conroy is agnostic as to
13 how each subsystem does its own individual power
14 management?

15 MR. LEWIS: Objection. Vague.

16 THE WITNESS: I -- I would not say ag- --
17 agnostic.

18 I think the -- if you read through Conroy you
19 will find that each subsystem can't just assign power on
20 its own. It depends on what the other subsystems there
21 are.

22 BY MR. FAHMI:

23 Q. Let me see if I understand what you're saying.

24 So how one subsystem manages its allocated
25 power depends upon how another subsystem manages its own

1 allocated power in Conroy.

2 Is that correct?

3 MR. LEWIS: Objection to the extent it
4 mischaracterizes the testimony.

5 You may answer.

6 THE WITNESS: The allocation of power to the
7 different subsystems is a -- is across the system. It's
8 not under control of each indiv- -- each individual
9 subsystem. It can't take as much power as it wants.

10 The Figure 7 of Conroy shows the -- an
11 allocation of power in Figure 6.

12 BY MR. FAHMI:

13 Q. Okay. I -- I think I understand what you're
14 saying.

15 So each individual subsystem in Conroy can't
16 decide how much power to allocate for itself, correct?

17 A. That's what I'm saying, yeah.

18 Q. Once a particular amount of power has been
19 allocated to a subsystem by Conroy's overall process,
20 does it matter how the power within that subsystem is
21 then divided up?

22 MR. LEWIS: Objection. Vague.

23 THE WITNESS: You're assuming that the power
24 inside the subsystem is separately divided.

25 There's -- there's no requirement that there's

1 separate voltage and frequency that control over
2 elements inside a subsystem.

3 BY MR. FAHMI:

4 Q. In -- in Conroy does the subsystem have, for
5 example, two processor cores?

6 A. I believe that a subsystem could have multiple
7 processor cores.

8 Q. So in that circumstance, where a subsystem has
9 multiple processor cores, and an allocation for that
10 subsystem, along the lines of what is shown in Figure 7
11 has been made, does it matter in terms of Conroy's
12 process how the power is allocated in the different
13 process cores within the single subsystem?

14 MR. LEWIS: Objection. Vague.

15 THE WITNESS: The -- the allocation between the
16 different subsystems is shown in my expert report in
17 Paragraph 220.

18 It would be easier to answer that question
19 looking at that figure, Figure 22.

20 BY MR. FAHMI:

21 Q. What are we looking at in Figure 22?

22 A. Some -- it's up on the screen here.

23 This -- it's in my expert report.

24 This is not the page that I'm seeing in my
25 expert report on Page 124.

1 Q. Okay. Let's turn to your declaration,
2 Exhibit 1029, Page 124.

3 You've got a set of figures here, Figure 21A,
4 21B, 21C, and 22, correct?

5 A. That's right.

6 Q. And I think you said that Figure 22 was helpful
7 in respect of the question I was posing.

8 Is that right?

9 A. Yes. In this case it is showing just two
10 subsystems, the CPU and the GPU. And that the power can
11 be adjusted for each of those, but it's not showing any
12 separate adjustments for, if there happen to be multiple
13 cores within the CPU, for instance.

14 So I -- I interpret this to mean that in all of
15 the cores within that module would be running at the
16 same frequency and voltage.

17 Q. Okay. Let's turn back to Conroy, please.

18 I will have you turn to Paragraphs 196 and 197.

19 Take a few moments and just refresh your memory
20 about that portion of Conroy, and let us know when
21 you're ready.

22 A. Okay. I've read part of this. If you ask the
23 question I may need to look at it some more.

24 Q. Okay. So, in Paragraph 196 we're told that a
25 load profile for the system is defined by workloads of

1 each subsystem, correct?

2 A. Yes, each of the subsystems.

3 Q. And it's the workload of a subsystem that
4 determines the amount of power used by the subsystem,
5 correct?

6 A. It -- it says: In one embodiment of workload
7 and subsystem determines the amount of power used by the
8 subsystem. In another embodiment the operating system
9 may determine the workload of the subsystem from
10 historical scheduling data, or an application may
11 explicitly inform the system about the workload.

12 So it's talking about several different
13 embodiments here.

14 Q. In each of those cases, it's the same load --
15 load profile table for the system that's going to be
16 used.

17 Is that right?

18 A. The -- the embodiment that talks about the
19 historical scheduling data may use that same load
20 profile, or it may base that on some other recorded
21 information.

22 Q. Let me see if I can phrase the question a
23 little differently: The load profile table, an example
24 of which we looked at in your declaration, discusses the
25 -- or specifies the power allocation for the entire

1 system.

