

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

MERCEDES-BENZ USA, LLC, *
Petitioner, * IPR2023-01333
* U.S. Patent No. 10,049,080
VS. *
*
DAEDALUS PRIME, LLC, *
Patent Owner. *

ORAL AND VIDEOTAPED DEPOSITION OF
MICHAEL C. BROGIOLI
JULY 31, 2024

ORAL AND VIDEOTAPED DEPOSITION OF MICHAEL
C. BROGIOLI, produced as a witness at the instance of
the Petitioner and duly sworn, was taken in the
above-styled and numbered cause on the 31st day of
July, 2024, from 10:02 a.m. to 1:43 p.m., before Marsha
Yarberry, Certified Shorthand Reporter in and for the
State of Texas, reported by machine shorthand, at the
law offices of Scott Douglass & McConnico LLP,
303 Colorado Street, Suite 2400, Austin, Texas,
pursuant to 37 C.F.R. 42.53 and the provisions stated
on the record hereto.

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ALSO PRESENT:

Ms. Joss Harrington, Videographer

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EXHIBITS

NO.	DESCRIPTION	PAGE/LINE REFERENCED
Exhibit 1.....	Petitioner's Notice of Deposition of Michael C. Brogioli, Ph.D.	7/3
Exhibit 2.....	Declaration of Michael C. Brogioli, Ph.D. in Support of Patent Owner's Response	38/17
Exhibit 3.....	United States Patent 10,049,080	40/7
Exhibit 4.....	United States Patent Application Publication US 2008/0288748	75/15
Exhibit 5.....	United States Patent Application Publication US 2011/0213950	89/9

1 THE VIDEOGRAPHER: Here begins the
2 deposition of Michael C. Brogioli, PhD. The date is
3 July 31, 2024. The time on the video is 10:02 a.m.

4 Will the court reporter please swear in
5 the witness.

6 (Witness sworn)

7 MICHAEL C. BROGIOLI,
8 having been first duly sworn, testified as follows:

9 EXAMINATION

10 QUESTIONS BY MR. LEWIS:

11 Q. Good morning, Dr. Brogioli. My name is Damon
12 Lewis. I represent Mercedes-Benz USA in connection
13 with this matter.

14 Can you please state your full name and
15 address for the record?

16 A. Yes. It's Michael Charles Brogioli. My home
17 address is 3420 Mount Barker Drive, Austin, Texas
18 78731.

19 Q. Okay. And do you understand that we are here
20 for the purpose of taking your deposition testimony
21 today?

22 A. Yes.

23 Q. Have you ever had your deposition taken
24 before?

25 A. I have.

1 Q. How many times, about?

2 A. Maybe 55 or so.

3 Q. Is that including yesterday?

4 A. Maybe -- 56 maybe after yesterday, but in that
5 range.

6 Q. Okay. I'm just going to go over a couple of
7 things that are pro forma, although I expect that
8 somebody with your experience has answered this many
9 times already, but let's go over some ground rules.

10 I will be asking the questions, and you
11 will be giving me the answers. Is that okay?

12 A. Yes.

13 Q. The court reporter here take -- taking down
14 everything we say, so we should try not to talk over
15 each other, okay?

16 A. Okay.

17 Q. When I'm asking the question, please let me
18 finish asking before you answer, and I will do the same
19 with your answers, okay?

20 A. Okay.

21 Q. And the court reporter cannot take down a nod
22 of the head or an uh or an um, so it's important that
23 you provide your answers verbally to my questions,
24 okay?

25 A. Okay.

1 Q. Do you understand that your testimony today
2 will be provided here under oath?

3 A. Yes.

4 Q. And you understand your testimony is provided
5 under the penalties of perjury?

6 A. Yes.

7 Q. And do you understand that you should give the
8 same seriousness and truthfulness in answering my
9 questions here as you would if you were testifying
10 before a court with a judge and jury?

11 A. Yes.

12 Q. Is there any reason that you are unable to
13 answer my questions truthfully today?

14 A. No.

15 Q. No medications or illnesses that could
16 interfere?

17 A. No.

18 Q. Okay. And if you answer a question, I have to
19 assume that you understand it. Is that okay?

20 A. Yes.

21 Q. So if I ask something you do not understand,
22 can you confirm that you -- strike that.

23 If I ask you a question that you don't
24 understand, will you tell me that you don't understand
25 it?

1 A. Yes.

2 Q. Okay.

3 MR. LEWIS: Mark this as Exhibit 1,
4 please.

5 (Exhibit 1 marked)

6 Q. (By Mr. Lewis) Dr. Brogioli, can you tell me
7 what this document is?

8 A. This looks like a -- or my deposition notice I
9 received maybe late last week.

10 Q. Okay. Can you confirm that you have seen this
11 document before?

12 A. Yes. That's correct.

13 Q. Can you confirm that you are appearing today
14 based on this notice?

15 A. That's my understanding, yes.

16 Q. Okay. What have you done to prepare yourself
17 for deposition testimony today?

18 A. So I reviewed my declaration, the '080 patent,
19 the prior art references that I cite in my declaration,
20 probably have looked at -- Dr. Horst I believe is the
21 other expert, some of his declaration, and then
22 periodically met with counsel who is here today in
23 preparing.

24 Q. Okay. Did you meet with anyone else?

25 A. No.

1 Q. Did you discuss this with anyone else?

2 A. No.

3 Q. Where did you meet with counsel?

4 A. We met via -- or online, Zoom or a similar
5 solution. I guess it would have been mostly last week
6 in preparing for the three depositions this week, and
7 then we met briefly this morning at his hotel.

8 Q. Okay. Did you review any other documents than
9 the ones you cited? You said you had reviewed the
10 declaration, the '080 patent, the prior art references
11 that you cite in your declaration. Did you review any
12 other documents in preparation for this deposition?

13 A. I think I had also mentioned I may have looked
14 at Dr. Horst's declaration. I think that would be it.
15 Maybe there was something cited in my declaration that
16 I looked at, but nothing outside the scope of that.

17 Q. Okay. What is an operating system?

18 A. I would say generally it's a piece of software
19 that is used to run, for example, a server, a personal
20 computer, used to control things like dispatching of
21 jobs on the computer or access to hard disks,
22 peripherals, things like that.

23 Q. Do you have experience in building operating
24 systems?

25 A. Aspects of them, yes.

1 Q. What aspects?

2 A. Things like some of the software optimization,
3 things like low-level interfaces between software, how
4 software interfaces with hardware or what relatively
5 modern microprocessors use, things like BIOS system,
6 firmware, stuff like that. I have worked in aspects of
7 scheduling in the past. Those are, I guess, the
8 immediate things that come to mind.

9 Q. Were these as engineers as -- strike that.
10 Was this experience while you were an engineer
11 somewhere or consulting somewhere or for testimony as
12 an expert?

13 A. I would say as -- I would say a mix of
14 engineering work in research, a mix in industry and
15 probably consulting work as well and probably some
16 expert work as well.

17 Q. Okay. What is hardware?

18 A. I will say hardware is chips, a die from which
19 we create chips and put them in packages, silicon,
20 things like a physical microprocessor that software
21 runs on or instructions execute on. The other I would
22 say physical components of a computer, things like
23 DRAM, interconnects, things like that, are examples of
24 hardware.

25 Q. Is a microchip hardware?

1 A. I think in the sense a person of skill would
2 look at a microchip or a piece of silicon chip, that
3 would be a piece of hardware.

4 Q. Is a microchip ever not hardware?

5 A. In its physical form I would say that's a
6 piece of hardware.

7 Q. I'm not sure that quite answers my question.
8 Is a microchip ever not hardware?

9 A. So I'm answering it. If you are talking about
10 the physical implementation of, let's say, a 16-bit
11 processor or something, that would be a piece of
12 hardware. If a design engineer is working with VHDL or
13 RTL and designing it, at that point in time I wouldn't
14 consider it a microchip but a design. It wouldn't be
15 hardware.

16 Q. So once you would consider it a microchip you
17 would consider it hardware?

18 A. I guess in a generic sense, yes. If there's a
19 physical chip that's been fabricated and cut from a
20 die, that would be a piece of hardware I would think.

21 Q. Okay. Is it your opinion that hardware
22 implies something physical?

23 A. I would say generally yes when we talk about
24 hardware it's something physical that's part of the
25 computer. Obviously there is power that goes to it and

1 electrical aspects to it, but it's something --
2 generally something physical.

3 Q. You can touch hardware, correct?

4 A. I would say that's true, yeah. A person of
5 skill of the art would understand that.

6 Q. Okay. So a microchip is hardware, then?

7 A. If I've got a physical implementation of, in
8 your language, a microchip that's a processor, I would
9 consider that hardware, yes.

10 Q. Okay. Is a DRAM hardware?

11 A. If I've got a DRAM chip on a DIMM and nine of
12 them on each side kind of thing, I would think that's a
13 piece of hardware.

14 Q. Is an ASIC hardware?

15 A. If I've designed an ASIC and gone and
16 fabricated it into a, you know, 32-nanometer part or
17 something like that, I would generally consider that
18 hardware.

19 Q. Is a FPGA hardware?

20 A. I would say if I've got an FPGA that I went
21 and purchased from Altera or Xilinx or somebody that I
22 plan on using for design or implementing something,
23 that device itself is a piece of hardware.

24 Q. You qualified that, sir. Is an FPGA ever not
25 hardware?

1 A. The FPGA itself I would say is hardware.
2 There are aspects of an FPGA which are peculiar pieces
3 of hardware in this case where I can put different
4 designs on it to do different things, but the physical
5 FPGA itself would be a piece of hardware.

6 Q. You've worked with FPGAs in your history,
7 correct?

8 A. That's right.

9 Q. Have you designed FPGAs?

10 A. I have designed systems that use FPGAs and
11 implementations that go onto an FPGA. I don't know if
12 I've designed a PCB that's actually the FPGA chip with
13 power supply, to answer it another way.

14 Q. When you say "implementations that go onto an
15 FPGA," what do you mean by that?

16 A. In the case of an FPGA, let's say I'm trying
17 to design some kind of filter for a cellphone, radio,
18 or something. I can design that with various design
19 tools, the filter itself, and then I can push that
20 design onto the FPGA, into the circuits of the FPGA,
21 and then the FPGA behaves in a certain way. You can
22 then alter that design and put a new design onto the
23 FPGA, and it would effectively implement your new
24 algorithm on that hardware.

25 Q. You just testified that you could design some

1 kind of filter for a cellphone/radio and put it on an
2 FPGA, correct?

3 A. That's correct, yes.

4 Q. When you put that cellphone/radio filter on an
5 FPGA, the FPGA is still hardware, correct?

6 A. The FPGA itself is, yes.

7 Q. And the -- strike. And the FPGA does a
8 filtering function when you put that filter on the
9 FPGA, correct? Do you understand the question?

10 A. I believe so. When I take my filter design in
11 this example and it turns into a stream of bits that
12 you put into the FPGA, the goal, if everything is
13 working right, is the hardware of the FPGA is now
14 behaving in a way that implements that filter function.

15 Q. Is it fair to say that the filter's function
16 is now performing on hardware?

17 A. That generally sounds right. I've taken the
18 bit stream -- my -- the implementation of my filter
19 function, and that FPGA should be behaving in a way
20 that implements that filter function.

21 Q. What is software?

22 A. I guess you'd have to be more specific in what
23 sort of lens we're looking at it through, but it's
24 typically what engineers write or programmers write in
25 a programming language, and then we take those

1 languages and compile them down through a complicated
2 process to bits and bytes that run, for example, on a
3 microprocessor so I can write an operating system. It
4 gets compiled and linked and loaded and all of those
5 things into a binary that is designed for a specific,
6 let's say, microprocessor, and then with a bunch of
7 other functionality that runs on that hardware.

8 Q. Software is not just things that are written
9 with programming languages, correct? Let me strike and
10 ask you a better question.

11 A. Better question.

12 Q. The fact that it was made with a programming
13 language does not make it software, correct?

14 A. Oh. I guess that's probably true. I could go
15 implement a piece of software using, you know, a hex
16 editor or something that would be compatible to run on
17 a processor, something like that.

