



Planet Depos®
We Make It *Happen™*

Transcript of John Hart, Ph.D. (IPR2023-00564)

Date: April 5, 2024

Case: Realtek Semiconductor Corp. -v- ATI Technologies ULC (PTAB)

Planet Depos

Phone: 888.433.3767

Email: transcripts@planetdepos.com

www.planetdepos.com

WORLDWIDE COURT REPORTING & LITIGATION TECHNOLOGY

Conducted on April 5, 2024

1	1	1	3
1	UNITED STATES PATENT AND TRADEMARK OFFICE	1	A P P E A R A N C E S
2	BEFORE THE PATENT TRIAL AND APPEAL BOARD	2	ON BEHALF OF THE PETITIONER:
3	-----	3	MR. JEFFREY JOHNSON
4	REALTEK SEMICONDUCTOR CORP.,	4	BAKER BOTTS, L.L.P.
5	Petitioner,	5	910 Louisiana Street
6		6	Houston, Texas 77002-4995
7	v.	7	713.229.1234
8		8	jeffrey.johnson@bakerbotts.com
9	ATI TECHNOLOGIES ULC	9	
10	Patent Owner.	10	ON BEHALF OF THE PATENT OWNER:
11	-----	11	MR. REZA DOKHANCHY
12	Case IPR2023-00564	12	MINTZ, LEVIN, COHN, FERRIS,
13	U.S. Patent No. 7,742,053	13	GLOVSKY & POPEO, P.C.
14	-----	14	3580 Carmel Mountain Road, Suite 300
15		15	San Diego, California 92130
16	Deposition of JOHN HART, Ph.D.	16	858.314.1500
17	Champaign, Illinois	17	rdokhanchy@mintz.com
18	Friday, April 5, 2024	18	
19	9:02 a.m. CST	19	ALSO PRESENT:
20	Job No.: 530863	20	Massoud Pedram, Ph.D. (Remotely)
21	Pages: 1 - 86	21	
22	Reported By: Michelle M. Yohler, CSR, RMR, CRR	22	
2	2	4	4
1	Deposition of JOHN HART, Ph.D., held at the	1	E X A M I N A T I O N S
2	location of:	2	WITNESS PAGE
3		3	JOHN HART, PH.D.
4		4	By Mr. Johnson..... 5
5		5	By Mr. Dokhanchy..... 79
6	I Hotel and Conference Center	6	
7	1900 South 1st Street	7	
8	Champaign, Illinois	8	E X H I B I T S
9		9	EXHIBITS PAGE
10		10	No. 1001 '053 Patent..... 6
11		11	No. 1005 Stuttard Prior Art Reference..... 56
12	Pursuant to notice before Michelle M. Yohler, a	12	No. 2009 Declaration of John Hart
13	Certified Shorthand Reporter, Registered	13	Regarding U.S. Patent No.
14	Professional Reporter, Registered Merit Reporter,	14	7,742,053..... 6
15	Certified Realtime Reporter, and a Notary Public,	15	
16	CSR No. 84-4531, in and for the State of Illinois.	16	
17		17	
18		18	
19		19	
20		20	
21		21	
22		22	

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Realtek Ex. 1016, Page 2

Realtek Semiconductor Corp., v. ATI Technologies ULC

IPR2023-00564

Conducted on April 5, 2024

5 1 (WHEREUPON, the witness was duly sworn.) 2 JOHN HART, Ph.D., 3 called as a witness herein, having been first duly 4 sworn, was examined and testified as follows: 5 EXAMINATION 6 BY MR. JOHNSON: 7 Q Good morning, Dr. Hart. 8 A Good morning. 9 Q How are you? 10 A I am fine. How are you? 11 Q I'm doing good. 12 Had your deposition yesterday in another 13 matter, so I know you already know all the rules. 14 I appreciate your candor yesterday, so I'm sure 15 you'll give me the same courtesies today, not 16 speaking over me, and I'll try my best not to 17 speak over you, okay? 18 A Understood. 19 Q You feeling well today? No medicines, 20 nothing that will keep you from giving me 21 truthful, full answers? 22 A Correct. Nothing that would get in the	7 1 signature? 2 A Yes, that's my signature. 3 Q Okay. And you signed that on 4 January 17th, 2024, correct? 5 A Correct. 6 Q And when you signed your declaration, had 7 you already reviewed the patent owner response? 8 A What I used in the preparation of the 9 report is in my materials considered list. And I 10 do not see the patent owner's response there, so, 11 no, I don't believe so. 12 Q So you don't know whether or not you have 13 reviewed the patent owner response before writing 14 your declaration? 15 A Correct. I don't recall, and I don't 16 believe so. It certainly wasn't used in the 17 preparation of this report. It's not something I 18 considered. 19 Q And you made the initial draft of your 20 report? 21 A Yes. 22 Q And you just referred to your list of
6 1 way. 2 Q Today we're going to cover the '053 3 patent, some issues related to that. 4 I have marked and handed to you 5 Exhibit 1001, which is a copy of the '053 patent. 6 Do you have that? 7 A Yes, I do. 8 Q And we've also handed you what was marked 9 as Exhibit 2009, which is a copy of your 10 declaration that you submitted in support of 11 patent owner's response; is that correct? 12 A I believe I submitted it in response to 13 Dr. Pedram's report, but yes. 14 Q Okay. And, just for the record, 15 Exhibit 2009 is -- shows a cover page through a 16 page marked with Page Number 77, but it's Page 81 17 of 81 of the exhibit; is that correct? 18 A I don't know how many -- I think it's 19 181 pages total, but, yeah, it goes through the 20 cover page to a page marked 77. 21 Q And on Page 77 of your declaration, 22 there's a signature there. Is that your	8 1 materials considered. That starts on Page Line 4 2 of your report, correct? 3 A Correct. 4 Q Which is Page 8 of the exhibit. 5 And is that a complete and accurate list 6 of everything you reviewed for -- in order to 7 prepare your declaration? 8 A Yes. 9 Q Have you had a chance to review your 10 declaration after signing it? 11 A Yes. 12 Q Any mistakes in it? 13 A I think there might be a missing S at the 14 end of one of the words as I recall, but -- 15 Q Other than typos, any errors that you need 16 to correct? 17 A No. 18 Q All right. So if we could look at the 19 patent and just get started. I think I just want 20 to look at the claims and talk about some claim 21 language. So Exhibit 1001 and turn to the claim. 22 You there?

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Conducted on April 5, 2024

9 1 A Mm-hm. 2 Q So let's just start with claim 1. 3 And it recites a memory device, correct? 4 A Yeah, the first element is at least one 5 memory device. 6 Q And do you agree that the phrase "memory 7 device" would be understood by a person of 8 ordinary skill in the art to have its plain and 9 ordinary meaning? 10 A I don't believe I'm aware of a 11 construction, so I would've used plain and 12 ordinary meaning without -- if there was no 13 construction, I would have used plain and ordinary 14 meaning as understood by a person of ordinary 15 skill in the art having read the claims in light 16 of the specification. 17 Q So do you agree that a person of ordinary 18 skill in the art would have considered the memory 19 device as claimed in the '053 patent to be any 20 type of memory capable of storing command threads? 21 A I'm not sure what you mean by any type of 22 memory capable of storing command threads. You	11 1 A No. It demonstrates a person of ordinary 2 skill in the art would have understood "memory" as 3 an example to be a physical piece of memory, 4 memory circuit. 5 Q And is that inconsistent with the plain 6 and ordinary meaning that a memory device could be 7 any type of memory capable of storing command 8 threads? 9 A Well, when you say "any type of memory," 10 I'm not familiar with that language in the claim 11 or -- in the claims or the specification or in any 12 of the constructions. 13 If paper is any type of memory and 14 somebody's just writing down command threads, I 15 don't think a person of ordinary skill in the art 16 would have looked at that. 17 I think there was some examples in here in 18 the embodiments that were consistent with a person 19 of ordinary skill in the art's understanding of 20 memory. 21 Q So do you agree or disagree that the plain 22 and ordinary meaning of the phrase "memory device"
10 1 know, a person could write down command threads on 2 a piece of paper; I don't think a person of 3 ordinary skill in the art would have understood it 4 to be that because it's a graphics processing 5 system, so... 6 Q All right. Well, then what do you believe 7 a person of ordinary skill in the art would 8 understand a memory device to be under the plain 9 and ordinary meaning? 10 A So there's discussion of an example of 11 memory in the patent at Page 4 -- or column 4, 12 line 49, "In one embodiment, each command thread 13 within the reservation station may be stored 14 across two physical pieces of memory wherein a 15 majority of the bits are stored in one report 16 device." 17 So that's an example of physical pieces of 18 memory, memory chips. 19 Q And so is that your definition of memory 20 device according to the plain and ordinary meaning 21 as understood by a person of ordinary skill in the 22 art?	12 1 is any type of memory capable of storing command 2 threads? 3 A I think the example I've given of a piece 4 of paper that you would use to write down a -- the 5 code for a thread would not be -- it might fit 6 your definition, would not be what the person of 7 ordinary skill in the art would have understood to 8 be a memory used in that claim. 9 Q And the example you gave me was a physical 10 memory from the specification, correct? 11 A The example I just gave you about the 12 person writing down something on a piece of paper? 13 Q Let me try it a different way. 14 Would you agree that the plain and 15 ordinary meaning of the phrase "memory device" is 16 any type of electronic memory capable of storing 17 command threads? 18 A No. I haven't used that construction. I 19 used plain and ordinary meaning of "memory" as 20 demonstrated by the embodiments, and that was 21 sufficient to respond to Dr. Pedram's opinions and 22 to analyze the embodiments in the '053 as well as

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Conducted on April 5, 2024

13 1 any of the prior art. 2 Q So when you say "as demonstrated by the 3 embodiments," are you limiting yourself to the 4 embodiments for the plain and ordinary meaning of 5 memory device? 6 A No. That's not what I said. Those were 7 consistent with a person of ordinary skill in the 8 art's understanding of a memory device. 9 Q And so all I'm trying to understand is 10 what is your plain and ordinary meaning as 11 consistent with a person of ordinary skill in the 12 art? 13 A I didn't provide a construction or a 14 definition of a memory device. I used plain and 15 ordinary meaning for a memory device, one that is 16 consistent with the examples in the embodiments of 17 the '053, one that would be well understood by a 18 person of ordinary skill in the art, by 19 Dr. Pedram, and as used in the prior art. That it 20 was sufficient -- that was sufficient definition 21 and understanding to respond to Dr. Pedram's 22 opinions.	15 1 A I don't recall a situation where it did. 2 I'm not sure that came up in Dr. Pedram's 3 opinions. 4 Q If you could please look at Figure 1 in 5 the '053 patent. 6 Do you agree that each of the FIFO buffers 7 104 and 106 shown in Figure 1 are storing command 8 threads? 9 A Yes. 10 Q And do you agree that each of the FIFO 11 buffers 104 and 106 are storing multiple command 12 threads identified as, for example, 112, 114, and 13 116? 14 A Yes. 15 Q Do you agree that Figure 1 of the 16 '053 patent discloses an arbiter? 17 A Arbiter's a claim term. So it discloses 18 a -- there's a box labeled "arbiter." Figure 1 is 19 labeled "prior art." And so this is not an 20 arbiter, for example, that satisfies claim 1. 21 Q Okay. So Figure 1 discloses three 22 arbiters, correct?
14 1 Q Do you agree that memory devices capable 2 of storing command threads were known in the art 3 at the time of the invention? 4 A Yes. 5 Q Do you agree that -- strike that. 6 Do you know what a FIFO buffer is? 7 A Yes. 8 Q What is it? 9 A It's used -- it's described in column 1 of 10 the '053 patent around line 35, first in and first 11 out buffer. So items in that buffer are output in 12 the order that they're input. 13 Q And do you agree that FIFO buffers capable 14 of storing command threads were known in the art 15 at the time of the invention? 16 A Yes. The background of the invention says 17 as much. 18 Q Do you agree that FIFO buffers are a type 19 of memory? 20 A Yes. 21 Q Does the '053 patent exclude FIFO buffers 22 from serving as the claimed memory device?	16 1 A Figure 1 has three boxes labeled 2 "arbiter." None of those arbiters satisfy 3 claim 1. 4 Q And do you agree that arbiter 102 has 5 access to FIFO buffer 104 and FIFO buffer 106? 6 A Yes. 7 Q Do you agree that the '053 patent 8 discloses that the arbiters disclosed in Figure 1 9 can select command threads? 10 A Yes. 11 Q And do you agree that arbiters were known 12 in the art at the time of the invention? 13 A Not the arbiter described -- or not an 14 arbiter meeting the requirements of claim 1, for 15 example. An arbiter in general, yes. 16 Q Do you agree that arbiter 102 as shown in 17 Figure 1 can select command threads from either 18 FIFO buffer memory 104 or FIFO buffer memory 106? 19 A Yes. 20 Q Do you agree that FIFO buffers 104 and 106 21 are storing different types of command threads? 22 A Yeah, my understanding is that the threads