2 Is that right?

3 A. Yes. It -- it shows how power is allocated --
4 the total system power is allocated to different
5 subsystems.

6 Q. And there might be different load profile
7 tables for different conditions, right?

8 So, for example, there might be a balanced load
9 profile table, a different one for CPU heavy load
10 profile, and still a different one for GPU heavy load
11 profile, correct?

12 A. Yes. Those are what are described in 21A, B,
13 and C.

14 Q. But in each case that load profile table for
15 that particular workload scenario is specifying how the
16 power is distributed for the entire system.

17 Is that correct?

18 A. Yes. That -- that's assuring that allocation,
19 for at -- at least for the variable portion for the
20 whole system. There may be another fixed portion that's
21 not -- it doesn't need to be recorded in the table.

22 Q. Does a subsystem have to use all of the power
23 that it's allocated?

24 A. The subsystem will select the power based on
25 what it's allocated, so it will select its voltage and

1 frequency based on what's allocated.

2 Q. Depending on that selection of voltage and
3 frequency it might use less than a total allocation of
4 power.

5 Is that right?

6 A. The selection of voltage and frequency will
7 control the maximum power that that can use.

8 And typically that will also be specifying the
9 actual amount of power that's used because a particular
10 frequency of a subsystem will use all of the available
11 power of that frequency.

12 Q. Would each of the subsystems operate in that
13 fashion?

14 A. Each of the subsystems will -- would set its
15 frequency or would have its frequency and voltage set
16 based on the maximum power from that power allocation
17 table.

18 Q. And if I understand you, each of those
19 subsystems would set the voltage and frequency so it can
20 use all of the allocated power.

21 Is that correct?

22 A. Yes. At least in some conditions it would --
23 it would use all of that allocated power.

24 Q. Does that mean there were also some cases where
25 a subsystem might not use all of its allocated power?

1 A. It says that a performance -- I'm reading from
2 my report in Paragraph 221. That the performance levels
3 are typically determined by both its frequency
4 combination used by the processor.

5 So at least in the difficult condition, the
6 power is based on the voltage frequency and frequency
7 setting.

8 Q. My question is slightly different. I
9 understand the voltage and frequency setting determines
10 the amount of power used.

11 My question really is, whether in Conroy a
12 subsystem always has to use all of its allocated power?

13 A. I -- I don't see how that relates to the claims
14 of the '833. As long as -- as Conroy discloses, what --
15 what condition where the voltage and frequency are set
16 for each of subsystems, then it meets the claim terms of
17 the '833.

18 MR. FAHMI: Move to strike as nonresponsive.

19 BY MR. FAHMI:

20 Q. Dr. Horst, I'm not asking you to make a legal
21 determination about what may or may not apply to the
22 claims. I'm just asking you in Conroy, whether a
23 subsystem always has to use all of its allocated power.

24 MR. LEWIS: Asked and answered.

25 THE WITNESS: I haven't analyzed whether it

1 could use less than all of its power, but it certainly
2 can use all of its power in some condition.

3 MR. FAHMI: Okay. I don't have any further
4 questions at this time, Dr. Horst. Thank you.

5 THE WITNESS: Thank you.

6 MR. LEWIS: Let's take a quick two-minute break
7 and I'll get back to you.

8 (Recess.)

9 MR. LEWIS: Back on the record.

10 Mercedes has no questions either.

11 MR. FAHMI: Thank you, Dr. Horst. We
12 appreciate your time today.

13 THE WITNESS: Thank you.

14 MR. FAHMI: Off the record.

15 THE REPORTER: Ms. Milevsky, do you want a
16 copy?

17 MR. LEWIS: Just to me, please.

18 ---oOo---

19 (Proceedings concluded at 10:54 a.m.)

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DECLARATION UNDER PENALTY OF PERJURY

I, Robert W. Horst, Ph.D., hereby declare under penalty of perjury that I have read the foregoing transcript of my deposition taken on May 14, 2024, or the same has been read to me; that the same is true and accurate, and except for such corrections, additions, or Changes, if any, that I deem necessary, with the understanding that I offer these changes as if still under oath.

Signed on this _____ day of _____,
20____ ,

Robert W. Horst, Ph.D.

1 I, Johnell M. Gallivan, Certified Shorthand Reporter for
2 the State of California, do hereby certify:

3
4 That the witness in the foregoing deposition was by me
5 first duly sworn to testify to the truth, the whole
6 truth and nothing but the truth in the foregoing cause;
7 that the deposition was taken by me in machine shorthand
8 and later transcribed into typewriting, under my
9 direction, and that the foregoing contains a true record
10 of the testimony of the witness.

11
12
13
14 Dated: This 16th day of May 2024 at San Diego,
15 California.

16 *Johnell M. Gallivan*

17 _____
18 Johnell M. Gallivan

19 CSR No. 10505
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