18 Q. Isn't it also true that I can use a
19 programming language like Verilog to design hardware?

20 A. To design hardware. Yes. That's one
21 technology that's used in the field.

22 Q. So what is the essence that makes something
23 software?

24 MR. FAHMI: Objection; form.

25 THE WITNESS: I don't know that I -- I

1 haven't done that analysis in my declaration. One
2 example I suppose is something that's a program that
3 runs on, for example, some type of processing device.
4 There is other definitions if we're looking at source
5 code or, you know, other design tools that are
6 software, different levels of abstraction kind of
7 thing.

8 Q. (By Mr. Lewis) Is firmware software?

9 A. It probably depends on the context you're
10 asking about or what type of engineer you're talking
11 to, but I would say, generally speaking, firmware is
12 something else that results in instructions that run on
13 a microprocessor, for example.

14 Q. Is it your opinion that if it's run on a
15 microprocessor it's software?

16 A. I would say if it's something that either I
17 write in assembly language or C++ or something else and
18 it's compiled into a binary that's compatible with or
19 designed or -- designed to run on that CPU
20 architecture, that generally would be a piece of
21 software.

22 Q. What is microcode?

23 A. It's one example being very low level -- maybe
24 I will answer the other way around. So a
25 microprocessor, depending on what type of

1 microprocessor you're talking about, they support
2 different instructions, like load, store, add. Some
3 microprocessor designs, not all, implement those types
4 of instructions, like a division instruction that's
5 complicated, with what's referred to as microcode that
6 are sort of smaller, finer grain types of things or
7 operations that occur within the CPU itself.

8 Q. If a CPU had microcode that had instructions
9 on how to perform division, for instance, is that
10 microcode on hardware?

11 A. I guess typically we view that whole box as
12 the CPU that implements whatever the instruction set
13 is, Pentium Pro or something like that. I haven't
14 performed an analysis here as to what aspects of things
15 related to these patents microcode does or doesn't
16 contain.

17 Q. Can you answer that question speaking from
18 your experience?

19 A. Your initial question was -- one more time?

20 Q. Yeah. I will repeat it. If a CPU had
21 microcode that had instructions on how to perform
22 division, for instance, is that microcode on hardware?

23 A. I guess at a high level going from memory, in
24 this example the microcode would be controlling aspects
25 of the CPU arithmetic units and aspects of the pipeline

1 to implement the division instruction in this example,
2 so all of that would be controlling the hardware of the
3 CPU to make the division happen.

4 Q. Is that performing on hardware?

5 MR. FAHMI: Objection; form.

6 THE WITNESS: I guess going back to my
7 earlier answer, I mean, the CPU itself is implemented
8 in silicon, and it's the CPU that I think a person of
9 skill would look at as a piece of hardware. Whether or
10 not in your example a given CPU has microcode in it
11 controlling the aspects of arithmetic and things like
12 that, the CPU itself is the piece of hardware.

13 To put it another way, a software
14 developer can't write -- can't just go download, like,
15 Microsoft Visual Studio and write microcode for a, you
16 know, Intel Nehalem chip or something like that.

17 Q. (By Mr. Lewis) Why is that?

18 A. They don't have access to it.

19 Q. They don't have access to the what?

20 A. To anything beyond the layer of the CPU
21 hardware itself.

22 Q. Is it fair to say that the things that the
23 software engineer doesn't have access to because it's
24 within the chip is hardware?

25 A. One more time?

1 Q. Uh-huh. Is it fair to say that the microcode
2 that the software engineer does not have access to
3 because it is in the chip -- is it fair to say that
4 that microcode is hardware?

5 MR. FAHMI: Objection; form.

6 THE WITNESS: I think in your question
7 the -- I view software developer or programmer. But
8 the person writing an application in this scenario just
9 views the CPU as the hardware.

10 Q. (By Mr. Lewis) You say that the software
11 developer or programmer just views the CPU as hardware.
12 Is that what you said?

13 A. Yes. When -- if I'm a semiconductor company
14 selling processors, I sell processors, and the
15 processor is the hardware. What I do inside of that or
16 what someone -- how it's implemented at the
17 microarchitecture level isn't something software
18 developers are typically concerned with or it doesn't
19 involve them. They just get a piece of hardware.

20 Q. Okay. Is it fair to say that the things
21 inside the chip are hardware?

22 MR. FAHMI: Objection; form.

23 THE WITNESS: I'm not sure what you mean
24 by things inside a chip, but if I -- if I go to a fab
25 and a piece of die comes out and it gets cut up into

1 chips that go into different, you know, buckets or bins
2 we call them and I pull one out, someone's going to
3 view that as a piece of hardware at that stage.

4 Q. (By Mr. Lewis) How about if I go to Micro
5 Center or Fry's or any kind of store that sells
6 microchips to designers, tinkerers, whatever? The
7 thing inside the box, the silicon, is it fair to say
8 that everything on the silicon is hardware?

9 MR. FAHMI: Objection; form.

10 THE WITNESS: I guess we'd need to be
11 more specific. Your question is less of an engineering
12 one and more of a, like, consumer products question as
13 to what whoever supplies microchips sticks on their
14 thing in the box.

15 Q. (By Mr. Lewis) I'm talking about just the
16 stuff that's on the silicon.

17 MR. FAHMI: Objection; form.

18 THE WITNESS: I don't know. We'd have to
19 go look. There's a whole -- from the time in my
20 previous answer of the chip coming off the fab to when
21 it ends up in a box at Micro Center, there is a whole
22 bunch of steps in there for creating a product that's
23 sold to consumers.

24 Q. (By Mr. Lewis) Do any of them alter whether
25 the things that are on the silicon is hardware or not?

1 A. Well, I mean, I guess if I take a piece of
2 hardware and throw a bunch of CD-ROMs in there with
3 drivers and all kinds of other things that I'm sure
4 we've all seen when we buy stuff at the store, the
5 things -- some of those things are software as part of
6 a consumer-facing product being sold at a retail store.

7 Q. So to be sure, I'm not talking about the
8 additional things that might be in the box with the
9 silicon. I'm just talking about the physical chip,
10 square piece with some pins sticking out of the
11 bottom --

12 A. Fair enough.

13 Q. -- inserted into the motherboard, just the
14 chip. Is it fair to say that the things that are on
15 the chip are hardware?

16 MR. FAHMI: Objection; form.

17 THE WITNESS: I'm not sure. You know,
18 there -- there are pieces of silicon that are just raw
19 silicon without much of, like, I guess an ecosystem put
20 on them, and then maybe there are other more advanced
21 pieces of hardware that have -- that a vendor chooses
22 to put something on the hardware before it goes to like
23 a Dell to be plugged into motherboards. I haven't
24 looked at that in this engagement.

25 Q. (By Mr. Lewis) Do you have experience with

1 vendors placing an ecosystem on a chip?

2 A. I have experience with selling, like, a chip
3 on a board to what we call OEMs, so not retail. People
4 that are taking the boards with a bunch of hardware and
5 building systems from them. And I guess I would say
6 I've also certainly worked with chips or processors
7 that are just bare silicon, that you have to do
8 everything to get it to come alive kind of thing.

9 Q. If a vendor were to put something on the
10 hardware, it's almost tonological, correct, that that
11 is now hardware, right?

12 MR. FAHMI: Objection; form.

13 THE WITNESS: I'm not sure I understand
14 the question.

15 Q. (By Mr. Lewis) Sure. Earlier you said that
16 there might be an ecosystem put onto a chip, that the
17 vendor chooses to put something on the hardware before
18 it goes to like Dell to be plugged into motherboards.
19 Is that a fair characterization of what you said?

20 A. That's one example. Yeah.

21 Q. Okay. So in that example, isn't it fair to
22 say that the things that the vendor put on the chip are
23 now hardware?

24 MR. FAHMI: Objection; form.

25 THE WITNESS: No. In that scenario there

1 could be all kinds of things that a vendor puts on
2 there. There could be ROM that has like a board
3 support package and drivers to interface with
4 development machines. There could be libraries on
5 there. There could be all kinds of different things.
6 It's software.

7 Q. (By Mr. Lewis) But it's implemented in
8 hardware, correct?

9 MR. FAHMI: Objection; form.

10 THE WITNESS: No.

11 Q. (By Mr. Lewis) No? Why not?

12 A. If I take a computer program and stick it in
13 flash memory, that's a program in flash memory that
14 happens to be on the board that this vendor sold to
15 Dell in this example.

16 Q. I believe we were talking about a
17 microprocessing chip. I don't want to expand it out to
18 an entire computer.

19 A. Okay.

20 Q. I'm just talking about the CPU.

21 A. Okay.

22 Q. Is everything that's on the CPU hardware?

23 MR. FAHMI: Objection; form.

24 THE WITNESS: I guess if we're talking
25 about the case of raw CPU being sold to someone who

1 then is going to put drivers and operating systems and
2 other things on it, there is an example where the raw
3 CPU is just a piece of hardware.

4 Q. (By Mr. Lewis) Can you put a driver or an
5 operating system on a CPU? Strike that question. Let
6 me ask a different way.

7 Do vendors put drivers or operating
8 systems on CPUs?

9 MR. FAHMI: Objection; form.

10 THE WITNESS: I would say ultimately
11 those things like an operating system will run on a
12 CPU. I was initially answering your question to say if
13 a vendor sells a raw 64-bit CPU, then the CPU is that
14 piece of hardware we've been talking about in terms of
15 the piece of silicon.

16 Q. (By Mr. Lewis) Is that the end of your
17 answer?

18 A. Yeah.

19 Q. Does the raw CPU contain -- strike that. Can
20 a raw CPU contain microcode?

21 A. At a point along the way from the fab to
22 selling the CPU, if it's a CPU that uses microcode, if
23 it's of that type of architecture, then at some point
24 microcode will be in the CPU which then gets sold to
25 someone as a piece of hardware.

1 Q. You say, "Then at some point microcode will be
2 in the CPU which then gets sold to someone as a piece
3 of hardware."

4 Is the microcode then part of the
5 hardware?

6 MR. FAHMI: Objection; form.

7 THE WITNESS: In the sense that the
8 person buying the CPU, the -- in this very specific
9 example of microcode, the microcode makes the CPU
10 operate according to the specification that the
11 customer purchased, right? Without the microcode it's
12 presumably not going to work, this raw CPU you're
13 selling. So they're part and parcel. For that type of
14 microprocessor architecture, for the microprocessor to
15 work, it's with the microcode that's very deeply inside
16 of it.

17 Q. (By Mr. Lewis) So then is the microcode part
18 of the hardware?

19 MR. FAHMI: Objection; form.

20 THE WITNESS: I guess it would depend on
21 what type of engineer you're asking. In your scenario
22 of someone buying CPUs I would think yes, it is. If
23 you -- I will follow up. If you talk to a microcode
24 engineer, they might have different language that they
25 might use.

1 Q. (By Mr. Lewis) Is there any software that
2 cannot be implemented in hardware?

3 MR. FAHMI: Objection; form.

4 THE WITNESS: I don't know. I would
5 think if you had a program large enough you just simply
6 wouldn't have enough transistors to implement it, as an
7 extreme example.

8 Q. (By Mr. Lewis) Theoretically if I had all the
9 transistors in the world, no cap on transistors --
10 crunch all you want. We'll make more, oodles of
11 transistors, in other words, not running out of
12 transistors. In that world is there any software that
13 cannot be implemented in hardware?

14 MR. FAHMI: Objection; form.

15 THE WITNESS: I would think there is a
16 lot of variables to that. It would sound like yes, I
17 mean, if the software has to meet certain requirements
18 or do certain things or have certain cost points or
19 malleability or programmability. There is a million
20 reasons why things don't get implemented in hardware
21 depending on a lot of other variables.

22 Q. (By Mr. Lewis) So I'm not asking why one
23 would implement something in software versus hardware.
24 I'm asking theoretically is there any software that
25 cannot be implemented in hardware.