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Conducted on April 5, 2024

17 1 in buffer 104 are ALU resource threads, and the 2 threads in buffer 106 are texture fetch resource 3 threads. 4 Q And as a person of ordinary skill in the 5 art, what would that indicate to you about those 6 different types of threads? 7 A So the threads in buffer 104 would be 8 provided to an ALU, and that the threads in 106 9 would be provided to a texture fetch processor. 10 Q And what type of command threads would you 11 as a person of ordinary skill in the art expect to 12 be sent to a texture fetch resource? 13 A They're sent to a texture fetch 14 processor -- 15 Q I'm sorry. Let me fix that. 16 As a person of ordinary skill in the art, 17 what type of threads would you expect to be sent 18 to a texture fetch processor? 19 A Threads concerning a texture fetch. 20 Q And would those be -- strike that. 21 And could those be pixel command threads 22 or vertex command threads?	19 1 '053 at Figure 1. 2 Q And as a person of ordinary skill in the 3 art, would you understand that an ALU could 4 process both pixel and vertex command threads? 5 A I think a person of ordinary skill in the 6 art reading the description of Figure 1 would not 7 make an association of the ALU resource with a 8 vertex processor or pixel processor; they would 9 see it as instructions for an ALU resource. 10 Q And in your experience as a person of 11 ordinary skill in the art, have you ever 12 encountered an ALU that could process both pixel 13 and vertex command threads? 14 A Are you -- can you ask that question 15 again? 16 Q In your experience as a person of ordinary 17 skill in the art, have you ever encountered an ALU 18 that can process both pixel and vertex command 19 threads? 20 A A person of ordinary skill in the art 21 would have been of skill in the art at the time. 22 And I don't believe a person of ordinary skill in
18 1 A It doesn't say. 2 Q Could it be either? 3 A It doesn't say. 4 Q But I'm asking you as a person of ordinary 5 skill in the art, would you understand that it 6 could be either type? 7 A I don't think a person of ordinary skill 8 in the art would have read this figure with that 9 understanding, making any association between the 10 ALU resource threads and the texture fetch 11 resource threads as having any correspondence 12 between vertex and texture. 13 Q As a -- 14 A I mean vertex and pixel. Sorry. 15 Q As an expert and a person of ordinary 16 skill in the art, can a texture fetch processor 17 execute both pixel and/or text command threads? 18 A I don't think a person of ordinary skill 19 in the art would understand a texture fetch 20 processor to be executing in that fashion. Those 21 are entirely different entities. There's not a 22 connection between the two as described in the	20 1 the art would have looked at this ALU, the ALU in 2 question, as necessarily being there to process 3 vertex threads or pixel threads. 4 A person of ordinary skill in the art at 5 the time would have been familiar with GPUs at the 6 time, which had a separate processor for vertex 7 threads and a separate processor for pixel 8 threads, and each of those processors would have 9 had an ALU. 10 Q ALUs were known at the time of the 11 invention, correct? 12 A Correct. 13 Q And when you said that each GPU -- strike 14 that. 15 When you said, "A person of ordinary skill 16 in the art at the time would have been familiar 17 with GPUs at the time, which had a separate 18 processor for vertex threads and a separate 19 processor for pixel threads, and each of those 20 processors would have had an ALU," did you mean 21 that the ALU will have some involvement in 22 executing either pixel threads or vertex threads?

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Conducted on April 5, 2024

21 1 A In the example I gave, there would have 2 been multiple ALUs, an ALU used for the vertex 3 processor and an ALU used for the pixel processor. 4 MR. JOHNSON: I'm skipping a bunch of 5 stuff. Hold on. 6 BY MR. JOHNSON: 7 Q Do you agree that FIFO buffer 104 and FIFO 8 buffer 106 are two different physical pieces of 9 memory? 10 A I don't recall that being stated in the 11 description of Figure 1. 12 Q So then in your opinion, it could be 13 either two portions of the same memory or two 14 different memories, correct? 15 A It doesn't really say. It characterizes 16 the function of these buffers, not really their 17 hardware. 18 Q Are there any other options other than 19 them being either two portions of the same memory 20 or two different memories? 21 A I haven't considered that. 22 Q Could you consider it now and tell me	23 1 possible that it could be two portions of the same 2 memory, yes? 3 A I don't know that I have any opinions over 4 what's possible. My opinions are in response to 5 Dr. Pedram's opinions. I just don't have an 6 opinion on whether that figure is one memory chip 7 or two chips or many chips. 8 Q Have you ever designed memory in your vast 9 experience? 10 A No, I've never designed a memory chip. 11 Q And so as you sit here today as an expert, 12 a professor, and a person of ordinary skill in the 13 art, you cannot tell me whether or not there's any 14 other possibilities other than these two FIFO 15 buffers being two portions of the same memory or 16 parts of two different memories? 17 A I think I've already said there's many 18 other possibilities than that. 19 Q And what are those possibilities? Just 20 give me one example. 21 A These could be very deep FIFOs, and we 22 could have limited memory systems. And so you'd
22 1 whether or not you can come up with any other 2 example of what they might be? 3 A I don't know how big these FIFOs are. I 4 don't know the size of the memory chips, how deep 5 they are. Each FIFO could span several memory 6 chips. 7 Q So they could be -- it's possible 8 that -- strike that. 9 So do you agree that it is possible that 10 the two FIFO buffers 104 and 106 could be portions 11 of the same memory? 12 A It doesn't say. 13 Q So that's possible, correct? 14 A It would depend on the size of the memory 15 chip, the access patterns, graphics processors 16 would run under a certain speed, and memory would 17 need to be able to accommodate that speed over 18 bandwidth concerns. 19 So you'd have to look at a lot of details 20 of implementation to determine how to implement a 21 memory system. 22 Q And if you had all those things, then it's	24 1 require even more memory circuit -- memory 2 circuits. 3 Q I guess I don't understand what the 4 distinction is between what you just said and one 5 of my two options. Can you explain that? 6 A If I understand your two options, you're 7 saying 1 memory chip or 2 memory chips. Could be 8 4 memory chips, could be 16. Could be on chip, 9 system on a chip. 10 Q How much memory is needed to store one 11 command thread? 12 A It varies from system to system. 13 Q So you have no opinion as to whether or 14 not the FIFO buffers 104 and FIFO buffer 106 are 15 either two portions of a single memory or are two 16 separate memories? 17 A I do not have that opinion in my 18 declaration. 19 Q Looking back at claim 1, we see that the 20 first limitation says, "At least one memory device 21 comprising a first portion operative to store a 22 plurality of pixel command threads and a second

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Realtek Ex. 1016, Page 7

Realtek Semiconductor Corp., v. ATI Technologies ULC

IPR2023-00564

Conducted on April 5, 2024

25 1 portion operative to store a plurality of vertex 2 command threads," correct? 3 A Correct. 4 Q Did you form an opinion as to what is 5 required of the memory device with respect to 6 having two portions? 7 A For it to satisfy this element in this 8 claim, that memory device would need two portions, 9 a first portion operative to store the plurality 10 of pixel command threads and a second portion 11 operative to store a plurality of vertex command 12 threads. 13 Q And what does that mean, to have two 14 portions? 15 A It has one portion that's operative to 16 store pixel command threads, plurality of pixel 17 command threads, and the second portion that's 18 operative to store the plurality of vertex command 19 threads. 20 For example, you couldn't use the same 21 portion to store both, one after the other. 22 Q Do the portions need to be dedicated	27 1 has to have dedicated storage areas for pixel and 2 vertex command threads? 3 A I did hear the "not" in the previous 4 question, and I think the term "dedicated," 5 whether the memory is dedicated or not dedicated, 6 in both cases is not the understanding that a -- 7 does not represent the understanding that a person 8 of ordinary skill in the art would have. 9 The understanding a person of ordinary 10 skill in the art would have with claim 1 is that a 11 first portion is operative to store a plurality of 12 pixel command threads and a second portion 13 operative to store a plurality of vertex command 14 threads. 15 A person of ordinary skill in the art 16 would follow the language of the claim. 17 Q So you have not taken a position that the 18 memory device has to have dedicated storage areas, 19 correct? 20 A My opinions don't use the term "dedicated" 21 as far as I recall. I try to stick to the claim 22 language, and the claim language is "operative."
26 1 areas? 2 A I don't think I've ever used the term 3 "dedicated." It's "operative." The claim 4 language is "operative." 5 Q So then do you agree that a POSITA would 6 not consider claim 1 to require that the memory 7 device has to have dedicated storage areas for 8 pixel and vertex commands? 9 A I don't think I've said that. That kind 10 of is a different characterization, different 11 language for claim 1. 12 I think a person of ordinary skill in the 13 art would understand that it has to have two 14 portions with each portion operative to store the 15 referred-to threads. 16 Q I think we're saying the same thing, but 17 maybe it's because you didn't hear the negative 18 part of my question. So I'm just going to say it 19 again to make sure we're on the same page, okay? 20 A Okay. 21 Q Do you agree that a POSITA would not 22 consider claim 1 to require that the memory device	28 1 Q So you mentioned the word "operative to" 2 several times. I understand that your opinion is 3 that that means "configure to," correct? 4 A I'm not sure what you're referring to that 5 uses the term "configured." The -- I'm following 6 the ALJ's adopted constructions, and I'm looking 7 at that construction. I don't see "configured." 8 Q So is it your opinion that "operative to" 9 means "configured to" in the '053 patent? Or does 10 it mean "capable of"? 11 A I don't recall I've used either term. I'm 12 adopting the ALJ's adopted construction and 13 initial determination. For example, "that 14 requirement means the memory devices are operable 15 to store both pluralities at the same time." 16 Q So does that just mean they're capable of 17 storing both at the same time? 18 A I was -- I've been very careful to use the 19 constructions and the language of the claims. So 20 my recollection at least is that I've always used 21 "operable." I don't think I've characterized it 22 as anything else.