1 MR. FAHMI: Objection; form.

2 THE WITNESS: I guess I don't have an
3 opinion on that. I don't know the universe of software
4 that exists today or will exist tomorrow.

5 Q. (By Mr. Lewis) Do you not know if there is
6 any software that cannot be implemented in hardware?

7 MR. FAHMI: Objection; form.

8 THE WITNESS: I would say same answer.
9 There are a lot of reasons why we develop software, and
10 I would think there are pieces of software -- this
11 sounds like a theoretical mathematical analysis
12 exercise, but I really don't have an opinion on it.
13 There is many reasons why we don't do a lot of things
14 in hardware.

15 Q. (By Mr. Lewis) Is it fair to say that the
16 reasons why we wouldn't make something in software
17 instead of in hardware are practical?

18 MR. FAHMI: Objection; form.

19 THE WITNESS: That would probably be one
20 aspect of it. I don't know that we have the ability to
21 make hardware today as an industry that can incorporate
22 every piece of software out there. It seems unlikely
23 to me.

24 Q. (By Mr. Lewis) You're familiar with ASICs,
25 though, correct?

1 A. Correct.

2 Q. Do you know what ASIC stands for?

3 A. In my travels it's application-specific
4 integrated circuit.

5 Q. We travel in the same circles.

6 A. Okay.

7 Q. Here's the question. Doesn't
8 application-specific mean that we're implementing
9 something that could have been input in software and
10 hardware?

11 A. No. It generally means it's a -- in contrast
12 to like a general-purpose processor, it's something
13 that's specific to an application space, so it may do,
14 for example, a really specific type of efficient
15 filtering going back to our wireless telecom example,
16 whereas Microsoft Windows presumably doesn't need turbo
17 coding-type arithmetic to run Windows.

18 Q. ASIC's a hardware, though, correct?

19 A. I would say generally yes, when someone thinks
20 of ASICs you think of custom circuits that do specific
21 things.

22 Q. What is a kernel?

23 A. In what context?

24 Q. Let's start with popcorn.

25 MR. FAHMI: Objection; form.

1 THE WITNESS: I guess it's --

2 Q. (By Mr. Lewis) Strike that. Let's talk about
3 operating systems. What is a kernel?

4 A. It's a piece of -- my recollection is it's a
5 piece of software that's rather low level that
6 implements certain functionality that other layers --
7 software layers of the operating system interface with
8 them, rely upon kind of thing.

9 Q. Going back to our earlier discussion about
10 operating systems, is it fair to say that operating
11 systems generally are implemented in layers?

12 MR. FAHMI: Objection; form.

13 THE WITNESS: There are probably some
14 references that use that language. There's things like
15 a kernel space or a user space, things like that,
16 different privilege levels, and there is different ways
17 that different operating systems get architected at a
18 high level.

19 Q. (By Mr. Lewis) Is there a better terminology
20 that we should use to describe what I refer to as
21 layers of the operating system?

22 A. I mean, we're speaking in such a generic sense
23 I guess that's fine. If there was a specific UNIX
24 operating systems reference, we can use the language
25 they use.

1 Q. Okay. Is it fair to say that all or nearly
2 all operating systems have a kernel?

3 MR. FAHMI: Objection; form.

4 THE WITNESS: I would say a number of
5 them do, for example, when you talk about things like
6 Linux or different flavors of Linux. I don't know that
7 all of them do.

8 Q. (By Mr. Lewis) Is it fair to say that most
9 do?

10 A. I don't know if it's most or not. Some
11 certainly do.

12 Q. When an operating system has something that it
13 refers to as a kernel, what is the role of that
14 structure, the kernel?

15 A. I'd have to go back and look at an OS
16 architecture or reference. There is specific reference
17 for you on that to see how that operating system and
18 that kernel is designed. Even within like the Linux
19 community there is all different sort of debates about
20 how things are done and architected and so forth. I
21 don't recall having a huge section on operating system
22 architecture and kernel design in my declaration.

23 Q. Okay. But generally speaking, if somebody
24 were to ask you about the kernel of an operating
25 system, do you have a general understanding of what

1 that person is talking about?

2 MR. FAHMI: Objection; form.

3 THE WITNESS: I would say general in the
4 sense of certain aspects of it. It's a piece of
5 software. It's got certain timing requirements it
6 needs to meet. It's usually a very efficient, fairly
7 low-level software.

8 Q. (By Mr. Lewis) Okay. What is the basic role
9 of the kernel in an operating system?

10 A. One of the things it can do is respond to
11 requests from other layers of software, I think in
12 cases can do things like scheduling of jobs and
13 probably, depending on your example, has ways of the
14 software of the kernel to communicate to hardware or
15 hardware interfaces or things like that.

16 Q. Is the kernel software?

17 A. Yes.

18 Q. Does the kernel act transparently to the
19 programs executing on the operating system?

20 MR. FAHMI: Objection; form.

21 THE WITNESS: Typically if I'm writing
22 something like an email client, the email client
23 doesn't have -- or doesn't interface with the kernel
24 directly.

25 Q. (By Mr. Lewis) Does the email client know

1 what the kernel is doing?

2 A. In the sense of the email client isn't
3 normally making -- and this is in a very generic
4 example. At the application layer you're typically not
5 making calls directly into the kernel, for example,
6 from your email application or something like that, in
7 my experience.

8 Q. Earlier I used the word "transparently." What
9 does that word mean to you with respect to
10 applications?

11 A. Well, in my declaration I talk about things
12 happening transparently, for example, transparent to an
13 operating system when lower-level things in the system
14 are happening. I don't recall talking about
15 applications in my declaration, but I guess an example
16 might be if I have written an email client that's going
17 and checking my email and there's bad memory cells
18 happening on my solid-state hard drive, the email
19 client generally isn't going to be aware of that. That
20 will be taken care of transparently to the email
21 client.

22 Q. When you say "transparently to the email
23 client," that's because some other system in the
24 operating system is handling that issue?

25 A. I'd say some other system in the computer is

1 handling that.

2 Q. Do you understand the concept of a black box?
3 Does that phrase make sense to you?

4 A. As a concept, yes.

5 Q. Just so we're all on the same page, what does
6 a black box mean to you?

7 A. It may be something where things are happening
8 inside the box and observers from the outside don't
9 necessarily know what's going in, but if I -- I put in
10 the number 7 it gives me the number 8. If I put in the
11 number 9 it gives me 14. I don't necessarily know how
12 it's doing it inside kind of thing.

13 Q. You just know that if you put in a number 8
14 you're expecting to get 14 out of it, correct? You
15 don't really care how it happens.

16 MR. FAHMI: Objection; form.

17 THE WITNESS: I think, you know, sort of
18 in an academic example of a black box, that may be one
19 teaching example.

20 Q. (By Mr. Lewis) It's kind of ironic that black
21 box and transparent are kind of the same thing, isn't
22 it?

23 MR. FAHMI: Objection; form.

24 THE WITNESS: I don't know that that's
25 true.

1 Q. (By Mr. Lewis) Okay. Does the operating
2 system -- strike that.

3 Is the kernel part of the operating
4 system?

5 A. In -- I would say in the sense that they are
6 both software. In the context that I'm talking about
7 with you right now, there are interfaces defined
8 between them in terms of how calls are made and things
9 like that.

10 Q. You would not say that the kernel is part of
11 the operating system?

12 A. I guess it depends on who you're asking. I
13 talk about operating systems and kernels in my
14 declaration and the manner in which they are both
15 software and performing respective functions. There
16 are no doubt other references that refer to the
17 software of the kernel as a kernel space versus other
18 software like an operating system. But in the context
19 of my opinions, we're talking about software in both of
20 these cases.

21 Q. How does -- strike that. Does an operating
22 system control a processor?

23 A. In -- well, we'd have to look at what specific
24 functionality you're talking about, but in the sense of
25 scheduling jobs, for instance, is my email client

1 running on the processor now or is my Web browser
2 running on the processor now, one of the things that --
3 or is the email client trying to access the file system
4 on the disk or types of things that operating systems
5 do.

6 Q. What part of the operating system interfaces
7 with the processor?

8 A. I need to go look at a specific operating
9 system for a specific processor and how that is
10 architected.

11 Q. Is it the kernel that interfaces with the
12 processor?

13 A. There are aspects of the kernel that interface
14 with hardware and, depending on our definition of the
15 processor, the processor.

16 Q. Have you ever heard of the term "hypervisor"?

17 A. Yes.

18 Q. What does hypervisor mean?

19 A. So as I talk about in my declaration, the
20 hypervisor is a piece of software that effectively
21 provides an interface or abstracts away underlying
22 hardware, and so we hear about it a lot in things like
23 virtual machines. I'm sure we've -- some of us have
24 heard about it in the market. And that's one
25 technology that's used in that space.

1 Q. You used the phrase "abstracts away." Can you
2 let us know what that means in your -- from your
3 standpoint?

4 A. One example is, just as I think Dr. Horst
5 talks about in his declaration, hypervisors doing
6 things where you may have multiple operating systems
7 running -- or multiple instances of operating systems
8 running on a physical box, and a hypervisor is part of
9 that process, facilitating those operating systems to
10 run within that computer rather than directly on
11 silicon or something like that.

12 Q. The question was asking you to give me your
13 definition of what abstract away means.

14 A. Well, that's one example of it. There's a lot
15 of -- the term "abstraction" is used in a lot of
16 different contexts in computing.

17 Q. What does it generally mean?

18 A. At a hundred-thousand-foot level, to maybe add
19 a layer of indirection or something. If I'm -- for
20 instance, if I'm trying to do division like we talked
21 about earlier on a microprocessor that doesn't have it,
22 I might have some call to a library that I think is
23 just a vision and there is a bunch of things going on
24 behind the scenes, would be a definition of
25 abstraction.

1 Q. Is it fair to say that abstraction in this
2 situation would mean calling a library and not caring
3 how that library actually performs the division as long
4 as it's performed correctly?

5 A. I guess in a -- the sense of a software
6 abstraction in this case or like we see an
7 object-oriented program, that may be somewhat true. I
8 mean, you care about other things, like how long does
9 it take to come back or what compute resources are
10 used, but the caller making a call to do a division
11 operation in a purely software sense doesn't
12 necessarily need to know how the division is
13 implemented behind the callee. I'm done.

14 Q. Is it fair to paraphrase abstraction as in not
15 necessarily needing to know how the algorithm is
16 implemented?

17 A. Not necessarily. I mean, abstraction can be
18 making a call to get the division and not having to
19 worry about the interfacing of, for example, the
20 hardware or something like that. Again, it's a very
21 broad term that we're talking about. I don't recall
22 this being part of my declaration or perhaps
23 Dr. Horst's either. But, again, in computing there is
24 many different examples of what we call abstraction.

25 Q. When you use the word "abstraction," are you

1 using it in the way that generally engineers in the
2 field use it? It's nothing special?

3 MR. FAHMI: Objection; form.

4 THE WITNESS: I was using it in the way,
5 however we got on this line of questioning, someone
6 trying to do this division example in software might
7 use the word "abstraction."

8 Q. (By Mr. Lewis) You said earlier that a
9 hypervisor is a piece of software that effectively
10 provides an interface or abstracts away underlying
11 hardware, and so we hear about it a lot in things like
12 virtual machines.

13 A. Right.

14 Q. In the context of the '080 patent, what is a
15 hypervisor?

16 A. I guess I'll need to go back to the patent for
17 you and see where it talks about hypervisor.

18 Q. Before you do that, what are you currently
19 looking at?

20 A. So I have a binder with my declaration, the
21 patent, and the Sutardja references and I believe maybe
22 one or two other prior art references.

23 Q. Okay. Is that binder a clean copy of
24 everything?

25 A. It is, yes.

1 Q. Okay. Would you like those to be the
2 exhibits? Or I have --

3 A. Sure. Yours are probably stapled and easier
4 to use.

5 Q. And just to be certain since you were looking
6 at it during the last answer, what exactly are you
7 looking at? What document is that that you're looking
8 at?

9 A. I had just turned initially to the section
10 with my declaration.

11 MR. LEWIS: Can you mark this as
12 Exhibit 2, please?

13 (Exhibit 2 marked)

14 THE WITNESS: So maybe you can reask your
15 question before I start jumping in.

16 Q. (By Mr. Lewis) Okay. I just handed you
17 Exhibit 2. Can you tell me what it is?

18 A. This is a copy of my declaration in support of
19 patent owner's response for the '080 patent.

20 Q. Have you seen this document before?

21 A. I have, yes.

22 Q. Who prepared this document?

23 A. I did.

24 Q. Did you have assistance in preparing this
25 document?

1 A. Only in the sense of perhaps someone helped
2 correct things like table of contents or
3 cross-references. It's all my opinions and words in
4 here, and I certainly drafted the first version and
5 drafted this.

6 Q. Did you draft the later versions to this?

7 A. Yes. Typically is the case I --
8 cross-referencing tables and things like that never
9 work right on my end, so there may have been help with
10 that, and then some of the legal standards sections I
11 probably had used from something I had on file or maybe
12 had help from counsel on what those legal definitions
13 were.

14 Q. And you understand that the contents of this
15 document were provided under oath.

16 A. That's my understanding, yes.

17 Q. And that they are provided under oath by you.

18 A. That's my understanding, yes.

19 Q. And by that we mean that it was provided under
20 penalties of perjury.

21 A. That's right. That's my understanding, yes.

22 Q. If I refer to, quote, your declaration --
23 strike that.

24 If I refer to, quote, your declaration,
25 do you understand that I'm referencing this document,

1 Exhibit 2?

2 A. Yes, I do.

3 Q. Okay. I'm also going to give you another
4 document.

5 (Exhibit 3 marked)

6 Q. (By Mr. Lewis) Dr. Brogioli, I just handed
7 you Exhibit 3. Can you tell me what Exhibit 3 is?

8 A. This is the '080 -- patent number 10,049,080.

9 Q. Okay. Have you seen this document before?

10 A. Yes, I have.

11 Q. Do you understand that this patent is being
12 challenged in this IPR?

13 A. Yes.

14 Q. I may refer to the '080 patent. I assume that
15 you understand this is what I am referring to when I
16 say that. Right?

17 A. Yes.

18 Q. And your declaration is providing opinions on
19 this patent, correct? Amongst other things.

20 A. That's right. I would say my declaration is
21 addressing certain of Dr. Horst's opinions regarding
22 this patent and some of his prior art references.

23 Q. Can we go to Exhibit 2, your declaration? And
24 after the 36th page is your CV.

25 A. Okay.

1 Q. Let me know when you're there.

2 A. I am.

3 Q. I'm actually going to go to, let's see, one,
4 two, three, four -- you know what? Let me find it.
5 It's rather lengthy, sir. You've been busy. Oh, I
6 went past it. Okay. Page 4 at the top.

7 A. Okay.

8 Q. It says Rensselaer Electric Motor Sports, New
9 York, USA, hardware and software engineering from 1995
10 to 1997.

11 Was this a project before or after your
12 graduation from college?

13 A. Before. Yeah, before, and leading up to, I
14 guess.

15 Q. When did you graduate from college?

16 A. I think officially it was January of '99 from
17 taking co-ops and things like that.

18 Q. And where did you graduate from?

19 A. Rensselaer Polytechnic Institute.

20 Q. In Troy, New York?

21 A. That's right.

22 Q. And what year did you graduate?

23 A. Like I said, I believe I finished in '98, and
24 my diploma says January -- January of '99 confirmation.

25 Q. Okay. We're going to march backwards in time

1 from that first entry on the top of page 4, so we're
2 going to be going back to 3, then 2, then 1.

3 A. Okay.

4 Q. At the bottom of page 3, then, this is
5 still -- it says Rensselaer Polytechnic Institute
6 1997-1998. Is this still while you're in school?

7 A. That's right.

8 Q. It says you were a digital microelectronics
9 design instructor; is that correct?

10 A. That's right. I took, like, what are normally
11 graduate student paid positions I took when I was in
12 undergrad, teaching senior circuit design that year.

13 Q. Okay. Going up one, we have Stratus Computer
14 in Massachusetts from 1997 to 1998. Was that before
15 you graduated?

16 A. Before and after. If I remember, I spent nine
17 months there in '97, was back on campus, spent time
18 there then maybe in the latter part of '98, is my
19 general recollection.

20 Q. Okay. At this point in time -- at this
21 position I should say. Let me clean that up. Strike.

22 When you were at Stratus Computer, were
23 you working on hardware or software or both?

24 A. I guess I would say both. I was working on
25 fault-tolerant operating systems, I guess two different

1 flavors that we had, and on our fault-tolerant hardware
2 platforms and testing and debugging what was going on
3 in the hardware.

4 Q. Were you designing any microprocessors at this
5 role?

6 A. No.

7 Q. Okay. Going up to the next line, Vicarious
8 Visions, New York, do you see that?

9 A. Yes.

10 Q. You were a lead software engineer.

11 A. Yes. Although I was designing hardware as
12 well, but yes.

13 Q. What hardware were you designing?

14 A. This came up yesterday. We, just to give
15 context, were developing video game titles, and the
16 console line that I was the first employee there to
17 work on, we needed tools to build things on your
18 workstation and stick it on the console and look at it
19 on the screen and vice versa and also poke around into
20 the internals of the console to debug things and do all
21 kinds of fun stuff. And so I was building PC -- like
22 Microsoft Windows 95 interface boards that go between
23 your computer and the console with cables to move
24 things back and forth and do stuff like that.

25 Q. It says here that you were working on a game

1 for the Nintendo Color Game Boy, correct?

2 A. That's right. And a bunch of other software
3 tools and things.

4 Q. Okay. I want to focus on the Game Boy. Is it
5 correct that the Game Boy device had a Zilog Z80 chip
6 in it?

7 A. Ish, so that, but it was actually, I think, a
8 Hitachi something or other that was a little different
9 than a proper Z80, but I don't recall all the names
10 anymore.

11 Q. Okay. And it's also true that the Color Game
12 Boy was cartridge-based, correct?

13 A. That's right.

14 Q. Was the cartridge hardware?

15 A. I would say the cartridge itself is hardware,
16 yes.

17 Q. Okay. Going back -- actually before I go
18 there, now let's go to the next line. It says Rice
19 University in Texas from 2000-2003. What was your role
20 at Rice University?

21 A. Well, so my -- this line is talking about one
22 thing, but from I guess roughly '99 to '07 I was
23 working on a master's and PhD in a research position,
24 and in these earlier years in addition to that I was a
25 graduate instructor of what was like undergrad senior

1 computer architecture and then graduate level computer
2 architecture and other types of classes, things like
3 that.

4 Q. Is it fair to say that was a mix of hardware
5 and software?

6 A. Overall in that role, going from memory
7 probably yes, because there were labs that were --
8 people writing code to run on processors and things
9 like that and simulation tools and all those things.

10 Q. Did you design any microprocessors during this
11 time?

12 A. Yes.

13 Q. Do these microprocessors have names?

14 A. Not like a publicly released marketing name
15 kind of thing, no.

16 Q. These were microprocessors made for academic
17 work?

18 A. Some yes, some no. I think this time period
19 overlaps where we were doing design work for -- I don't
20 remember the name of the company. It began with an A.
21 And they had these multiprocessor Tigon network
22 interface designs that we were doing research on and
23 expanding for high-performance networking stuff. It's
24 maybe in my CV elsewhere or publications.

25 Q. You used the word "Tigon"?

1 A. Yeah. T-i-g-o-n if I remember right.

2 Q. Do you know what Tigon is? Today I mean.

3 A. For them I think they may have been called
4 Alteon Web Systems. It's probably in my publications
5 from this time frame. They were these -- were at the
6 time really high-performance network cards for, like,
7 big servers, and they had multiple processors in them
8 and high-performance memory and things like that.

9 Q. The next line up is also the year 2000 -- it
10 looks like it might perhaps be out of order -- where
11 you're working at Intel Corporation, or maybe this is
12 concurrent with work you were doing at Rice. Can you
13 explain the years?

14 A. Yeah. They're effectively concurrent. I
15 think I went to Intel research for some period of time
16 working on what was the IA-64 technology.

17 Q. It says that you implemented speculative
18 multithreading support in the Intel IA-64 compiler; is
19 that correct?

20 A. Yes. We were looking at new ways of doing
21 this threading stuff on new architectures and I was
22 actually -- the role was in the microprocessor research
23 labs group, so it was really tight collaboration
24 between the compilers and the silicon design people, in
25 a very short answer, because those types of processors

1 really rely on compilers.

2 Q. And to be certain, a compiler is a piece of
3 software, correct?

4 A. In this context, yes.

5 Q. Were you designing microchips when you were
6 working at Intel?

7 A. I was interfacing with the people designing
8 the processors and -- trying to recall 20-something
9 years ago -- these instructions or we should do things
10 this way or the experimental data shows we should try
11 this kind of thing.

12 Q. Okay. Moving up to Fulbright and Jaworski --
13 first off, had you left Rice University at this point?

14 A. No.

15 Q. Okay. When were you at Rice University as a
16 student?

17 A. Up through either the end of '06 or maybe
18 April of '07.

19 Q. Okay. And so you were at Fulbright and
20 Jaworski concurrently with being a student at Rice?

21 A. That's right.

22 Q. And you were a consultant, not a lawyer,
23 correct?

24 A. That's right.

25 Q. You're not a lawyer now, are you?

1 A. I'm not, no.

2 Q. Did you work on any microprocessors while you
3 were at Fulbright and Jaworski?

4 A. Probably. I probably looked at different
5 types of computing devices. There were some maybe
6 FPGA/VHDL type things I was working on. And I noticed,
7 you know, I list the CDMA 2000 things. There was
8 probably processor stuff or application processor
9 stuff, baseband in there as well.

10 Q. Would it be fair to say you were working on
11 ASICs then?

12 MR. FAHMI: Objection just to the extent
13 that it calls for the witness to reveal privileged
14 communications.

15 You can answer.

16 THE WITNESS: I would say just going on
17 what I've listed here to probably try and jog my own
18 memory as much as anyone else's I may have been looking
19 at VHDL designs for circuits and things like that. I
20 don't recall more specifically than that.

21 Q. (By Mr. Lewis) Moving up to Texas Instruments
22 line at the top of page 3, advanced architecture and
23 chip technologies, were you working on microprocessors
24 there?

25 A. Yes. They were multiprocessor system-on-chip

1 architectures for different types of workloads.

2 Q. Is there a general definition for a system on
3 a chip?

4 A. I would say a somewhat generic definition is
5 just as the name says, a system on a chip, so rather
6 than a -- like a bare microprocessor or a bare SRAM
7 chip -- sorry. A lone microprocessor or a lone SRAM
8 chip or something like that. Eventually the industry
9 got to the point where we can stick a bunch of this
10 stuff on one chip, and so you might have processors and
11 a little bit of memory and I/O, things like that.

12 Q. Is a system on a chip hardware?

13 A. Similar answer to before. If someone is
14 designing system-on-chip and I pick one up coming out
15 of the fab, it's a piece of hardware.

16 Q. Does it stop being hardware when it touches an
17 engineer?

18 MR. FAHMI: Objection; form.

19 THE WITNESS: In that -- continuing with
20 my same answer, if I take that thing from the fab and
21 hand it to someone who's an engineer, I think it's
22 still a piece of hardware coming off the fab line.

23 Q. (By Mr. Lewis) Is there any point in time
24 when a system on a chip is no longer hardware?

25 A. I mean, at some point along the way, assuming

1 it's got programmable processors and memory and flash
2 memory or ROM or something, someone's probably going to
3 put a software application on it. I don't know when
4 that point in time is. That doesn't preclude the
5 hardware from being hardware.

6 Q. If somebody adds something programmable to the
7 system on a chip, is that program now on hardware?

8 A. I guess if that program is installed on the
9 system on a chip and it's running, then there is a
10 program and software running on the hardware.

11 Q. But that program is now on hardware, correct?

12 MR. FAHMI: Objection; form.

13 THE WITNESS: In the sense that your
14 program that runs on the programmable processor that's
15 part of the system-on-chip is running on the
16 system-on-chip, software running on hardware.