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Conducted on April 5, 2024

29 1 Q Okay. But what does "operative to" mean 2 to a person of ordinary skill in the art? 3 A Well, one example for "operable," it means 4 that the memory devices are operable to store both 5 pluralities at the same time. 6 So you couldn't point to a portion of 7 memory and say that portion of memory stores 8 vertex threads at this time, and then later point 9 to that same portion of memory and say it stores 10 pixel threads at a later time. 11 That portion of memory needs to be 12 operable to store a plurality of vertex – pixel 13 command threads, and then a different portion 14 needs to be operable to store a plurality of 15 vertex command threads so that both can be stored 16 at the same time. 17 Q But can that memory device satisfy the 18 claim language if it's merely capable of storing 19 two different command threads in two different 20 portions, even if it never actually does it? 21 A That's not my understanding of operable. 22 It has to be able to not just by happenstance; it	31 1 portion of memory. So I think a person of 2 ordinary skill in the art would understand the 3 thread to be a complete thread. 4 Q So if a claim term doesn't say "portion," 5 then it must be complete; is that your 6 understanding? 7 A I don't know if I made that 8 generalization. I've read and understood claim 1 9 in the way that a person of ordinary skill in the 10 art would understand claim 1 in light of the 11 specification. 12 And based on the embodiments and examples 13 and descriptions of the specification and the 14 language of the claim, I believe a person of 15 ordinary skill in the art would understand these 16 threads to be complete threads. 17 Q And what is a command thread? 18 A A sequence of commands applicable to the 19 corresponding element. 20 Q So if the memory device stores the entire 21 set of the sequence of commands for a given 22 command thread, is it storing the command thread?
30 1 needs to actually do that. 2 Q So it has to be configured to? 3 A I didn't say "configured to." I'm using 4 the claim language. It has to be operable to 5 store the plurality of pixel command threads and 6 vertex command threads at the same time. 7 Q And I believe your opinion is that the 8 memory device must store complete command threads, 9 correct? 10 A Yes. 11 Q And you agree with me that claim 1 does 12 not have the word "complete" recited in it, 13 correct? 14 A So I don't see the word "complete," but I 15 do see "portion." It talks about a portion of 16 memory. It talks about a memory, at least one 17 memory device, and then talks about a portion of 18 that memory device. And then it talks about 19 threads. 20 So following the language of that claim, 21 it's not talking about a portion of a thread when 22 it obviously could because it's talking about a	32 1 A I think I've said that claim 1, when it's 2 speaking of storing command threads, it's storing 3 complete command threads. 4 Q So if the memory device stores the entire 5 set of the sequence of commands for a given 6 command thread, is it storing the command thread? 7 A I'm not sure what you mean by "set." 8 Q You said that a command thread is a 9 sequence of commands applicable to a corresponding 10 element, correct? 11 A Correct. 12 Q So if the memory device stores the entire 13 sequence of commands applicable to a corresponding 14 element for a given command thread, is it storing 15 the command thread? 16 A Yeah, that's a different question. It's 17 storing -- a command thread is a sequence of 18 commands applicable to the corresponding element. 19 That command thread is described in multiple 20 places in the patent. 21 For example, column 4, line 34, "Upon 22 execution of the command, the ALU then returns the

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Conducted on April 5, 2024

33 1 command thread to the appropriate reservation 2 station." 3 If it wasn't the entire thread, it's not 4 clear to me how it could be returned. 5 MR. JOHNSON: Objection. Nonresponsive. 6 BY MR. JOHNSON: 7 Q Do you agree with me that if the claimed 8 memory device stores the entire sequence of 9 commands applicable to the corresponding element 10 for a given command thread, that it is storing the 11 command thread? 12 A I'm not sure what the first 13 characterization you're giving refers to. I'm 14 saying that a -- the command thread is a complete 15 command thread, not a portion of a command thread. 16 Q I'm not sure I understand what you mean by 17 "first characterization." Can you identify that 18 for me? 19 A The first thing you referred to in your 20 question. 21 Q So I'll repeat my question, and then you 22 can tell me what you're talking about because just	35 1 the claim requires storage of a command thread? 2 A I don't know that I need to consider -- 3 needed to consider what's actually being stored, 4 what that representation looks like. It hasn't 5 really come up in Dr. Pedram's comments. 6 It represents a sequence of commands 7 applicable to the corresponding element. 8 Q And so what would a partial command thread 9 be if that's all that was stored? Would it just 10 be some part of that sequence of commands but not 11 all of the commands? 12 A Of that command thread? So one example 13 of -- that would not represent a complete command 14 thread, would not satisfy claim 1, is if something 15 stored just one instruction, for example. 16 Q So if I'm going to have to store the 17 complete command thread according to your 18 interpretation of the claim, I need to store all 19 of the sequence of commands that make up that 20 command thread, correct? 21 A You need to store some representation of 22 the complete command thread.
34 1 saying "the first thing" doesn't tell me anything. 2 I asked you: Do you agree with me that if 3 the claimed memory device stores the entire 4 sequence of commands applicable to the 5 corresponding element for a given command thread, 6 that it is storing the command thread? 7 A No, I don't agree with that. You calling 8 the -- you're referring to the complete sequence 9 of commands; I'm talking about a complete command 10 thread. And a command thread is a sequence of 11 commands applicable to the corresponding element. 12 You're saying that it's stored in a memory 13 device. Claim 1 requires that the pixel command 14 threads are stored in a first portion; that the 15 memory device comprises a first portion operative 16 to store a plurality of pixel command threads and 17 a second portion operative to store a plurality of 18 vertex command threads. 19 So I don't follow that question. I 20 don't -- I can't agree with -- I can't answer yes 21 to that. I'd say no. 22 Q So what is actually being stored then when	36 1 Q I see. So it could be just a 2 representation of the complete command thread? 3 A That's what I just said. Something that 4 represents the complete command thread. 5 Q Okay. And can you give me some examples 6 of that? 7 A One example would be all of the commands 8 in a command thread. 9 Q What's another example? 10 A An index to those commands. 11 Q Okay. Any other example? 12 A Those are the two I can think of off the 13 top of my head. 14 Q Okay. 15 A This didn't really come up in Dr. Pedram's 16 opinions, so I haven't considered all the possible 17 options. 18 MR. JOHNSON: We've been going about an 19 hour. You want to take a break? 20 MR. DOKHANCHY: Sure. 21 (WHEREUPON, a recess was had.) 22

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Conducted on April 5, 2024

37 1 BY MR. JOHNSON: 2 Q Are you ready to proceed? 3 A Yes. 4 Q I notice you've been having breaks with 5 your attorney. I just want to make sure you 6 haven't had any discussions with your attorney 7 about the substance of your testimony, correct? 8 A Correct. 9 Q So we were talking about storing command 10 threads in the memory device. And I believe that 11 your opinion is that the command threads must be 12 complete and that both command threads, pixel and 13 vertex, must be stored at the same time, correct? 14 A The memory devices are operable to store 15 both pluralities at the same time. 16 Q And with respect to just one command 17 thread, if what I'm storing is just the sequence 18 of commands that make up that command thread, do I 19 have to store all of those sequences at the same 20 time, or could I store them over time and 21 eventually store the entire command thread? 22 A So there's a discussion of this, for	39 1 stating that. I think I required that the entire 2 command thread -- storage of a command thread 3 means storing the entire command thread. And I've 4 got an example where storing a portion of a 5 command thread, for example an instruction, is not 6 sufficient. 7 Q So you have no opinion as to whether or 8 not, if I store the entire command thread over 9 time, that would satisfy the claim language to 10 store the command thread, correct? 11 A I think the answer is no because here is a 12 situation in Williams where you're getting 13 individual instructions stored. And I've argued 14 that that does not suffice because you are not 15 storing the entire command thread. 16 Q Right. But that -- I understand your 17 distinction to be that it never stores in Williams 18 the entire command thread over time. And what I'm 19 saying is, if you do store the entire command 20 thread over time, is that -- will that satisfy the 21 claim language? 22 There's a distinction I'm making between
38 1 example, in reference to Williams because Williams 2 does not store complete command threads. Williams 3 is an example that only stores individual graphics 4 commands, doesn't mention the word "thread," and 5 it doesn't store the entire -- what Dr. Pedram 6 puts forward as the entire command thread. 7 Q That's not my question. 8 My question is if I store all of the 9 component parts of a command thread over time, 10 have I stored the command thread? 11 A That does answer your question. In 12 Williams, as Williams is sending across these 13 commands, these commands are going to appear in 14 memory over time. 15 Dr. Pedram seems to think that a sequence 16 of those commands is a command thread. Even if it 17 is, just because each of those individual commands 18 gets stored in memory over time doesn't mean that 19 we have stored the entire command thread. 20 Q If I store the entire command thread over 21 time, have I stored the command thread? 22 A I don't know that I have an opinion	40 1 Williams and what you're saying. 2 A I'm giving Williams as an example where -- 3 Q But I'm distinguishing Williams. So I 4 want to make sure that we're on the same page 5 because you're not answering the right question. 6 MR. DOKHANCHY: Can you finish your 7 answer, Dr. Hart. I believe Counsel cut you off. 8 BY THE WITNESS: 9 A Williams shows an example where individual 10 commands are being stored, and those commands are 11 what Dr. Pedram opines form a command thread. I 12 disagree that they're a thread. Williams doesn't 13 even mention the word "thread." 14 But even if they were, even if we accept 15 Dr. Pedram's opinion on that, which we don't -- 16 which I don't, that still wouldn't be a complete 17 command thread because Williams is only storing a 18 command at a time. So even over time, if it 19 stores all of those commands that together form 20 what Dr. Pedram thinks is a thread, it still isn't 21 a complete thread. 22

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Conducted on April 5, 2024

41 1 BY MR. JOHNSON: 2 Q Thanks for that explanation. That makes 3 it more clear for me. 4 So if you could turn to Page 18 of your 5 declaration, which is Page 22 of Exhibit 2009. 6 And on Page 18 of your declaration, starting in 7 Paragraph 40, you have a section that deals with 8 claim constructions, correct? 9 A Yes. That's -- the claim construction 10 discussion begins. 11 Q And in Paragraph 40, it says, "I 12 understand certain terms of the '053 patent have 13 been previously construed by the Board and by the 14 ALJ in the ITC investigation." 15 You see that? 16 A Yes, I do. 17 Q And when you say "previously construed by 18 the Board," do you mean in this action or in a 19 previous action? 20 A I've been informed of these constructions. 21 I've listed them in Page 19 as the Board's adopted 22 construction, so I believe I understand that to be	43 1 A Yes. But it's -- those two boxes aren't 2 just arbiter. The first is an arbiter showing a 3 board's adopted construction. So these two things 4 do indeed have different definitions, but also the 5 claim terms are different. 6 The claim term is not just arbiter; it's 7 arbiter select a command thread from either the 8 plurality of pixel command threads and the 9 plurality of vertex command threads and relative 10 priorities. 11 Q Well, I understand the box in Paragraph 42 12 to be showing that there's three different terms 13 set off by quotation marks, and that for each 14 three of those terms, they were construed to be 15 given their plain and ordinary meaning. 16 Isn't that the way you understand this 17 box? 18 A Well, the second thing, "select a command 19 thread from either the plurality of pixel command 20 threads and plurality of vertex command threads" 21 is related to the first thing, arbiter. 22 In any case, it's talking about the action
42 1 the current board. 2 Q Okay. If you look at the term -- the 3 table of terms that's in Page 4 -- that's in 4 Paragraph 41, you see the first term listed is 5 "arbiter," correct? 6 A Yes. 7 Q And you have a cite there to IPR 2015-325; 8 do you see that? 9 A Yes. 10 Q And so that's not this action, correct? 11 A No. This is 564. That's 325. So, yeah, 12 that would have been the previous board. 13 Q And they construed "arbiter" to have the 14 construction that you have in the box, correct? 15 A Yes. 16 Q And then in Paragraph 42, you have a table 17 with certain constructions that was adopted by the 18 ALJ in the 1318 investigation, correct? 19 A Yes. 20 Q And it also has the term "arbiter," and it 21 has a different construction than what the 22 previous board had, correct?	44 1 of the arbiter along with the arbiter, and both 2 have plain and ordinary meaning. 3 Q I don't think it makes a difference for my 4 question. I was just going to use "arbiter" as an 5 example. 6 I just want to understand what 7 construction you used for terms where there was a 8 difference between previous constructions? 9 A I've never encountered a situation, both 10 in Dr. Pedram's opinions, in the prior art, and in 11 the '381 where these two constructions were in 12 conflict with each other. 13 Q So which one did you use? 14 A I used them both. They were consistent 15 with each other. They matched in as far as was 16 needed to provide opinions in reference to 17 Dr. Pedram's opinions. 18 Q And later in time, there was an initial 19 determination in the 1318 investigation which 20 construed additional terms and went back and gave 21 further clarity to certain terms. 22 Do you understand that?