17 Q. (By Mr. Lewis) I think this is a yes or no,
18 but I will let you give your answer the way you want to
19 give it.

20 If I put a program on hardware, it's on
21 hardware, correct?

22 MR. FAHMI: Objection; form.

23 THE WITNESS: In the sense that if the
24 program's up and running on a processor. If we've got
25 a system-on-chip that's ARM-based and I write an ARM

1 program and boot the machine up, then the program is
2 running on the system-on-chip or the ARM processor on
3 the system on chip.

4 Q. (By Mr. Lewis) If a manufacturer put a
5 program on a system-on-chip and packaged it up and sent
6 it in the box to the purchasing engineers, didn't tell
7 them it was programmed, is that program on hardware?

8 MR. FAHMI: Objection; form.

9 THE WITNESS: So sticking with my ARM
10 example, if I've got a piece of software that's written
11 and I stick it in the EEPROM or something in this
12 system-on-chip package, then there's a piece of
13 software stored in the -- in that memory of the
14 hardware. It later runs on the processor on the ARM
15 processor hardware.

16 Q. (By Mr. Lewis) When you say your ARM example,
17 you mean like A-R-M?

18 A. Yes.

19 Q. Yeah. I don't think that you actually
20 answered my question there.

21 I'm asking that if a manufacturer of a
22 microprocessor had implemented part of the
23 microprocessor with, say, microcode, is that microcode
24 on hardware?

25 MR. FAHMI: Objection; form.

1 THE WITNESS: I guess I would say in this
2 example within the -- for lack of a better term the box
3 that's the microprocessor, the microcode is in the
4 processor.

5 Q. (By Mr. Lewis) Okay. I'm now on page 2 of
6 your appendix at the bottom, Method Seven, from 2006 to
7 2007. It says you founded this.

8 A. That's right.

9 Q. And is a financial engineering company?

10 A. That's right.

11 Q. Were you working on hardware or software
12 there?

13 A. Software.

14 Q. Okay. Moving up to Freescale Semiconductor
15 from 2007 to 2009, it says you were a team leader on
16 compiler engineering?

17 A. Yeah. One of my roles, yes.

18 Q. And that's software, correct?

19 A. That portion of the job. So this was -- part
20 of what I was doing was we were designing new
21 processors, and the flavor of the processors in this
22 example don't use microcode, and they really depend on
23 the compiler or vice versa, and so I was like dual duty
24 between the compiler division and next-generation
25 silicon and making sure that they both sort of glued

1 together three years down the road, so doing hardware
2 and software.

3 Q. What is VLIW?

4 A. Very long instruction word.

5 Q. Did you work on any hardware while you were --
6 let me ask you a better question. Strike that.

7 While you were at Freescale, did you
8 design any microprocessors?

9 A. Yes. We had one that was -- well, we had a
10 bunch that were currently shipping, and then there was
11 a next-gen that was supposed to -- take over the market
12 was the goal, as is always the goal. So I spent a long
13 time working on that design.

14 Q. Okay. And you look like you had a hiatus and
15 then returned to Freescale in 2009?

16 A. Actually, no. My role just sort of
17 dramatically shifted. That's all one continuous slog.

18 Q. Okay. Was your answer encompassing both of
19 those lines?

20 A. Effectively. The '09 to 2011 I was just --
21 now I guess chief architect was my title, so I had more
22 things under my purview and more R&D and things like
23 that, industry-facing stuff.

24 Q. Okay. And next is RISC-V Foundation, which is
25 2018 to the present?

1 A. That's right.

2 Q. Now, you also had some other things to the
3 present. You're doing these things concurrently?

4 A. That's right.

5 Q. What is the RISC-V Foundation? What is your
6 role with them?

7 A. So I'm on their technical committee or
8 technical member, and the overall idea is building
9 effectively open-source CPU designs so people can take
10 and build upon the community and either build their own
11 RISC-V or RISC-V. I call it RISC-V. But if they want
12 to put in a disk controller or maybe they want to build
13 one for servers or they want to build one for telecom.
14 It's a relatively new -- I guess not new anymore, but
15 relatively new initiative.

16 Q. Okay. Now RISC-V or RISC-V, that is an
17 instruction set, not a specification for a CPU design,
18 correct?

19 A. There is an instruction set with it that you
20 can customize, expand, et cetera, to design CPUs and
21 fab them.

22 Q. Okay. Is it fair to say that you were working
23 on hardware here?

24 A. I would say in terms of what hardware designs
25 are and being involved in that community, and I've

1 worked with it hands-on, but it's been a little bit of
2 time since I've done that.

3 Q. Okay. Next it says you're currently a guest
4 lecturer at The University of Texas Austin.

5 A. That's right.

6 Q. Are you lecturing on hardware at UT Austin?

7 A. It probably comes up at some point, but, no, I
8 wouldn't say that's the subject matter.

9 Q. You're also an adjunct professor at Rice?

10 A. Yes.

11 Q. And there you're teaching wireless
12 telecommunications, embedded computing software,
13 embedded computing hardware, and hardware/software --
14 I'm sorry. Software/hardware optimization. Is it fair
15 to say that incorporates hardware in your teachings?

16 A. That's right.

17 Q. What is embedded computing hardware?

18 A. In that context it was things like -- not
19 desktop or not server, but maybe real-time systems,
20 things like hardware accelerators that might go into a
21 cellphone or maybe something like that, audio device,
22 things like that.

23 Q. How long have you been working on embedded
24 computing hardware?

25 A. Probably since the '90s, late '90s.

1 Q. Okay. What is the difference between embedded
2 computing hardware and embedded computing software?

3 A. In the context of this position, one is
4 silicon design of a system for doing something that --
5 I don't know. Engine control or antilock brakes maybe.
6 And then the software aspect is the application that
7 may run on those processors and then sort of a deep
8 dive on how do you write and architect software here,
9 because the -- the silicon in this space isn't like a
10 general purpose processor or server. You don't get to
11 use Java and things. You kind of need to know how the
12 silicon and the hardware work.

13 Q. Okay. Two more. IEEE and ACM Design
14 Automation Conference. This is on the bottom of page
15 1. What is that, and does it involve hardware?

16 A. So it's a conference that's part of or related
17 to IEEE, I-E-E-E, and ACM, and it's a mix of people
18 from industry and people from academia, and
19 typically -- so it's been going on for decades. The
20 areas I have tended to work in are like embedded
21 systems, hardware and software, and also like hardware
22 design tools. So if you're designing ASICs there is
23 new ways to go about it or things like that.

24 And I guess for the last -- I don't know.
25 I think I actually started this in 2010 or so. But I

1 have either been on the steering committee or in some
2 years was chairing -- I think it was the embedded
3 systems and software track, but I don't chair every
4 year. It's been a couple times.

5 Q. Okay. And last, Polymathic Consulting, is
6 this your own personal company?

7 A. Yes.

8 Q. And is this the venue for expert witness
9 services?

10 A. Amongst other things, but this type of role
11 falls under Polymathic Consulting.

12 Q. Okay. And outside of engagements as an expert
13 witness, have you done microprocessor or other hardware
14 work under Polymathic Consulting?

15 A. Not that I can remember.

16 Q. Okay.

17 MR. LEWIS: Let's go off the record.

18 THE VIDEOGRAPHER: Going off the record.

19 The time is 11:34.

20 (Recess from 11:34 to 12:00)

21 THE VIDEOGRAPHER: Back on the record.

22 The time is 12:00.

23 Q. (By Mr. Lewis) Welcome back, Dr. Brogioli.
24 Does the invention of the '080 patent control power
25 management?

1 A. Well, the patent talks about -- certainly
2 talks about power and the notion of having these
3 various multicore processors and processors of -- that
4 are implemented in different ways and how those operate
5 in terms of a system that is doing things related to
6 power or power management I would say.

7 Q. What is power in this context?

8 A. I would say generally in this area of
9 technology power is the amount of power -- power is the
10 amount of voltage and current, for example, that's
11 being consumed by a device depending on how it's being
12 controlled or operated, and in some cases you want to
13 get performance out of a device but maybe get enough
14 performance without burning as much power as you need
15 to.

16 Q. When we are using the word "power" here, we're
17 not talking about occupational power, right? We're
18 talking about wattage, like electrical power?

19 A. I would say that's one thing that these
20 references contemplate. There is also, as I recall, in
21 some places they talk about performance and things like
22 that.

23 Q. Okay. When we use the phrase "power control"
24 or "power control management" or "controlling power
25 management," we're talking about the electricity

1 consumed, correct?

2 A. That's generally right in this matter. That's
3 what's -- that's what the patent is generally -- one of
4 the things it's talking about in monitoring and things
5 like that.

6 Q. And you said that there is a relationship
7 between the power and the voltage and the current. Is
8 that simple P equals IE ?

9 A. Yeah. I was referring to, like, power is
10 voltage and current equation. Yeah.

11 Q. Okay. Where P is power and I is current and E
12 is voltage?

13 A. That's fine.

14 Q. All right. There is a relationship, right,
15 between the frequency and the power, correct?
16 Generally speaking, if you increase the frequency of a
17 chip you're also increasing the power?

18 A. I would say the notion generally if you're
19 trying to increase the frequency that some circuit is
20 switching, well, in certain cases you may need to
21 increase or be mindful of other aspects. The power
22 that gets consumed are heat or things like that.

23 Q. Again, there is a relationship between the
24 frequency and the power, correct?

25 MR. FAHMI: Objection; form.

1 THE WITNESS: I would say it depends on
2 the circuit or system you're looking at. There can or
3 can't depending on the system you're looking at. Those
4 are subjects that some of the references talk about in
5 different ways and I talk about in my declaration.

6 Q. (By Mr. Lewis) And what is the relationship
7 between frequency and power? If I lower the frequency
8 does that adjust the power?

9 MR. FAHMI: Objection; form.

10 THE WITNESS: The power of what?

11 Q. (By Mr. Lewis) The power consumed.

12 A. I understand that part. I mean, you're
13 talking about -- I guess just as I say in my
14 declaration, you can have different processor cores
15 that behave differently for a given frequency. I may
16 be able to turn it up or turn it down for one or adjust
17 each of the respective cores and they have different
18 characteristics associated with them depending on how
19 they're designed.

20 Q. Let's discuss something simpler, instead of
21 cores and maybe a complex processor circuit, maybe just
22 a simple ASIC, just a filter. If I increase the
23 frequency that that filter is operating at, do I
24 increase the power consumed?

25 A. I guess it depends how -- what technology

1 you're using to implement this filter or what
2 frequencies you're talking about running your --
3 running your design at.

4 Q. Is there any situation in which I can increase
5 the frequency and it would lower the power consumed?

6 MR. FAHMI: Objection; form.

7 THE WITNESS: Depending on how your
8 filter example is implemented, there probably are.

9 Q. (By Mr. Lewis) How could I implement the
10 filter so that it would consume less power when I
11 increase the frequency?

12 MR. FAHMI: Objection; form.

13 THE WITNESS: There might be a case where
14 you're implementing your filter at a certain rate, and
15 if you want to turn the filter rate up or the sample
16 rate up but you do other techniques in the hardware to
17 selectively power down things or something like that,
18 you wouldn't necessarily burn more power. It's
19 possible you might burn less depending on your
20 implementation in the specific example you're talking
21 about.

22 Q. (By Mr. Lewis) But you won't agree with me
23 that if I take a simple circuit and I increase the
24 frequency of it, it's going to consume more power?

25 MR. FAHMI: Objection; form.

1 THE WITNESS: What do you mean by "simple
2 circuit"?

3 Q. (By Mr. Lewis) Let's say a --

4 A. I don't consider a filter a simple circuit in
5 this context.

6 Q. Okay. Let's consider a revolving register.
7 What I mean by that is a chain of registers that
8 eventually links back to the front, put a bit in the
9 beginning and it cycles to the next register which
10 cycles to the next register which eventually, after a
11 long chain, is linked back to the front, so it's a
12 continuous loop. That one bit is going to be cycled
13 throughout the register, simplest clock-based circuit
14 that I can think of.

15 If I increase the frequency of that
16 clock, is there any circumstance where I would not be
17 increasing the power consumed by that simple circuit?

18 MR. FAHMI: Objection; form.

19 THE WITNESS: I haven't looked at all the
20 scenarios or the specifics of what you're talking
21 about. It sounds like if I've got this sort of chained
22 set of registers, if I'm understanding your example
23 right, you might want to run it at different speeds.
24 There may be some point -- there may not -- where the
25 switching speed of the transistors isn't fast enough or

1 something, but that's just sort of how transistors
2 work.

3 Q. (By Mr. Lewis) The power's consumed when it's
4 switching, correct? The transistor?

5 A. There will be power consumed when the
6 transistors are switching, and then, as I talk about in
7 my declaration, there is also other power consumed when
8 they're not switching. Yeah.

9 Q. If I switch twice as fast, I'm going to
10 consume more power, correct?

11 MR. FAHMI: Objection; form.

12 THE WITNESS: Not -- I mean, you need to
13 be more specific. It depends on what types of
14 transistors or the size of them or other aspects as to
15 what's going on and how this system's -- what the power
16 characteristics of it are, and there's all kinds of
17 variables to take into account, you know, when we -- I
18 talk about some of this in my declaration.

19 Even just manufacturing these kinds of
20 devices there is variability that needs to be tested
21 and accounted for in complex ways and then putting
22 fuses and things in the device so that the systems
23 know, okay, the variance of this device versus that.
24 They're complex systems.

25 Q. (By Mr. Lewis) I am not talking about

1 changing the system. I'm talking about a circuit that
2 I can run at a base frequency and, say, a turbo
3 frequency that's higher than the base frequency. So
4 all I'm doing -- the only thing I'm changing is the
5 clock speed.

6 Isn't it correct that if I increase the
7 clock speed I will increase the power consumed by that
8 simple circuit?

9 A. I think you could construct a simple circuit
10 for a teaching purpose where if I keep turning up the
11 frequency on it the power consumption may be going up
12 on transistor switching or something like that.

13 Q. Okay. Now --

14 A. That's a very -- seems like a very different
15 example than what we're talking about in these patents,
16 but okay.

17 Q. Well, in the patent we're not changing the
18 circuit mid use, right? We're just changing the speed
19 at which the circuit is operating, the frequency at
20 which the circuit is operating, correct?

21 MR. FAHMI: Objection; form.

22 THE WITNESS: No. The frequency is one
23 aspect of what the patent talks about, but it also
24 talks about different aspects of the cores and their
25 instruction set and how they're designed and different

1 things as I recall.

2 Q. (By Mr. Lewis) Well, we can remove the
3 variable -- the instruction set, correct? In the '080
4 patent they're all using the same instruction set,
5 correct?

6 A. I think that's my recollection, that the cores
7 are using the same instruction set.

8 Q. So that variable is gone. The -- there is a
9 variable about transistor sizing or maybe core sizing,
10 but the main constraint of the '080 is that all the
11 cores use the same instruction set, correct?

12 MR. FAHMI: Objection; form.

13 THE WITNESS: The cores having the same
14 instruction set is one thing the '080 talks about.

15 Q. (By Mr. Lewis) So that variable is not
16 germane to the discussion of the '080, correct?

17 A. I guess I would answer I don't discuss in my
18 declaration how either of the cores of the '080 having
19 the same instruction set or maybe changing instruction
20 sets impacts power one way or the other.

21 Q. Okay. Well, let's focus on exactly one core,
22 and I don't think it even matters which core we're
23 talking about. We're talking about one of the cores in
24 the '080. If I increase the frequency of that one
25 unitary core, doesn't that also increase the power

1 output, the power consumed?

2 MR. FAHMI: Objection; form.

3 THE WITNESS: It sounds like your
4 question is similar to something that the patent talks
5 about. In my -- I will go to paragraph 29 in my
6 declaration where the patent talks about power consumed
7 by a processor being correlated with performance
8 capabilities and that generally the processing
9 performance corresponds to power savings -- or
10 decreasing processing performance corresponds to power
11 savings and vice versa.

12 Q. (By Mr. Lewis) That's not responding to my
13 question, though, because I'm asking about a core, not
14 the entire processor, and I'm asking about frequency,
15 not performance capabilities.

16 So isolating to a single core and
17 discussing the frequency at which that core is being
18 operated at, would you agree with me that if I increase
19 the frequency I am also going to be increasing the
20 power consumed by that core, if I do nothing else
21 except increase the frequency?

22 MR. FAHMI: Objection; form.

23 THE WITNESS: So I think if you have a
24 core on your test bench and it's running at a certain
25 frequency and I keep increasing and increasing the

1 frequency, you are going to start consuming more power
2 I would think, just as a generic example. At some
3 point things may break down and no longer function
4 right or there's other variables there.

5 Q. (By Mr. Lewis) Okay. Does the '080 control
6 power management in hardware?

7 MR. FAHMI: Objection; form.

8 Q. (By Mr. Lewis) Let me ask a different
9 question if that's all right.

10 Does the invention of the '080 control
11 power management?

12 MR. FAHMI: Objection; form.

13 MR. LEWIS: Let me strike the question.

14 Just so I understand the objection,
15 what's the issue?

16 MR. FAHMI: I think the question is
17 incomplete in your way it's been formed because you
18 haven't described what the invention of the '080 patent
19 is.

20 MR. LEWIS: Okay. Thanks.

21 Q. (By Mr. Lewis) Does the '080 patent disclose
22 power management?

23 A. I would say at a high level the patent talks
24 about power management techniques that I discuss in my
25 declaration.

1 Q. Does the '080 discuss power management being
2 controlled in hardware or software or either?

3 A. I'd say the patent talks about, for instance,
4 in Claim 1 the plurality of cores and the power
5 management hardware and an operating system to execute
6 on the multicore processor and monitoring demand for
7 multicore processor. So there are aspects of I would
8 say hardware and the operating system itself being
9 software.

10 Q. I just want to make sure I understood the last
11 little bit of your answer there.

12 You said there are aspects that you would
13 say are hardware and the operating system itself being
14 software? Is that what you said?

15 A. It sounds like similar to what I said.

16 Q. What is the power management hardware
17 disclosed in the '080?

18 A. I'll go back to the patent for you.

19 Q. Sure.

20 A. So one cite I see is in Column 4 at 47,
21 talking about the Figure 6 power management process
22 flow that can be executed, for example, with power
23 management software that is running on the
24 multiprocessor, dot dot dot. "Conversely, the power
25 management process flow of Figure 6 can be executed

1 entirely in hardware on the multiprocessor or by some
2 combination." I'm just continuing on.

3 Q. Can you finish reading that sentence?

4 A. I guess I will start over. "Conversely, the
5 power management process flow of Figure 6 can be
6 executed entirely in hardware on the multiprocessor or
7 by some combination of such hardware and software."

8 Q. So is it fair to say that at the time of the
9 '080 patent that the inventors at least understood that
10 the power management could be software, hardware, or
11 some combination of the two? Correct?

12 A. It sounds like what they're saying here is you
13 can do it in hardware or you can do it in a combination
14 of hardware and software, as least as they're
15 describing the Figure 6.

16 Q. Does the '080 disclose why you would do the
17 power management in hardware versus in software or
18 versus a combination of the both?

19 A. Well, the passage I just read says in -- let
20 me go back. "Entirely in hardware on the
21 multiprocessor or by some combination of such hardware
22 and software." I don't recall in my declaration or
23 perhaps Dr. Horst -- and I hope I don't confuse his
24 name with another one of the experts -- talking about
25 what the patent discloses in terms of motivation for a

1 particular design choice. It may be in the patent. I
2 just don't recall from memory.

3 Q. It doesn't say, does it?

4 A. I don't recall. Do you want me to continue
5 going through the specification or --

6 Q. If you have more thoughts, I --

7 A. I can continue.

8 Q. -- I'd love to hear them.

9 A. I pause. The initial question is why
10 someone -- maybe I should hear your question again.

11 Q. The question was does the -- strike. Does the
12 '080 disclose why you would do the power management in
13 hardware versus in software versus a combination of
14 both?

15 A. So I'm just skimming -- I have been skimming
16 through the specification. I guess I'd need to go back
17 through it. To the extent it says more about that, it
18 sounds like something that I don't address in my
19 declaration.

20 Q. Okay. Can you look at the bottom of Column 5,
21 around line 56? Let me know when you're there.

22 A. Okay.

23 Q. You see the sentence that starts "lower
24 performance"?

25 A. Yes.

1 Q. Can you read that?

2 A. Lower -- excuse me. Lower --

3 Q. Through the end of the paragraph. I'm sorry.

4 A. I'm sorry?

5 Q. Through the end of the paragraph. I'm sorry.

6 A. "Lower performance may be recognized with
7 lower cores, but no special adjustments as to the
8 content of the instruction streams should be necessary.
9 In various alternative implementations, one, the
10 hardware/machine readable firmware can monitor and
11 control the core mix, or, two, the hardware can
12 relinquish control to the operating system and let it
13 monitor the demand and control the core mix."

14 Q. Okay. So is it fair to say that that passage
15 is referring to whether hardware or software is going
16 to be controlling the core mix there?

17 A. Okay. Let me read the paragraph again.

18 Q. Sure.

19 A. So it looks like this passage is talking about
20 the scenario of -- well, it's talking about the same
21 instructions it seems like across the cores, and
22 roughly at 56 lower performance can be achieved with
23 lower cores and no adjustments to the instruction
24 streams, and then the hardware and it says machine
25 readable firmware can monitor and control the core mix,

1 or in two it states the hardware here can relinquish
2 control to the operating system and it's going to do
3 the monitoring of the demand for the -- and control for
4 the core mix.

5 Q. So it's dividing this into two manners of
6 controlling the core mix, right? There is
7 hardware/machine readable firmware on the one hand and
8 software being the operating system on the other hand,
9 correct?

10 A. It sounds like in this alternate
11 implementation the Clause 2 is talking about the
12 hardware, but in this case it's going to relinquish
13 control to the operating system, and that operating
14 system is going to monitor the demand.

15 Q. Okay. How will the operating system control
16 the core mix?

17 MR. FAHMI: Objection; form.

18 Q. (By Mr. Lewis) Do you understand the
19 question, sir?

20 A. I'm not sure -- I'm not sure I'm entirely
21 understanding.

22 Q. Yeah. Let me try to ask it slightly
23 different, then.

24 In the '080 patent, when we relinquish
25 control to the operating system and let it monitor

1 demand and control the core mix, how does the operating
2 system control the cores?

3 A. I would say just as probably Claim 1 talks
4 about where the operating system executes on the
5 multicore processor and monitors a demand here and then
6 controls the power management hardware based on, in
7 this case, the demand the operating system's seeing.

8 Q. The operating system controls the hardware
9 here, correct?

10 A. That the operating system is executing on the
11 multicore processor to monitor that demand.

12 Q. The operating system is controlling the power
13 management here, correct?

14 A. Like Claim 1 says, the operating system
15 executing on the multicore processor, it's going to
16 monitor and control the power management hardware based
17 on the demand.

18 Q. Do you know which components of the operating
19 system will control the power management?

20 A. What do you mean by "which components"?

21 Q. Does the '080 disclose which components of the
22 operating system will control the power management?

23 A. That sounds like something I don't -- I don't
24 think Dr. Horst raised or I responded to in my
25 declaration in terms of is it Red Hat Linux Version X

1 with Module Y interfacing to Z. I don't think that's
2 something I discuss in my declaration.

3 Q. Do you know if the '080 discloses this?

4 A. I don't recall from memory. I don't think
5 that's something I talked about in my declaration. I
6 know that it, for instance, in Column 9 gives examples
7 of various operating systems like UNIX and Linux and
8 things like that. I don't think in my declaration or
9 Dr. Horst talk about -- I think your question is using
10 the language of operating system components.