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Conducted on April 5, 2024

45 1 A I believe so. 2 Q And I assume that based on Paragraph 44 of 3 your declaration, that you also took into account 4 those additional constructions or guidance by the 5 ITC court, correct? 6 A These are the constructions I used for the 7 reasons stated. 8 Q So I'd like to have a cleaner response to 9 my question. Let me ask a better question. 10 Did you take into account the 11 constructions and claim construction guidance that 12 was provided in the initial determination by 13 Judge Elliot in the 1318 investigation when 14 forming your opinions for your declaration in this 15 action? 16 A Everything I utilized was listed in 17 materials considered. In the 1318 matter, order 18 number 31 is listed as Exhibit 1010, so I would 19 have considered that. 20 Q So looking at Page 23 of your declaration, 21 which is Page 27 of Exhibit 2009 -- I'm sorry, 22 Page 24, Page 28 of Exhibit 2009, you are	47 1 A I'd have to consider that at -- I didn't 2 use that terminology. 3 Q Do you understand the terminology that I 4 used? 5 A I understand the question, but to answer 6 that question would require another opinion. I'd 7 need to take time to formulate that opinion. I 8 formulated the opinions in response to 9 Dr. Pedram's report based on what I've stated here 10 using these constructions. 11 Q All I'm asking you is, do you agree with 12 me that based on your interpretation of this 13 language, that the arbiter must select from a pool 14 of at least two pixel command threads and two 15 vertex command threads? 16 A I haven't analyzed that language -- that 17 particular language. I used the claim language, 18 and my -- and I've stated here a person of 19 ordinary skill in the art would understand that 20 claim language; those are your words, those aren't 21 my words. I haven't considered those particular 22 words in my opinions on these constructions.
46 1 addressing the claim term that reads, "Select a 2 command thread from either of the plurality of 3 pixel command threads and the plurality of vertex 4 command threads," correct? 5 A Yes. 6 Q And that section is a single paragraph, 7 which is Paragraph 55 of your declaration, 8 correct? 9 A Yes. 10 Q And I understand your interpretation of 11 this claim phrase to be that the arbiter must 12 select from a pool of at least two pixel command 13 threads and two vertex command threads, correct? 14 A I don't see that. 15 Q Is your opinion that the arbiter must 16 select from a pool of at least two pixel command 17 threads and two vertex command threads? 18 A I don't see that that's what's stated here 19 in Paragraph 55. 20 Q Is that a consistent statement with your 21 opinion about how this phrase should be 22 interpreted?	48 1 Q Okay. So then what is your opinion about 2 how this claim phrase should be interpreted? 3 A Paragraph 55. And also how it's applied, 4 for example, in the -- my opinions on Dr. Pedram's 5 opinions regarding the prior art. 6 Q Can you simply articulate for me your 7 interpretation of this claim phrase? 8 A I didn't provide a construction. What I 9 did is provide an opinion in response to 10 Dr. Pedram's opinions in Paragraph 55. 11 Q When the arbiter makes its selection of a 12 command thread, must there be at least two pixel 13 command threads and two vertex command threads 14 present at the time of selection? 15 A I'm stating that both types of command 16 threads must be present when that selection is 17 made. 18 Q Wouldn't the plain language of the phrase 19 be that I can select a command thread from either 20 the plurality of pixel command threads or the 21 plurality of vertex command threads? 22 A No.

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Realtek Ex. 1016, Page 13

Realtek Semiconductor Corp., v. ATI Technologies ULC

IPR2023-00564

Conducted on April 5, 2024

49 1 Q Such that I could just have a plurality of 2 pixel command threads to choose from or I could 3 have a plurality of vertex command threads to 4 choose from? 5 A I mean, as this paragraph states, there's 6 also the word "and." "From either of the 7 plurality of pixel command threads and the 8 plurality of vertex command threads." And so as I 9 state in here, both need to be present. 10 Q So if I took the words "either of" 11 completely out of the sentence and I said, "Select 12 a command thread from the plurality of pixel 13 command threads and the plurality of vertex 14 command threads," would there be any difference in 15 scope to those two sentences? 16 A I didn't consider that altered claim 17 language; I considered the claim language as 18 written. 19 Q You have a whole discussion in 20 Paragraph 55 about what "either of" means and how 21 it affects the claim language. So you didn't 22 consider whether or not -- or what the phrase	51 1 Q Do you have any patents of your own? 2 A Yes. 3 Q And have you ever heard of something 4 called a Markush group? 5 A No. 6 Q Okay. Have you been instructed by counsel 7 at all about whether or not the term "and" can 8 mean "and" or "or" in a claim? 9 A I'm not a lawyer. 10 Q I understand that. I understand that your 11 counsel would have to give you any legal 12 ramifications that you have to use. And all I'm 13 asking is were you -- did you have any advice or 14 counsel regarding what the word "and" might mean 15 in a claim term? 16 A I haven't documented anything of that sort 17 that I see here in Paragraph 55. I don't recall. 18 Q Okay. And on Page 10 of Exhibit 9, which 19 is Page 6 of your declaration, there's a section 20 Roman Numeral IV that starts with Paragraph 16 and 21 goes to Paragraph 23. 22 And that is the legal standards that you
50 1 "either of" meant? 2 A I clearly did consider what the phrase 3 "from either of" means in Paragraph 55. I did not 4 propose alternate claim language. 5 Q What does "from either of" mean? 6 A In the context of Dr. Pedram's opinion, I 7 state that, "If the phrase 'from either of' in the 8 larger phrase 'select a command thread from either 9 of the plurality of pixel command threads and the 10 plurality of vertex command threads' meant that 11 only one type needed to be stored, it would, by 12 the same argument, mean that only one type needed 13 to be selected from." 14 And that was to show that Dr. Pedram's 15 interpretation was wrong. 16 Q And so you're placing emphasis on the word 17 "and," correct? 18 A I'm reading the claim in totality as 19 illuminated by the specifications. 20 Q Could the word "and" mean "and/or"? 21 A I use the language in the claim; I didn't 22 propose alternate language.	52 1 applied, correct? 2 A Correct. 3 Q And to the extent that you were provided 4 any guidance about the law, it would be stated 5 within this section, correct? 6 A This is documenting the legal standard I 7 applied; I don't know that this documents the sum 8 total of my understanding of these matters. I 9 think there's a lot of details here that aren't 10 necessarily included. 11 I'm relying on certain basic legal 12 principles that counsel has explained to me and 13 that this section discusses those principles. 14 Q And one of those legal principles that is 15 not included in this legal section is how the term 16 "and" may be interpreted in a patent claim, 17 correct? 18 A That's correct. This section doesn't 19 refer specifically to the term "and." 20 Q And then looking back to the claim 21 construction section of your report, the last term 22 that you address is "command processing engine"

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Realtek Ex. 1016, Page 14

Realtek Semiconductor Corp., v. ATI Technologies ULC

IPR2023-00564

Conducted on April 5, 2024

53 1 starting in Paragraph 55, correct? 2 A No. 3 Q Oh, I'm sorry. Paragraph 56. 4 Correct? 5 A Correct. 6 Q And is it your opinion that the command 7 processing engine as recited in the '053 claim 8 cannot be a processing engine that can only do 9 vertex or pixel command threads? 10 A I agree with Dr. Pedram that a unified 11 shader includes a command processing engine that 12 can perform both kinds of vertex and pixel 13 processing. 14 And I also state that a person of ordinary 15 skill in the art would understand this type of 16 command processing engine to be a unified shader. 17 Q When you say "this type of command 18 processing engine," you mean the one that's 19 claimed? 20 A Yes. When I say, "The command processing 21 engines claimed by claims 2 and 5 must be able to 22 process whichever thread presented to it" -- "is	55 1 specification. 2 Q But that -- is that a legal issue, how to 3 define "operative to" as "configured to"? 4 A I'm not a lawyer. 5 Q I know. And that's why I'm trying to 6 understand how you came to the understanding that 7 "operative to" means "configured to." 8 A I think this sentence is introducing the 9 rest of the paragraph. The rest of the paragraph 10 means exactly what "operable to" and "operative 11 to" means. It means that the system is configured 12 to actually perform the function, not that it's 13 capable of doing so. It needs to actually be 14 configured to perform that function. 15 Q Okay. So you came to that understanding 16 based on your reading of the claims? 17 A And how a person of ordinary skill in the 18 art would understand the claims. This is -- here 19 in Paragraph 87, it's not in claim construction; 20 it's to illustrate that you can't just -- you 21 can't just have something capable of doing 22 something, you need to actually be able to
54 1 presented to it by an arbiter," meaning it's 2 capable of processing both pixel and vertex 3 command threads. 4 Q Can you look at Paragraph 87 of your 5 report. 6 A Yes. 7 Q And it says that, "I understand 'operative 8 to' or 'operable to' to be synonymous with 9 'configure to'," correct? 10 A Yes. 11 Q And when you say, "I understand," how did 12 you come to that understanding? 13 A "Operative to" or "operable to" in the 14 claims meaning "configured to" as described in the 15 following sentences. It's not -- and the sentence 16 following that. It's not just coincidental or 17 probability that it happens; it actually -- it's 18 configured to actually perform that function, not 19 that it's capable of doing so. 20 Q Okay. And how did you come to that 21 understanding? 22 A I read the claims in light of the	56 1 configure it. The system has to -- the system has 2 to be configured to actually perform that 3 function. 4 Q Do you know whether or not this issue was 5 addressed in the 1318 investigation as to whether 6 or not "operative to" in the '053 claims meant 7 "configured to" or "capable of"? 8 A I don't believe I cited to anything of the 9 sort in Paragraph 87. 10 Q I'm going to hand you what's marked as 11 Exhibit 1005 in this investigation. 12 (WHEREUPON, Exhibit No. 1005 was presented 13 to the witness.) 14 BY MR. JOHNSON: 15 Q And I'll just represent for the record 16 that it is a copy of the Stuttard prior art 17 reference that is asserted in this IPR. 18 Do you recognize it? 19 A Yes. 20 Q Stuttard discloses a cache memory, 21 correct? 22 A Specifically Stuttard discloses a cache