11 Q. You said Column 9. Did you mean a different
12 column?

13 A. I'm sorry. Column 7, roughly starting around
14 line 40. I'm sorry. Roughly around 33.

15 Q. Would you agree that the '080 patent actually
16 does not describe the components of the operating
17 system that would control power management?

18 A. I haven't -- for the scope of what I discuss
19 in my declaration, I don't recall going through that
20 exercise in terms of, to use your language, what
21 components of an operating system the '080 talks about
22 or doesn't talk about.

23 Q. Okay. Does the '080 patent claim a particular
24 portion of the operating system controlling the power
25 management of the chip?

1 MR. FAHMI: Objection; form.

2 THE WITNESS: So as I recall I talk about
3 Claims 1 and 9 -- independent Claims 1 and 9, and -- in
4 my declaration, and those claims mention an operating
5 system, for example, and I also talk about Claim 17,
6 another independent claim, which also mentions an
7 operating system. I don't -- I haven't gone through
8 the patent to -- again, and I don't recall Dr. Horst
9 doing this. Maybe he did -- analyzing what the patent
10 does or doesn't talk about in terms of operating
11 systems or a finer level of granularity.

12 MR. LEWIS: Okay.

13 (Exhibit 4 marked)

14 Q. (By Mr. Lewis) Dr. Brogioli -- I'm sorry.
15 Dr. Brogioli, you have just been handed Exhibit 4. Do
16 you recognize this document?

17 A. Yes. This is the Sutardja or one of the two
18 Sutardja references, this one being the '748.

19 Q. Okay. Have you seen this document before?

20 A. Yes. I talk about certain aspects of it in my
21 declaration.

22 Q. I'm only planning on talking about Sutardja
23 '748 in this interview today, but there is another
24 Sutardja reference that you have discussed in your
25 declaration and our side has discussed as well,

1 correct?

2 A. That's right.

3 Q. That's the Sutardja '785, correct?

4 A. Let me double-check. That's the right number,
5 yes.

6 Q. Okay. For just bookkeeping purposes, when I
7 mention Sutardja, I'm intending to talk about the
8 exhibit that's in front of you. Is that fair?

9 A. Understood.

10 Q. Can we agree to that?

11 A. Understood, yes.

12 Q. Okay. I might not always say Sutardja '748.
13 I might just say Sutardja. Is that okay?

14 A. Okay.

15 Q. If ever you're confused by that because
16 it's -- of course, it makes sense that it could be
17 confused because there is more than one. Please let me
18 know so I can clean it up if necessary.

19 A. Okay.

20 Q. All right. And you understand that the
21 Sutardja references prior art to the '080 patent,
22 correct?

23 MR. FAHMI: Objection; form.

24 THE WITNESS: That, I guess, is perhaps
25 what I was informed in writing my declaration. I

1 haven't gone through things like file histories in my
2 declaration or things like that.

3 Q. (By Mr. Lewis) Okay. We were discussing
4 earlier about how an operating system -- whether an
5 operating system controls hardware, right? Do you have
6 an understanding for how an operating system controls a
7 CPU?

8 A. I guess you would need to ask a more specific
9 question. There is a lot of solutions out there in the
10 world.

11 Q. Uh-huh. Generally speaking, though, is it
12 correct to say that an operating system is the
13 interface between the applications and a CPU?

14 A. There are scenarios where an application runs
15 on bare metal. There's other scenarios where
16 simulation may be in the mix or there are cases where
17 there are things, as we discussed this morning like a
18 hypervisor, that are between, for example, hardware and
19 an operating system. I guess we'd need to look at a
20 specific example.

21 Q. How about Windows? Does Windows operate as a
22 conduit to execute the applications on a CPU?

23 A. I guess it depends how you're -- so we're not
24 getting into specific Windows versions. I don't in my
25 declaration. But I guess it depends how you're -- you

1 know, if you're using it in a virtual environment or a
2 virtual machine or something. But one way you can use
3 Windows is to run applications like Microsoft Outlook
4 on Microsoft Windows on your laptop, for example.

5 Q. Is it the operating system's job to figure out
6 what execution -- I'm sorry. Let me strike that.

7 Is the operating system's job to figure
8 out what lines of an executable are going to be
9 sequenced to a CPU at an appropriate time?

10 A. I don't understand the question.

11 Q. Okay. So an application is made up of lines
12 of executable code, correct?

13 A. I -- I'm not trying to be difficult. I guess
14 if I'm at my desk writing an email client in Java,
15 there is lines of code in my, you know, desktop
16 development environment. By the time I billed -- I
17 think my example was an email client. If -- once I
18 compile that and put it into an application, you don't
19 really have the notion of, like, lines of an
20 application. I mean, there's data and instructions and
21 things like that that comprise the email client I'm
22 writing and probably libraries and stuff like that.

23 Q. Okay. Let me use that word, then. An
24 application is made up of lines of instructions,
25 correct?

1 A. I would say it's made up of instructions and
2 data.

3 Q. Okay. Is it the operating system that
4 controls when the instructions and data are sent to the
5 CPU?

6 A. I would say, sticking with our email client
7 example on some flavor of Windows, the operating system
8 will give the email client time on a processor to run
9 and update and send out your email and things like
10 that, during which time it's executing instructions and
11 presumably using data that's part of that application.

12 Q. Okay. And if the operating system were
13 multithreaded like most modern operating systems are,
14 is it the operating system that controls when you're
15 running the email client and when you're running the --
16 I don't know -- Web browser, the Excel spreadsheet?
17 Does the operating system do the threading for you?

18 A. I would say in this case the operating system
19 is going to do the tasking or the multitasking of is it
20 email or the browser running or Spotify or Netflix or
21 what have you.

22 Q. So the operating system is dictating what the
23 CPU is going to be working on at this moment, be it the
24 application one or application two or application N,
25 correct?

1 A. I would say the operating system will schedule
2 different jobs, things like an email client or other
3 things that a user is really not aware of, to give them
4 CPU time.

5 Q. Okay. What is a system call?

6 MR. FAHMI: Objection; form.

7 Q. (By Mr. Lewis) Does that phrase make sense?

8 A. It's a phrase I am familiar with, but I think
9 we'd have to add some context. I don't think I talk
10 about them in my declaration. If I do, you can please
11 point me there.

12 Q. In the general sense, system call's a term
13 you've heard of, correct?

14 A. Yes.

15 Q. And that's a -- kind of a term in the industry
16 that's related to operating systems?

17 A. I would say at a very high level, yes, or I
18 think it's even related to things like ACPI or things
19 like that.

20 Q. Just for making sure we're on the same page,
21 what is ACPI again? Not again. You haven't said it
22 yet. What is ACPI?

23 A. I think it's advanced configuration and power
24 interface, if I'm remembering right.

25 Q. It's a power management system, right?

1 A. Part of what it does.

2 Q. Like a standard?

3 A. It does a lot of things, a lot of different
4 layers, but -- but, yeah, system calls as I recall are
5 things to get sort of lower level or internal
6 information about what the machine with software is
7 doing, things like that.

8 Q. Okay. Look at your declaration at page 25,
9 paragraph 52.

10 A. Okay.

11 Q. Feel free to read that if you want. My
12 question again is what is a system call.

13 A. Okay. Let me just read the paragraph. Okay.
14 Right. So these are the -- I think the system calls
15 mentioned in Sutardja. And so what -- what's being
16 described in Sutardja and what I'm talking about in
17 this paragraph is, for instance, at the fourth line
18 down the kernel and the PMS, they only make system
19 calls to that core switching module, and then the core
20 switching module, et cetera, will go off and do its
21 thing in response or things will happen such as
22 disabling interrupts, generating system call to
23 hypervisor or the core switching module, and then that
24 in turn is triggering the transition.

25 Q. Okay. So what is the system call? What does

1 that mean in that context?

2 A. That it is in the case of Sutardja -- I guess
3 253. That the -- I guess third line down, the PMS
4 module and/or the kernel module 220 disable interrupts
5 and then generate a system call, and that system call
6 calls into the hypervisor module or a core switching
7 module, and then either the hypervisor or that core
8 switching module -- as it says, either the core
9 switching module may be standalone or integrated into
10 the hypervisor module, which is software, and then that
11 is what's -- the core switching module then transition,
12 switch, the operations from the LP core to the HP core.
13 So what Sutardja is saying in 253 is the use of a
14 system call to perform this process.

15 Q. Okay. Thank you. Isn't that the operating
16 system when a system -- let me try again. Strike that.

17 So when the operating system sends the
18 system call, isn't it controlling the processor?

19 A. Well, the system call -- one moment. Just as
20 I say in 52, the kernel or the PMS module only make a
21 system call, and then that system call is going to, for
22 example, the core switching module, and the core
23 switching module does things such as about seven lines
24 down in my paragraph 52. The core profile module 240,
25 the PMS module 242, and/or the kernel module 220

1 disable interrupts and generate a system call to the
2 hypervisor module, and then the hypervisor module or
3 that core switch module are triggering this transition.
4 And so it's that intermediate hypervisor component that
5 I'm referring to here.

6 If you continue down on the top of page
7 26, same paragraph, as I say, a person of ordinary
8 skill in the art reading this passage would understand
9 that the core switch module, not the operating system,
10 that controls the hardware to make the switch.

11 Q. If the system call triggers a transition as it
12 says in the '748, the Sutardja reference, it's causing
13 the transition to happen, right?

14 A. If the operating system is making the system
15 call here, it's not that system call that's performing
16 the operation. Just as I say, that it's ultimately the
17 core switch module and not the operating system that's
18 controlling the hardware to make that switch, and
19 then -- just as we continue to my last sentence, and
20 then makes the transition from one core to another and
21 then returns control to the operating system.

22 Q. But the operating system is triggering the
23 transition when it makes the system call, correct?

24 A. I would say the system call is what
25 communicates here to the core switching module that

1 then has the core switching module performing these
2 steps that we're talking about.

3 Q. Does the '080 patent explain what control
4 means in this context?

5 A. Does the '080 patent discuss what control
6 means --

7 Q. Uh-huh.

8 A. -- is your question? Not Sutardja? I don't
9 know. We'd have to go back to the '080. I think
10 that's something a person of skill in the art would
11 understand and I mentioned earlier in terms of callers
12 and callees.

13 Q. So, for instance, in Claim 1 of the '080 near
14 the bottom --

15 A. One second.

16 Q. Uh-huh. You want to follow with me?

17 A. Yeah, please.

18 Q. Okay.

19 A. Okay.

20 Q. Second limitation, power management hardware
21 to, from a state where the first plurality of cores and
22 the second plurality of cores are enabled, disable all
23 of the first plurality of cores for a drop in demand
24 below a threshold without disabling any of the second
25 plurality of cores, wherein an operating system to

1 execute on the multicore processor is to monitor a
2 demand for the multicore processor and control the
3 power management hardware based on the demand.

4 A. Okay.

5 Q. If the operating system is sending a system
6 call that results in a change in the power management
7 hardware, has not the operating system controlled the
8 power management hardware?

9 A. The -- no. There's a call that calls into
10 another piece of functionality, and that second piece
11 of functionality is controlling the behavior of things.

12 Q. If I sent you a letter via the email, have I
13 communicated with you?

14 MR. FAHMI: Objection; form.

15 THE WITNESS: I guess in this very far
16 removed example, if you consider writing something on a
17 piece of paper and sending it me and my reading it you
18 communicated information to me, I guess that's
19 communication.

20 Q. (By Mr. Lewis) But I didn't actually deliver
21 that letter, right? I gave it to the post office, and
22 they did something, and it arrived in your mailbox, at
23 which point you opened it and read it, correct?

24 MR. FAHMI: Objection; form.

25 THE WITNESS: I guess in your

1 hypothetical scenario you can send a letter or take it
2 to the post office, and then they will deliver it to my
3 mailbox, and I can read it.

4 Q. (By Mr. Lewis) But once I put it in the
5 mailbox, I am effecting communication with you,
6 correct?

7 MR. FAHMI: Objection; form.

8 THE WITNESS: I wouldn't say you're
9 communicating with me by putting it in the mailbox.
10 You're putting it in a mailbox. A whole separate
11 process of events and service providers kicks in.