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Conducted on April 5, 2024

57 1 unit 1024 that Dr. Pedram identifies as the "at 2 least one memory device." But I don't agree with 3 that opinion that that was the one memory device. 4 Q So the cache unit 1024 stores pixel 5 command threads at some time, correct? 6 A No. 7 Q So it's your opinion that the cache memory 8 in Stuttard cannot ever store pixel command 9 threads? 10 A My opinion is that Stuttard does not 11 disclose or render obvious the storing of complete 12 command threads, and Dr. Pedram points to that 13 cache is a memory device, and so that cache does 14 not store complete command threads. 15 Q Would a person of ordinary skill in the 16 art understand that Stuttard's cache memory is 17 capable of storing a complete pixel command 18 thread? 19 A It needs to be operable. The memory 20 device needs to be operative to store pixel 21 command threads and vertex command threads in the 22 first and second portion -- in first and second	59 1 thread, and it's not configured to store a thread. 2 It's not operative to store pixel command 3 threads and vertex command threads in the first 4 and second portions of memory. 5 Q Did you form an opinion as to whether or 6 not a person of ordinary skill in the art would 7 understand that Stuttard's cache memory is capable 8 of storing a complete vertex command thread? 9 A No. That's not part of my opinions. 10 In fact, my opinion says that capable 11 doesn't matter, mere probability or happenstance 12 isn't sufficient; it needs to be operable too. 13 And I used the term "configure to" to 14 illustrate an example of "operative to," what 15 "operative to" would mean. 16 Q Did you form an opinion of whether or not 17 a person of ordinary skill in the art would 18 understand that Stuttard's cache memory is capable 19 of storing complete pixel and vertex command 20 threads at the same time? 21 A As I said before, I did not use "capable 22 of doing so" as the criteria of my opinions. I
58 1 portions of memory. 2 So it needs to be configured to actually 3 perform that function and not merely capable of 4 doing so -- doing so not by probability or 5 happenstance. 6 It's a cache, meaning it's designed to 7 hold a small amount of information that can be 8 accessed quickly. It's not designed to hold an 9 entire thread; it's designed to hold an 10 instruction so that that instruction can be 11 accessed quickly. 12 Q Did you form an opinion as to whether or 13 not Stuttard's cache memory is capable of storing 14 a complete pixel command thread? 15 A No. The opinion that I said -- the 16 opinion that I offered in response to Dr. Pedram's 17 opinion is that the system is configured to 18 actually perform a function, not that it is -- not 19 merely that it is capable of doing so. 20 So I didn't form an opinion about whether 21 it was -- the cache memory was capable of storing 22 a thread; it needs to be configured to store a	60 1 used "operative to." I used the claim language in 2 my opinions. So my opinions did not rely on 3 something being -- on memory being capable of 4 doing that storing. 5 Q Do you understand that Stuttard discloses 6 having eight processing blocks? 7 A Figure 3 shows Stuttard and processing 8 block 106, and there seems to be some number of 9 processing blocks. 10 Q And do you recall that there is disclosure 11 within Stuttard that that could be any number of 12 processing blocks? 13 A I'm paraphrasing Stuttard, but... 14 Yes. Page 8, Line 10, "It would be 15 readily appreciated that any number of processing 16 blocks can be provided in a graphic system using 17 this architecture." 18 Q Okay. So then it could have, say, ten 19 processing blocks, correct? 20 A I believe ten is any number. 21 Q Can you tell me what is the benefit of 22 having ten processing blocks in Stuttard as

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Realtek Ex. 1016, Page 16

Realtek Semiconductor Corp., v. ATI Technologies ULC

IPR2023-00564

Conducted on April 5, 2024

61 1 compared to having just one big processing block 2 that's ten times the size? 3 A I don't have an opinion on that. I didn't 4 see that particular item in Dr. Pedram's opinions. 5 Q Okay. Do you know why Stuttard divides 6 the processing blocks into individual multiple 7 blocks? 8 A The title of this is "Parallel Data 9 Processing Apparatus," and so I believe it was in 10 search of parallel benefit. 11 The abstract says, "A data processing 12 apparatus consisting of a SIMD (single instruction 13 multiple data) array ten of processing elements, 14 the processing core," and it's that processing 15 core that comprises any number of processing 16 blocks. 17 Q And do you agree with me that each 18 processing block is the same in Stuttard? 19 A I don't know if I have an opinion on that. 20 I don't know that Dr. Pedram suggested that they 21 be different. I haven't looked at that aspect of 22 Stuttard to see if it supported heterogeneous	63 1 processing blocks is solely for redundancy? 2 A I don't recall using the term "redundancy" 3 in my opinion of Stuttard's parallelism. 4 Q Can you look at Figure 2B. 5 A Okay. 6 Q Can you tell me what are the fusion blocks 7 represented by Item 106 in the figure? 8 A Stuttard, Page 8, Line 9 says, "In the 9 example shown in Figure 2 the processing core 10 10 is provided with eight processing blocks 106." 11 In Figure 2, 106 is labeled 8x fusion 12 blocks, eight times fusion blocks, and so that's 13 showing eight processing blocks. 14 Q And do you see the thread processors 1026 15 in Figure 4? 16 A Yes. 17 Q Why would the system need so many thread 18 processors if it's all running the same 19 instruction? 20 A So the thread processors are in the thread 21 manager 102 in Figure 4. There is a single-thread 22 manager 102 in Figure 3 feeding an instruction
62 1 processing blocks. 2 I believe the examples Dr. Pedram put 3 forward assumed that Stuttard was using the same 4 processing blocks, that all the processing blocks 5 were the same. 6 Q Is it your opinion that the different 7 processing blocks in Stuttard are all running the 8 exact same task? 9 A The processing blocks in Stuttard are 10 running an instruction from a thread, and they are 11 all running the same instruction on multiple data 12 items. 13 Q Do you need to take a break? 14 A No, I'm good. 15 Q Why is it that if they're running the same 16 instruction, that each of them need their own 17 thread processor? 18 A I'm not sure what thread processor you're 19 speaking of. I don't see a thread processor in 20 Figure 3's illustration of a processing block. 21 Q Is it your opinion that the reason 22 Stuttard has divided its processing into multiple	64 1 that eventually makes it into all of the 2 processing blocks, the stack of processing blocks 3 shown as 106. So the processing blocks are all 4 executing the same instruction it gets from that 5 one thread manager. 6 The thread processor, there's eight of 7 them because this thread manager is performing 8 time-interleaved multithreading. It can manage, 9 in this case, up to eight different threads in a 10 time-interleaved manner so that all of these 11 processing blocks are executing an instruction 12 from one thread and, at a later time, can execute 13 an instruction from a different thread. 14 Q Do you agree that there's an advantage in 15 having eight smaller processing blocks that 16 operate in tandem in SIMD fashion compared to one 17 larger block operating in SIMD fashion? 18 A I didn't see such a configuration from 19 Dr. Pedram. I don't believe I've done that 20 analysis in my opinions responding to Dr. Pedram. 21 Q So you don't have an opinion as a person 22 of ordinary skill in the art or an expert in this

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Conducted on April 5, 2024

65 1 field that there's an advantage in having eight 2 smaller processing blocks that operate in tandem 3 in SIMD fashion compared to one larger block 4 operating in SIMD fashion? 5 A I haven't performed that analysis as part 6 of my opinions in response to Dr. Pedram because 7 Dr. Pedram didn't put forward that opinion. 8 Q Do you agree or disagree that a person of 9 ordinary skill in the art would consider it 10 obvious to separately store pixel and vertex 11 command threads, since these command threads 12 correspond to different types of graphics data 13 processing tasks, and separate storage would 14 improve access sufficiency? 15 A Could you repeat the question? 16 Q Sure. Do you agree or disagree that a 17 person of ordinary skill in the art would consider 18 it obvious to separately store pixel and vertex 19 command threads, since these command threads 20 correspond to different types of graphics data 21 processing tasks, and separate storage would 22 improve access efficiency?	67 1 A Yes. 2 Q Do you agree that if Stuttard is 3 performing multithreading in a non-interleaved 4 fashion, it can be running instructions from 5 different active threads at one -- one after the 6 other in an alternate fashion? 7 A Can you repeat that question? 8 Q Sure. Do you agree that if Stuttard is 9 performing multithreading in a non-interleaved 10 fashion, it can be running instructions from 11 different active threads one after the other in an 12 alternate fashion? 13 A I did not consider that. Stuttard 14 performs multithreading in a time-interleaved 15 fashion, so I didn't -- I mean, I considered 16 Stuttard as written, as a person of ordinary skill 17 in the art would understand Stuttard. 18 So I did not consider any other form of 19 multithreading in Stuttard other than 20 time-interleaved as stated in Stuttard. 21 Q Do you agree that storing or retrieving an 22 entry in a smaller memory is easier than storing
66 1 A No. I don't think that would be obvious. 2 For example, it certainly wouldn't be obvious in 3 Stuttard because Stuttard's either working on 4 vertex processing or pixel processing, and to -- 5 it would be a waste of storage to have to store 6 pixel threads while you're processing vertex 7 threads. And it would be a waste of storage to 8 store vertex threads while you're processing pixel 9 threads. 10 Q Do you agree -- strike that. 11 I take it that your answer is based on 12 your interpretation that Stuttard is limited to a 13 phased operation, correct? 14 A My opinion is that Stuttard operates in a 15 phased manner. It first processes all of the 16 vertices in all of the vertex threads, and then 17 there's a binning step. And after that binning 18 step is completed, after all of the vertex 19 processing threads have occurred, then it does the 20 pixel processing and processes the pixel threads. 21 Q And you agree with me that each processing 22 block has its own binning unit, correct?	68 1 or retrieving the same entry in a larger memory? 2 A It would depend on the implementation. 3 Q Do you agree that storing or retrieving an 4 entry in a smaller random access memory is less 5 costly than storing or retrieving the same entry 6 in a larger random access memory? 7 A It would depend on the implementation. I 8 couldn't answer that in general. 9 Q Do you have an opinion on whether or not 10 Stuttard's arbiter knows the type of command 11 thread it is selecting? 12 A I have an opinion that Stuttard does not 13 care about command thread type. It is on Page 40, 14 which is Page 44 of the exhibit, Paragraph 85. 15 Dr. Pedram argues that "Stuttard's system 16 would benefit from knowing where in memory 17 commands of specific types are, but Stuttard does 18 not disclose that the alleged arbiter, the 19 scheduling module 1025 along with the thread 20 processors 1026 performs that selection on the 21 basis of command thread type. 22 Q Do you know whether or not Stuttard's

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Conducted on April 5, 2024

69 1 cache memory is actually storing only portions of 2 command threads, or is that an assumption that 3 you're making? 4 A The cache memory 1024 is not operative to 5 store complete threads. It's a cache, meaning 6 it's designed to be small and local and fast to 7 store enough instructions to be able to -- in 8 order for the thread to be efficiently processed 9 by the thread manager. 10 Q And "operative to" means "configured to," 11 right? 12 A I used "configured to" to illustrate what 13 I mean by "operative to" in that discussion. 14 MR. DOKHANCHY: Jeff, if you're at a good 15 stopping place, do you mind if we take a break? 16 MR. JOHNSON: Yeah. Sure. Absolutely. 17 (WHEREUPON, a recess was had.) 18 BY MR. JOHNSON: 19 Q Do you know what the typical size is of an 20 instruction -- strike that. 21 Do you know what a typical size of an 22 instruction cache memory is?	71 1 A I don't know that I've established a 2 range. I haven't really looked into a range, and 3 I don't believe I have an opinion on the -- on 4 that range in response to Dr. Pedram's opinions. 5 Q Could it be less than ten? 6 A I don't know. I'd have to see the 7 application, what it was doing. 8 Q In your experience, have you ever come 9 across a vertex command thread that has less than 10 ten instructions? 11 A We're not talking about any vertex command 12 thread; we're talking about a vertex thread as 13 specified in the '053 for those purposes and would 14 be considered in the prior art. The examples I 15 use for classrooms and other things can vary 16 widely because they are used for different 17 purposes. 18 Q In your vast experience, have you ever 19 come across a vertex command thread as it would be 20 known in the '381 patent that has less than ten 21 instructions? 22 A In my class, I could come up with example:
70 1 A No. I'm not sure there is a typical size. 2 I certainly didn't consider a typical size in 3 response to Dr. Pedram's opinions. 4 Q Do you know as a person of ordinary skill 5 in the art how many instructions are in a typical 6 vertex command thread? 7 A I didn't really look at typical. I looked 8 at, for example, complete storage of a command 9 thread, not an average size command thread or a 10 minimal size command thread. 11 Q Right. But I'm asking you as a person of 12 ordinary skill in the art, as an expert, as 13 someone who teaches classes and has research in 14 this field of art, do you have an understanding 15 about how many instructions are typically in a 16 vertex command thread? 17 A I don't know that I've ever offered a 18 typical vertex command thread or a pixel command 19 thread. They can vary depending on the 20 application. 21 Q And what kind of range would you give in 22 that variance?	72 1 Vertex programs that are very short for 2 illustrative purposes. I didn't really consider 3 those when I was examining the '053 patent and the 4 prior art because those were full-fledged graphic 5 systems. 6 Q So do you have any experience with a 7 vertex command thread that has less than ten 8 instructions? 9 MR. DOKHANCHY: Objection. Asked and 10 answered. 11 BY THE WITNESS: 12 A I've come up with toy vertex command 13 threads when I'm teaching how to do vertex 14 programming in my classes. They can do something 15 very simple such as not implement any of the 16 operations described in the '053 vertex 17 processing, but to demonstrate how to load and 18 execute a vertex thread -- a vertex programming. 19 BY MR. JOHNSON: 20 Q Do you have any experience with a vertex 21 command thread as it would be understood in the 22 '053 patent that has less than ten instructions?

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Conducted on April 5, 2024

73 1 MR. DOKHANCHY: Same objection. 2 BY THE WITNESS: 3 A I didn't consider my toy examples to be 4 what was being described in the '053 when it's 5 talking about vertex processing. The '053 6 discusses vertex processing in the background of 7 the -- sorry. 8 Paragraphs 24 through 27, relevant 9 technical background at the time of the '053, I 10 describe some of the steps in manipulating and 11 rendering 3D graphical objects onto a 2D screen. 12 First stage is often referred to as vertex 13 processing, computes for the 3D position in space 14 of each vertex. A new 2D position of that vertex 15 in the space of the screen or output image from 16 the perspective of the viewer. 17 So it also computes other things like 18 color, skinning, a variety of other steps that a 19 person of ordinary skill in the art would be aware 20 of. And then the next stage after skin conversion 21 is pixel processing. 22 Pixel processing stage computes the colors	75 1 8 bytes could be stored in a typical cache memory, 2 correct? 3 A So, as I said before, when I considered 4 the memory device with respect to Stuttard, I 5 understood "operative to" to be synonymous with 6 "configure to"; that the system is configured to 7 actually perform a function, not be capable of 8 doing so; and that is mere probability or 9 happenstance isn't sufficient. 10 If a vertex thread -- a complete vertex 11 thread happens to be very short in one particular 12 example, that doesn't say that the memory is 13 operative to store pixel command threads and 14 vertex command threads. 15 Q You testified previously that Stuttard's 16 system can do time-interleaved multithreading, 17 correct? 18 A Yes. 19 Q And that's how you justified having 20 multiple thread processors; for example, one per 21 processing block, correct? 22 A No.
74 1 of each of these pixels, fragments, and applies 2 textures and computing those colors involves 3 lighting and shading and other complex 4 calculations to determine the color of each of the 5 pixels. 6 BY MR. JOHNSON: 7 Q Do you have any personal experience with a 8 vertex command thread as it would be understood in 9 the '053 patent that has less than ten 10 instructions? 11 A As I said before, I have examples that are 12 very short that I use in class when understanding 13 how to load and execute a vertex shader. 14 Q Do you know how many bytes are needed to 15 represent a single instruction? 16 A That would depend on the architecture of 17 the processor. 18 Q And is it possible that it's less than 19 8 bytes? 20 A That would depend on the architecture of 21 the processor. 22 Q So a very short vertex thread of less than	76 1 Q Okay. Maybe I misunderstood your 2 testimony. Could you explain it again? 3 A The processing blocks are in Figure 3, and 4 there can be any number of those. And all of the 5 processing blocks are executing the same 6 instruction at any given time across multiple data 7 items, across all the processing blocks. 8 The thread processors are managing how 9 many different threads are -- can be 10 time-interleaved, such that you're sending just 11 one instruction from one thread at any given time 12 to the processing blocks. 13 Q Do the execution of the concurrently 14 running threads overlap in time? 15 A I'm not sure what you mean by 16 "concurrently" or "overlapping in time." The 17 thread processors and the thread manager are 18 selecting one instruction that go -- at a time 19 that goes to the processing block for execution 20 across all of the processing blocks. 21 Q Do you agree that the objective of 22 Stuttard is to increase the speed of graphics

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Conducted on April 5, 2024

1 processing? 2 A I don't know that I have opinions on the 3 objective of Stuttard. 4 Q Okay. Is 2D graphics processing a type of 5 graphics processing? 6 A So when I formed my opinions on the '053, 7 the '053 discloses a graphics processing system, 8 and that graphics processing system describes 9 vertex threads and pixel threads -- vertex command 10 threads and pixel command threads, and I 11 understood those the way a person of ordinary 12 skill in the art would have understood those to 13 refer to 3D graphics. 14 Q So your answer is no? 15 A My answer is I didn't really formulate 16 opinions on 2D graphics; I formulated opinions on 17 the '053, which discussed 3D graphics. 18 Q So you don't have an opinion on whether or 19 not 2D graphics processing is a type of graphics 20 processing, correct? 21 A I didn't really analyze 2D graphics 22 processing. The subject matter of the '053 is a	77 1 The claim language in the '053, the 2 arbiter selects, so I'd have to see what context 3 you were discussing sorting and selecting. 4 MR. JOHNSON: Okay. Let's take a break 5 and let me make sure that I'm done. 6 Actually, you know what? I pass the 7 witness. 8 EXAMINATION 9 BY MR. DOKHANCHY: 10 Q Dr. Hart, can you grab the '053 patent. 11 A Okay. 12 Q You were asked some questions earlier 13 about Figure 1 and whether the arbiter in Figure 1 14 selects things; do you recall that generally? 15 A Generally, yes. 16 Q If you go to the claim language, please. 17 In claim 1, for example, the arbiter is operable 18 to select a command thread from either of the 19 plurality of pixel command threads and the 20 plurality of pixel command threads -- 21 A Of vertex command threads. 22 Q Right. Let me restate that. So
78 1 graphics processing system that I and a person of 2 ordinary skill in the art in reference to the 3 operations applying the vertices and pixels would 4 have applied to -- would have been performed for 5 3D graphics processing. 6 Q Do you agree with me that time-interleaved 7 multithreading means running command 1 on thread 1 8 on all processing blocks, and then run command 1 9 of the second thread on all processing blocks, 10 then run command 1 of the third thread on all 11 processing blocks? 12 A I would have to see what system you were 13 showing me that example on and walk through all 14 the steps of executing commands on that system. 15 Q Stuttard's system. Assume Stuttard's 16 system. 17 A Stuttard supports time-interleaved 18 multithreading. 19 Q Does sorting involve some sort of 20 selection? 21 A I'd have to see what sorting was being 22 referred to, what selection was being referred to.	79 1 Withdrawn. 2 In claim 1 of the '053, the arbiter is 3 required to be operable to select a command thread 4 from either the plurality of pixel command threads 5 and the plurality of vertex command threads; is 6 that right? 7 A Yes. 8 Q And in your report on Paragraph 141, if 9 you could turn to that. And that is on Page 70. 10 You're interpreting that as, by virtue of 11 requiring a plurality of each type, the claim 12 requires that the arbiter select between at least 13 two pixel command threads and at least two vertex 14 command threads; is that your interpretation? 15 MR. JOHNSON: Objection. Leading. 16 BY THE WITNESS: 17 A Yes. 18 BY MR. DOKHANCHY: 19 Q If you could go back to the '053 patent 20 and turn to Figure 1. 21 Can you explain how the arbiter receives 22 command threads from FIFO 104 and FIFO 106? 80

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

Conducted on April 5, 2024

81 1 A These are FIFOs. It's what comes out of 2 the FIFO, goes to the arbiter. 3 Q Okay. Is that the type of selecting 4 that's claimed in the '053 patent, which, 5 according to your statement in Paragraph 141, 6 requires selecting from a plurality of each type? 7 A No. No. 8 MR. JOHNSON: Objection. Leading. 9 BY THE WITNESS: 10 A No. I mean, Figure 1 does not meet the 11 requirements of claim 1, and, you know, that 12 selection is not happening in Figure 1. 13 BY MR. DOKHANCHY: 14 Q And can you explain why that is? 15 A We're not selecting -- one reason is that 16 we're not selecting a command thread from either 17 the plurality of pixel command threads and the 18 plurality of vertex command threads. 19 Another reason is that these are FIFOs 20 that are -- and the result -- the output of the 21 FIFO is going to the arbiter. 22 Q Okay. And why is it that the fact that	83 1 Q And are you saying there that, similar to 2 in Figure 1, simply receiving from a FIFO does not 3 involve selecting from the FIFO? 4 MR. JOHNSON: Objection. Leading. 5 BY THE WITNESS: 6 A Correct. Selecting -- just receiving 7 something doesn't mean you select it. If you 8 receive the output from a FIFO, that's not doing 9 any form of selection. 10 The GBS is just receiving the commands in 11 the order that it was presenting; it's not 12 performing any kind of selection. 13 MR. DOKHANCHY: I pass the witness. 14 MR. JOHNSON: I have nothing further. 15 MR. DOKHANCHY: Thank you, Dr. Hart. 16 (WHEREUPON, the deposition was concluded 17 at 11:44 a.m. CST) 18 19 20 21 22
82 1 the output of the FIFO is going to the arbiter, 2 why does that mean the arbiter is not selecting 3 from each of the required types of command 4 threads? 5 A Well, it doesn't meet the selecting 6 criteria because what we have here is ALU resource 7 threads and texture thread resources -- texture 8 fetch resources, resource threads. So we don't 9 have anything to -- the appropriate thing provided 10 to this particular arbiter. 11 I don't have any opinions on whether this 12 arbiter performs the required kind of selection. 13 I don't believe it does. Obviously because it's 14 not selecting from the correct items. 15 Q And if you go to Paragraph 139 of your 16 report. It's on Page 68. 17 You point out that, "The GBS in Williams 18 does not select graphics commands (or anything). 19 Rather, the GBS receives commands ultimately from 20 the input buffer." 21 Do you see that? 22 A Yes.	84 1 ACKNOWLEDGMENT OF DEPONENT 2 I, JOHN HART, Ph.D., do hereby acknowledge 3 that I have read and examined the foregoing 4 testimony and the same is a true, correct, and 5 complete transcription of the testimony given by 6 me and any corrections appear on the attached 7 errata sheet signed by me. 8 9 _____ 10 (SIGNATURE) (DATE) 11 12 13 14 15 16 17 18 19 20 21 22

PLANET DEPOS

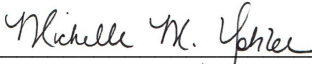
888.433.3767 | WWW.PLANETDEPOS.COM

Realtek Ex. 1016, Page 22

Realtek Semiconductor Corp., v. ATI Technologies ULC

IPR2023-00564

Conducted on April 5, 2024

85 1 CERTIFICATE OF REPORTER 2 3 I, MICHELLE M. YOHLER, a Certified 4 Shorthand Reporter within and for the County of 5 Will, State of Illinois, do hereby certify: 6 That previous to the commencement of the 7 examination of the witness, the witness was duly 8 sworn to testify the whole truth concerning the 9 matters herein; 10 That the foregoing deposition transcript 11 was reported stenographically by me, was 12 thereafter reduced to typewriting under my 13 personal direction and constitutes a true record 14 of the testimony given and the proceedings had; 15 That the said deposition was taken before 16 me at the time and place specified; 17 That I am not a relative or employee or 18 attorney or counsel, nor a relative or employee of 19 such attorney or counsel for any of the parties 20 hereto, nor interested directly or indirectly in 21 the outcome of this action. 22	
86 1 IN WITNESS WHEREOF, I do hereunto set my 2 hand and affix my seal of office at Chicago, 3 Illinois, this 7th day of April, 2024. 4 5 6 7 8  9 Michelle M. Yohler, CSR, RMR, CRR 10 Certified Shorthand Reporter 11 CSR No.: 84-4531 12 13 14 15 16 17 18 19 20 21 22	