12 Q. (By Mr. Lewis) So am I being fair to say that
13 your understanding of the word "control" is limited to
14 direct control and if there is any intermediaries, then
15 it's no longer control?

16 A. Are you asking about control in the claim
17 of -- Claim 1 of the patent or the control you were
18 talking about a moment ago in Sutardja or the U.S.
19 postal system?

20 Q. I asked the question.

21 A. Sorry. Apologize.

22 Q. It's okay. I think they're one and the same,
23 aren't they? I don't think that somebody would say, "I
24 have not communicated with you because somebody else
25 delivered the communication that I wrote to you." How

1 is that different in the context of the operating
2 system making a system call to something the operating
3 system knows will effect a triggering in the processor?

4 MR. FAHMI: Objection.

5 Q. (By Mr. Lewis) That's the point of the system
6 call, correct? To do something in the processor?

7 MR. FAHMI: Objection; form.

8 THE WITNESS: I can't really draw
9 parallels between the mailing of a letter scenario to
10 how computers work. It's just as Sutardja says, right?
11 There is the system call and then -- let me go back
12 here. And then you have the core switching module, not
13 the operating system, and it's the core switching
14 module that controls the hardware and makes the switch,
15 and then, just as Sutardja says, the core switching
16 module is taking control, makes the transition, and
17 then returns control back to the operating system.

18 Q. (By Mr. Lewis) What is the point of the
19 system call if not to control the power management of
20 the chip?

21 A. In this scenario the system call is to have
22 the core switching module here control hardware and
23 make a switch from one core to another. That's the
24 architecture and design of the solution that Sutardja
25 is talking about.

1 Q. Does the '080 explain what granularity of
2 control is required for control under Claim 1?

3 A. I don't think I talk about what, to use your
4 words, granularity of control in Claim 1, quote,
5 control the power management hardware based on the
6 demand. I'm not sure actually what you mean by
7 "granularity," but I don't recall discussing
8 granularity in my declaration.

9 Q. Does the '080 explain what level of control is
10 required for control under Claim 1?

11 A. That it states -- as it says in Claim 1, there
12 is an operating system to execute on a multi -- on the
13 multicore processor and monitors demand for the
14 multicore processor and control the power management
15 hardware. I guess similar to your "what module of the
16 operating system" question from earlier, I don't recall
17 if the patent gets into that level of detail or if
18 Dr. Horst raised that, or I don't recall discussing
19 that either.

20 Q. I don't think that answers my question,
21 though.

22 I'm asking does the '080 explain what
23 level of control is required when using that word
24 "control" in Claim 1.

25 A. And it says the -- "and control the power

1 management hardware based on the demand," so the
2 control is control sufficient to control the power
3 management hardware.

4 MR. LEWIS: Why don't we go off the
5 record.

6 THE VIDEOGRAPHER: Going off the record.
7 The time is 1:01.

8 (Recess from 1:01 to 1:31)

9 (Exhibit 5 marked)

10 THE VIDEOGRAPHER: Back on the record.
11 The time is 1:31.

12 Q. (By Mr. Lewis) Welcome back, Dr. Brogioli.
13 We just handed you a new exhibit. Can you tell me what
14 it is?

15 A. This is the Mathieson reference, which is U.S.
16 2011/0213950.

17 Q. Have you seen this document before?

18 A. Yes. I discuss portions of this in my
19 declaration.

20 Q. And do you understand that Mathieson is prior
21 art to the '080 patent?

22 A. That has been my understanding, yes.

23 Q. Okay. I'm going to ask you to use both hands
24 here. Your declaration, Exhibit 2, at page 30,
25 paragraph 59, do you see where you quote Mathieson's

1 statement that the transition is done transparently to
2 a high-level software, such as the operating system?

3 Let's unpack that statement. Do you see it?

4 A. Yes.

5 Q. Okay. First off, what is the transition we
6 are talking about here?

7 A. Okay. I'm just going back to Mathieson's
8 paragraph 43. So your question was the transition,
9 correct?

10 Q. Yeah. What does the transition in this
11 paragraph mean?

12 A. The transition is the -- what Mathieson is
13 talking about in 43, where I guess at that last
14 sentence in his 43, it's going from the first mode to
15 the second mode or that second mode to the first mode,
16 and as it states, that's being done transparently to
17 the high-level software, like the operating system.

18 Q. Okay. What is the first mode and second mode?

19 A. Go back to make sure I don't have it the other
20 way around. So these are what I describe in paragraph
21 48 where there is a first mode of execution of
22 processing operations on a first set of cores and, as I
23 recall, not the second set and then a second mode where
24 the execution of processing operations is on the second
25 set of cores and not the first set in Mathieson.

1 Q. You said paragraph 48. Did you mean 48?

2 A. No. I meant 58 of my declaration.

3 Q. Okay. What does transparently mean in this
4 context?

5 A. In this context it would be something that,
6 for instance, the operating system isn't aware of, is
7 an example, where the operating system itself isn't
8 effecting the transition itself.

9 Q. Okay. What does high-level software mean in
10 that sentence?

11 A. In that sentence of 43, an example that
12 Mathieson is giving is the operating system, and what
13 he's getting at there is high level in the sense of not
14 lower levels in the software stack, things like that,
15 perhaps what he might consider something much closer or
16 internal to the metal or something running on a power
17 or a -- like an I/O unit or something like that, higher
18 level being like an operating system, or maybe I would
19 consider higher level something like software running
20 on top of an operating system, something like that.

21 Q. Like applications?

22 A. That may be the case what Mathieson would also
23 consider higher-level software.

24 Q. So the transition would be done transparent to
25 the applications.

1 A. I guess one example he is giving is
2 transparent to the operating system. I think -- I
3 don't recall talking about applications in Mathieson,
4 but it may be the case that he would consider those
5 applications as higher-level software as well.

6 Q. Okay. Is the kernel high-level software?

7 A. I think in the context we're talking about
8 here, I don't know that that would be what Mathieson
9 considers higher level. I don't know that I talk about
10 that one way or the other. Yeah. I think -- I don't
11 know that Mathieson mentions the kernel here. I guess
12 we'd need to go back and see how Mathieson
13 characterizes that.

14 Q. We earlier had a discussion about the
15 relationship between voltage and current to power. Do
16 you recall that?

17 A. Yes.

18 Q. And you agreed that power is proportional --
19 or I don't want to put words in your mouth. Let me ask
20 it like this. Strike that.

21 Is power proportional to current?

22 A. Just if we're taking the equation power is
23 watts or voltage times current, there is in that
24 equational relationship there.

25 Q. So all things being equal, if all I change is

1 the current, I increase the power?

2 A. If we're putting that equation on the
3 whiteboard, if I increase the variable I, P will go up.

4 Q. And similarly if I increase the voltage and
5 nothing else, I increase the power consumed, correct?

6 A. That's correct.

7 Q. Can you look at Figure 6 of Mathieson?

8 A. Okay.

9 Q. Am I correctly characterizing this graphic as
10 a graph of frequency on the X axis and power on the Y
11 axis?

12 A. That is how Mathieson has labeled the X axis
13 602 and the Y axis 604.

14 Q. Okay. Am I correctly characterizing Mathieson
15 to say that looking at curve 606, for instance, as
16 frequency increases, power increases?

17 A. It is showing that for line 606, as frequency
18 increases along the X axis, line 606 moves further up
19 along the Y axis for power.

20 Q. And similarly, am I correct in characterizing
21 Mathieson to say that looking at line 608 Mathieson
22 discloses that as frequency increases, the power
23 consumed increases for 608 as well?

24 A. 608 is showing a different trend line where as
25 frequency increases along that X axis 602, Mathieson

1 shows that power increases along 604.

2 Q. Okay.

3 MR. LEWIS: I don't have any further
4 questions.

5 MR. FAHMI: Patent owner does not have
6 any questions.

7 THE VIDEOGRAPHER: You would like to
8 conclude?

9 This concludes the deposition of Michael
10 C. Brogioli, PhD. Going off the record. The time is
11 1:43.

12 (Deposition concluded at 1:43 p.m.)
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UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD

MERCEDES-BENZ USA, LLC, *
Petitioner, * IPR2023-01333
* U.S. Patent No. 10,049,080
VS. *
*
DAEDALUS PRIME, LLC, *
Patent Owner. *

REPORTER'S CERTIFICATION
DEPOSITION OF MICHAEL C. BROGIOLI
JULY 31, 2024

I, Marsha Yarberry, Certified Shorthand Reporter in
and for the State of Texas, hereby certify to the
following:

That the witness, MICHAEL C. BROGIOLI, was duly
sworn by the officer and that the transcript of the
oral deposition is a true record of the testimony given
by the witness;

That the deposition transcript was submitted on
August 9, 2024, to the witness or the witness's
attorney for examination and signature;

I further certify that I am neither counsel for,
related to, nor employed by any of the parties or
attorneys in the action in which this proceeding was
taken, and further that I am not financially or
otherwise interested in the outcome of the action.
Certified to by me this 9th day of August. 2024.



MARSHA YARBERRY, TEXAS CSR 5100
Expiration Date: 07/31/26
Veritext Legal Solutions
Firm Registration No. 571
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1 Tarek N. Fahmi, Esquire

2 tarek.fahmi@ascendallaw.com

3 August 9, 2024

4 RE: Mercedes-Benz USA LLC v. Daedalus Prime LLC

5 7/31/2024, Michael C. Brogioli , PhD (#6832314)

6 The above-referenced transcript is available for
7 review.

8 Within the applicable timeframe, the witness should
9 read the testimony to verify its accuracy. If there are
10 any changes, the witness should note those with the
11 reason, on the attached Errata Sheet.

12 The witness should sign the Acknowledgment of
13 Deponent and Errata and return to the deposing attorney.
14 Copies should be sent to all counsel, and to Veritext at
15 cs-midatlantic@veritext.com.

16 Return completed errata within 30 days from
17 receipt of testimony.

18 If the witness fails to do so within the time
19 allotted, the transcript may be used as if signed.

20
21
22 Yours,

23 Veritext Legal Solutions
24
25

Mercedes-Benz USA LLC v. Daedalus Prime LLC

Michael C. Brogioli , PhD (#6832314)

E R R A T A S H E E T

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Michael C. Brogioli , PhD

Date

Mercedes-Benz USA LLC v. Daedalus Prime LLC

Michael C. Brogioli , PhD (#6832314)

ACKNOWLEDGEMENT OF DEPONENT

I, Michael C. Brogioli , PhD, do hereby declare that I have read the foregoing transcript, I have made any corrections, additions, or changes I deemed necessary as noted above to be appended hereto, and that the same is a true, correct and complete transcript of the testimony given by me.

Michael C. Brogioli , PhD

Date

*If notary is required

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Federal Rules of Civil Procedure

Rule 30

(e) Review By the Witness; Changes.

(1) Review; Statement of Changes. On request by the deponent or a party before the deposition is completed, the deponent must be allowed 30 days after being notified by the officer that the transcript or recording is available in which:

(A) to review the transcript or recording; and

(B) if there are changes in form or substance, to sign a statement listing the changes and the reasons for making them.

(2) Changes Indicated in the Officer's Certificate. The officer must note in the certificate prescribed by Rule 30(f)(1) whether a review was requested and, if so, must attach any changes the deponent makes during the 30-day period.

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THE ABOVE RULES ARE CURRENT AS OF APRIL 1, 2019. PLEASE REFER TO THE APPLICABLE FEDERAL RULES OF CIVIL PROCEDURE FOR UP-TO-DATE INFORMATION.

VERITEXT LEGAL SOLUTIONS

COMPANY CERTIFICATE AND DISCLOSURE STATEMENT

Veritext Legal Solutions represents that the foregoing transcript is a true, correct and complete transcript of the colloquies, questions and answers as submitted by the court reporter. Veritext Legal Solutions further represents that the attached exhibits, if any, are true, correct and complete documents as submitted by the court reporter and/or attorneys in relation to this deposition and that the documents were processed in accordance with our litigation support and production standards.

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