PLANET DEPOS

888.433.3767 | WWW.PLANETDEPOS.COM

A			
able	71:9, 71:19,	11:21, 12:14,	also
22:17, 29:22,	76:6, 76:7,	14:1, 14:5,	3:19, 6:8,
53:21, 55:22,	76:20	14:13, 14:18,	42:20, 43:4,
69:7	action	15:6, 15:10,	45:3, 48:3,
about	41:18, 41:19,	15:15, 16:4,	49:6, 53:14,
8:20, 12:11,	42:10, 43:22,	16:7, 16:11,	73:17
17:5, 30:15,	45:15, 85:21	16:16, 16:20,	altered
30:16, 30:17,	active	21:7, 22:9,	49:16
30:18, 30:21,	67:5, 67:11	26:5, 26:21,	alternate
30:22, 33:22,	actually	30:11, 33:7,	50:4, 50:22,
34:9, 36:18,	29:20, 30:1,	34:2, 34:7,	67:6, 67:12
37:7, 37:9,	34:22, 35:3,	34:20, 47:11,	alu
43:22, 46:21,	54:17, 54:18,	53:10, 57:2,	17:1, 17:8,
48:1, 49:20,	55:12, 55:13,	61:17, 64:14,	18:10, 19:3,
51:7, 52:4,	55:22, 56:2,	65:8, 65:16,	19:7, 19:9,
58:20, 68:13,	58:2, 58:18,	66:10, 66:21,	19:12, 19:17,
70:15, 71:11,	69:1, 75:7, 79:6	67:2, 67:8,	20:1, 20:9,
71:12, 73:5,	additional	67:21, 68:3,	20:20, 20:21,
79:13	44:20, 45:4	76:21, 78:6	21:2, 21:3,
absolutely	address	alj	32:22, 82:6
69:16	52:22	41:14, 42:18	alus
abstract	addressed	alj's	20:10, 21:2
61:11	56:5	28:6, 28:12	always
accept	addressing	all	28:20
40:14	46:1	5:13, 8:18,	amount
access	adopted	10:6, 13:9,	58:7
16:5, 22:15,	28:6, 28:12,	22:22, 35:9,	analysis
65:14, 65:22,	41:21, 42:17,	35:11, 35:18,	64:20, 65:5
68:4, 68:6	43:3	36:7, 36:16,	analyze
accessed	adopting	37:19, 38:8,	12:22, 77:21
58:8, 58:11	28:12	40:19, 47:11,	analyzed
accommodate	advantage	51:7, 51:12,	47:16
22:17	64:14, 65:1	62:4, 62:7,	another
according	advice	62:11, 63:18,	5:12, 36:9,
10:20, 35:17,	51:13	64:1, 64:3,	47:6, 81:19
81:5	affects	64:10, 66:15,	answer
account	49:21	66:16, 66:18,	34:20, 38:11,
45:3, 45:10	affix	76:4, 76:7,	39:11, 40:7,
accurate	86:2	76:20, 78:8,	47:5, 66:11,
8:5	after	78:9, 78:10,	68:8, 77:14,
acknowledge	8:10, 25:21,	78:13	77:15
84:2	66:17, 66:18,	alleged	answered
acknowledgment	67:5, 67:11,	68:18	72:10
84:1	73:20	along	answering
across	again	44:1, 68:19	40:5
10:14, 38:12,	19:15, 26:19,	already	answers
	76:2	5:13, 7:7,	5:21
	agree	23:17	any
	9:6, 9:17,		8:12, 8:15,

9:19, 9:21, 11:7, 11:9, 11:11, 11:13, 12:1, 12:16, 13:1, 18:9, 18:11, 21:18, 22:1, 23:3, 23:13, 36:11, 37:6, 43:22, 49:14, 51:1, 51:11, 51:13, 52:4, 60:11, 60:15, 60:20, 61:15, 67:18, 71:11, 72:6, 72:15, 72:20, 74:7, 76:4, 76:6, 76:11, 82:11, 83:9, 83:12, 84:6, 85:19 anything 28:22, 34:1, 51:16, 56:8, 82:9, 82:18 apparatus 61:9, 61:12 appeal 1:2 appear 38:13, 84:6 applicable 31:18, 32:9, 32:13, 32:18, 33:9, 34:4, 34:11, 35:7 application 70:20, 71:7 applied 48:3, 52:1, 52:7, 78:4 applies 74:1 applying 78:3 appreciate 5:14 appreciated 60:15	appropriate 33:1, 82:9 april 1:18, 86:3 arbiter 15:16, 15:18, 15:20, 16:2, 16:4, 16:13, 16:14, 16:15, 16:16, 42:5, 42:13, 42:20, 43:2, 43:6, 43:7, 43:21, 44:1, 44:4, 46:11, 46:15, 47:13, 48:11, 54:1, 68:10, 68:18, 79:2, 79:13, 79:17, 80:2, 80:12, 80:21, 81:2, 81:21, 82:1, 82:2, 82:10, 82:12 arbiter's 15:17 arbiters 15:22, 16:2, 16:8, 16:11 architecture 60:17, 74:16, 74:20 areas 26:1, 26:7, 27:1, 27:18 aren't 43:1, 47:20, 52:9 argued 39:13 argues 68:15 argument 50:12 around 14:10 array 61:13	art 4:11, 9:8, 9:15, 9:18, 10:3, 10:7, 10:22, 11:2, 11:15, 12:7, 13:1, 13:12, 13:18, 13:19, 14:2, 14:14, 15:19, 16:12, 17:5, 17:11, 17:16, 18:5, 18:8, 18:16, 18:19, 19:3, 19:6, 19:11, 19:17, 19:20, 19:21, 20:1, 20:4, 20:16, 23:13, 26:13, 27:8, 27:10, 27:15, 29:2, 31:2, 31:10, 31:15, 44:10, 47:19, 48:5, 53:15, 55:18, 56:16, 57:16, 59:6, 59:17, 64:22, 65:9, 65:17, 67:17, 70:5, 70:12, 70:14, 71:14, 72:4, 73:19, 77:12, 78:2 art's 11:19, 13:8 articulate 48:6 asked 34:2, 72:9, 79:12 asking 18:4, 47:11, 51:13, 70:11 aspect 61:21 asserted 56:17 association 18:9, 19:7	assume 45:2, 78:15 assumed 62:3 assumption 69:2 ati 1:9 attached 84:6 attorney 37:5, 37:6, 85:18, 85:19 average 70:9 aware 9:10, 73:19 B back 24:19, 44:20, 52:20, 80:19 background 14:16, 73:6, 73:9 baker 3:4 bandwidth 22:18 based 31:12, 45:2, 47:9, 47:12, 55:16, 66:11 basic 52:11 basis 68:21 because 10:4, 26:17, 30:22, 33:22, 38:1, 38:17, 39:11, 39:14, 40:5, 40:17, 64:7, 65:6, 66:3, 71:16, 72:4, 82:6, 82:13 been 5:3, 19:21,
---	---	---	---

20:5, 20:16, 21:2, 28:18, 36:18, 37:4, 41:13, 41:20, 42:12, 51:6, 78:4 before 1:2, 2:12, 7:13, 59:21, 74:11, 75:3, 85:15 begins 41:10 behalf 3:2, 3:10 being 20:2, 21:10, 21:19, 23:15, 34:22, 35:3, 40:10, 60:3, 73:4, 78:21, 78:22 believe 6:12, 7:11, 7:16, 9:10, 10:6, 19:22, 30:7, 31:14, 37:10, 40:7, 41:22, 45:1, 56:8, 60:20, 61:9, 62:2, 64:19, 71:3, 82:13 benefit 60:21, 61:10, 68:16 best 5:16 better 45:9 between 18:9, 18:12, 18:22, 24:4, 39:22, 44:8, 80:12 big 22:3, 61:1 binning 66:17, 66:22	bits 10:15 block 60:8, 61:1, 61:18, 62:20, 64:17, 65:3, 66:22, 75:21, 76:19 blocks 60:6, 60:9, 60:12, 60:16, 60:19, 60:22, 61:6, 61:7, 61:16, 62:1, 62:4, 62:7, 62:9, 63:1, 63:6, 63:10, 63:12, 63:13, 64:2, 64:3, 64:11, 64:15, 65:2, 76:3, 76:5, 76:7, 76:12, 76:20, 78:8, 78:9, 78:11 board 1:2, 41:13, 41:18, 42:1, 42:12, 42:22 board's 41:21, 43:3 both 18:17, 19:4, 19:12, 19:18, 25:21, 27:6, 28:15, 28:17, 29:4, 29:15, 37:12, 37:15, 44:1, 44:9, 44:14, 48:15, 49:9, 53:12, 54:2 botts 3:4 box 15:18, 42:14, 43:11, 43:17 boxes 16:1, 43:1	break 36:19, 62:13, 69:15, 79:4 breaks 37:4 buffer 14:6, 14:11, 16:5, 16:18, 17:1, 17:2, 17:7, 21:7, 21:8, 24:14, 82:20 buffers 14:13, 14:18, 14:21, 15:6, 15:11, 16:20, 21:16, 22:10, 23:15, 24:14 bunch 21:4 bytes 74:14, 74:19, 75:1 C cache 56:20, 56:22, 57:4, 57:7, 57:13, 57:16, 58:6, 58:13, 58:21, 59:7, 59:18, 69:1, 69:4, 69:5, 69:22, 75:1 calculations 74:4 california 3:15 called 5:3, 51:4 calling 34:7 came 15:2, 55:6, 55:15 can't 34:20, 55:20, 55:21	candor 5:14 cannot 23:13, 53:8, 57:8 capable 9:20, 9:22, 11:7, 12:1, 12:16, 14:1, 14:13, 28:10, 28:16, 29:18, 54:2, 54:19, 55:13, 55:21, 56:7, 57:17, 58:3, 58:13, 58:19, 58:21, 59:7, 59:10, 59:18, 59:21, 60:3, 75:7 care 68:13 careful 28:18 carmel 3:14 case 1:12, 43:22, 64:9 cases 27:6 center 2:6 certain 22:16, 41:12, 42:17, 44:21, 52:11 certainly 7:16, 66:2, 70:2 certified 2:13, 2:15, 85:3, 86:10 certify 85:5 champaign 1:17, 2:8 chance 8:9
--	---	--	---

characterization 26:10, 33:13, 33:17 characterized 28:21 characterizes 21:15 chicago 86:2 chip 22:15, 23:6, 23:10, 24:7, 24:8, 24:9 chips 10:18, 22:4, 22:6, 23:7, 24:7, 24:8 choose 49:2, 49:4 circuit 11:4, 24:1 circuits 24:2 cite 42:7 cited 56:8 claim 8:20, 8:21, 9:2, 11:10, 12:8, 15:17, 15:20, 16:3, 16:14, 24:19, 25:8, 26:3, 26:6, 26:11, 26:22, 27:10, 27:16, 27:21, 27:22, 29:18, 30:4, 30:11, 30:20, 31:4, 31:8, 31:10, 31:14, 32:1, 34:13, 35:1, 35:14, 35:18, 39:9, 39:21, 41:8, 41:9, 43:5, 43:6, 45:11, 46:1,	46:11, 47:17, 47:20, 48:2, 48:7, 49:16, 49:17, 49:21, 50:4, 50:18, 50:21, 51:8, 51:15, 52:16, 52:20, 53:7, 55:19, 60:1, 79:1, 79:16, 79:17, 80:2, 80:11, 81:11 claimed 9:19, 14:22, 33:7, 34:3, 53:19, 53:21, 81:4 claims 8:20, 9:15, 11:11, 28:19, 53:21, 54:14, 54:22, 55:16, 55:18, 56:6 clarity 44:21 class 71:22, 74:12 classes 70:13, 72:14 classrooms 71:15 cleaner 45:8 clear 33:4, 41:3 clearly 50:2 code 12:5 cohn 3:12 coincidental 54:16 color 73:18, 74:4 colors 73:22, 74:2 column 10:11, 14:9,	32:21 com 3:8, 3:17 come 22:1, 35:5, 36:15, 54:12, 54:20, 71:8, 71:19, 71:22, 72:12 comes 81:1 commands 26:8, 31:18, 31:21, 32:5, 32:9, 32:13, 32:18, 33:9, 34:4, 34:9, 34:11, 35:6, 35:10, 35:11, 35:19, 36:7, 36:10, 37:18, 38:4, 38:13, 38:16, 38:17, 40:10, 40:19, 68:17, 78:14, 82:18, 82:19, 83:10 commencement 85:6 comments 35:5 compared 61:1, 64:16, 65:3 complete 8:5, 30:8, 30:12, 30:14, 31:3, 31:5, 31:16, 32:3, 33:14, 34:8, 34:9, 35:13, 35:17, 35:22, 36:2, 36:4, 37:12, 38:2, 40:16, 40:21, 57:11, 57:14, 57:17, 58:14, 59:8, 59:19,	69:5, 70:8, 75:10, 84:5 completed 66:18 completely 49:11 complex 74:3 component 38:9 comprises 34:15, 61:15 comprising 24:21 computes 73:13, 73:17, 73:22 computing 74:2 concerning 17:19, 85:8 concerns 22:18 concluded 83:16 concurrently 76:13, 76:16 conference 2:6 configuration 64:18 configure 28:3, 54:9, 56:1, 59:13, 75:6 configured 28:5, 28:7, 28:9, 30:2, 30:3, 54:14, 54:18, 55:3, 55:7, 55:11, 55:14, 56:2, 56:7, 58:2, 58:17, 58:22, 59:1, 69:10, 69:12, 75:6 conflict 44:12
--	--	---	--

connection 18:22 consider 21:22, 26:6, 26:22, 35:2, 35:3, 47:1, 49:16, 49:22, 50:2, 65:9, 65:17, 67:13, 67:18, 70:2, 72:2, 73:3 considered 7:9, 7:18, 8:1, 9:18, 21:21, 36:16, 45:17, 45:19, 47:21, 49:17, 67:15, 71:14, 75:3 consistent 11:18, 13:7, 13:11, 13:16, 44:14, 46:20 consisting 61:12 constitutes 85:13 construction 9:11, 9:13, 12:18, 13:13, 28:7, 28:12, 41:9, 41:22, 42:14, 42:21, 43:3, 44:7, 45:11, 48:8, 52:21, 55:19 constructions 11:12, 28:6, 28:19, 41:8, 41:20, 42:17, 44:8, 44:11, 45:4, 45:6, 45:11, 47:10, 47:22 construed 41:13, 41:17, 42:13, 43:14, 44:20 context 50:6, 79:2	conversion 73:20 copy 6:5, 6:9, 56:16 core 61:14, 61:15, 63:9 corp 1:4 correct 5:22, 6:11, 6:17, 7:4, 7:5, 7:15, 8:2, 8:3, 8:16, 9:3, 12:10, 15:22, 20:11, 20:12, 21:14, 22:13, 25:2, 25:3, 27:19, 28:3, 30:9, 30:13, 32:10, 32:11, 35:20, 37:7, 37:8, 37:13, 39:10, 41:8, 42:5, 42:10, 42:14, 42:18, 42:22, 45:5, 46:4, 46:8, 46:13, 50:17, 52:1, 52:2, 52:5, 52:17, 52:18, 53:1, 53:4, 53:5, 54:9, 56:21, 57:5, 60:19, 66:13, 66:22, 75:2, 75:17, 75:21, 77:20, 82:14, 83:6, 84:4 corrections 84:6 correspond 65:12, 65:20 correspondence 18:11 corresponding 31:19, 32:9,	32:13, 32:18, 33:9, 34:5, 34:11, 35:7 costly 68:5 could 8:18, 10:1, 11:6, 15:4, 17:21, 18:2, 18:6, 19:3, 19:12, 21:12, 21:22, 22:5, 22:7, 22:10, 23:1, 23:21, 23:22, 24:7, 24:8, 30:22, 33:4, 36:1, 37:20, 41:4, 49:1, 49:2, 50:20, 60:11, 60:18, 65:15, 71:5, 71:22, 75:1, 76:2, 80:9, 80:19 couldn't 25:20, 29:6, 68:8 counsel 40:7, 51:6, 51:11, 51:14, 52:12, 85:18, 85:19 county 85:4 court 45:5 courtesies 5:15 cover 6:2, 6:15, 6:20 criteria 59:22, 82:6 crr 1:22, 86:9 csr 1:22, 2:16, 86:9, 86:11 cst 1:19, 83:17	current 42:1 cut 40:7 D data 61:8, 61:11, 61:13, 62:11, 65:12, 65:20, 76:6 date 84:10 day 86:3 deals 41:7 declaration 4:12, 6:10, 6:21, 7:6, 7:14, 8:7, 8:10, 24:18, 41:5, 41:6, 45:3, 45:14, 45:20, 46:7, 51:19 dedicated 25:22, 26:3, 26:7, 27:1, 27:4, 27:5, 27:18, 27:20 deep 22:4, 23:21 define 55:3 definition 10:19, 12:6, 13:14, 13:20 definitions 43:4 demonstrate 72:17 demonstrated 12:20, 13:2 demonstrates 11:1 depend 22:14, 68:2, 68:7, 74:16,
--	--	---	--

74:20 depending 70:19 deponent 84:1 deposition 1:16, 2:1, 5:12, 83:16, 85:10, 85:15 describe 73:10 described 14:9, 16:13, 18:22, 32:19, 54:14, 72:16, 73:4 describes 77:8 description 19:6, 21:11 descriptions 31:13 designed 23:8, 23:10, 58:6, 58:8, 58:9, 69:6 details 22:19, 52:9 determination 28:13, 44:19, 45:12 determine 22:20, 74:4 device 9:3, 9:5, 9:7, 9:19, 10:8, 10:16, 10:20, 11:6, 11:22, 12:15, 13:5, 13:8, 13:14, 13:15, 14:22, 24:20, 25:5, 25:8, 26:7, 26:22, 27:18, 29:17, 30:8, 30:17, 30:18, 31:20, 32:4, 32:12, 33:8,	34:3, 34:13, 34:15, 37:10, 57:2, 57:3, 57:13, 57:20, 75:4 devices 14:1, 28:14, 29:4, 37:14 diego 3:15 difference 44:3, 44:8, 49:14 different 12:13, 16:21, 17:6, 18:21, 21:8, 21:14, 21:20, 23:16, 26:10, 29:13, 29:19, 32:16, 42:21, 43:4, 43:5, 43:12, 61:21, 62:6, 64:9, 64:13, 65:12, 65:20, 67:5, 67:11, 71:16, 76:9 direction 85:13 directly 85:20 disagree 11:21, 40:12, 65:8, 65:16 disclose 57:11, 68:18 disclosed 16:8 discloses 15:16, 15:17, 15:21, 16:8, 56:20, 56:22, 60:5, 77:7 disclosure 60:10 discussed 77:17 discusses 52:13, 73:6	discussing 79:3 discussion 10:10, 37:22, 41:10, 49:19, 69:13 discussions 37:6 distinction 24:4, 39:17, 39:22 distinguishing 40:3 divided 62:22 divides 61:5 documented 51:16 documenting 52:6 documents 52:7 doing 5:11, 54:19, 55:13, 55:21, 58:4, 58:19, 59:22, 60:4, 71:7, 75:8, 83:8 dokhanchy 3:11, 4:5, 36:20, 40:6, 69:14, 72:9, 73:1, 79:9, 80:18, 81:13, 83:13, 83:15 done 64:19, 79:5 down 10:1, 11:14, 12:4, 12:12 dr 5:7, 6:13, 12:21, 13:19, 13:21, 15:2, 23:5, 35:5, 36:15, 38:5, 38:15, 40:7,	40:11, 40:15, 40:20, 44:10, 44:17, 47:9, 48:4, 48:10, 50:6, 50:14, 53:10, 57:1, 57:12, 58:16, 61:4, 61:20, 62:2, 64:19, 64:20, 65:6, 65:7, 68:15, 70:3, 71:4, 79:10, 83:15 draft 7:19 duly 5:1, 5:3, 85:7 E each 10:12, 15:6, 15:10, 20:8, 20:13, 20:19, 22:5, 26:14, 38:17, 43:13, 44:12, 44:15, 61:17, 62:16, 66:21, 73:14, 74:1, 74:4, 80:11, 81:6, 82:3 earlier 79:12 easier 67:22 efficiency 65:22 efficiently 69:8 eight 60:6, 63:10, 63:12, 63:13, 64:6, 64:9, 64:15, 65:1 either 16:17, 18:2, 18:6, 20:22, 21:13, 21:19,
--	--	--	---

24:15, 28:11, 43:7, 43:19, 46:2, 48:19, 49:6, 49:10, 49:20, 50:1, 50:3, 50:5, 50:7, 50:8, 66:3, 79:18, 80:4, 81:16 electronic 12:16 element 9:4, 25:7, 31:19, 32:10, 32:14, 32:18, 33:9, 34:5, 34:11, 35:7 elements 61:13 elliott 45:13 else 28:22 embodiment 10:12 embodiments 11:18, 12:20, 12:22, 13:3, 13:4, 13:16, 31:12 emphasis 50:16 employee 85:17, 85:18 encountered 19:12, 19:17, 44:9 end 8:14 engine 52:22, 53:7, 53:8, 53:11, 53:16, 53:18 engines 53:21 enough 69:7 entire 31:20, 32:4,	32:12, 33:3, 33:8, 34:3, 37:21, 38:5, 38:6, 38:19, 38:20, 39:1, 39:3, 39:8, 39:15, 39:18, 39:19, 58:9 entirely 18:21 entities 18:21 entry 67:22, 68:1, 68:4, 68:5 errata 84:7 errors 8:15 established 71:1 even 24:1, 29:20, 38:16, 40:13, 40:14, 40:18 eventually 37:21, 64:1 ever 19:11, 19:17, 23:8, 26:2, 51:3, 57:8, 70:17, 71:8, 71:18 everything 8:6, 45:16 exact 62:8 exactly 55:10 examination 5:5, 79:8, 85:7 examined 5:4, 84:3 examining 72:3 example 10:10, 10:17, 11:3, 12:3,	12:9, 12:11, 15:12, 15:20, 16:15, 21:1, 22:2, 23:20, 25:20, 28:13, 29:3, 32:21, 35:12, 35:15, 36:7, 36:9, 36:11, 38:1, 38:3, 39:4, 39:5, 40:2, 40:9, 44:5, 48:4, 59:14, 63:9, 66:2, 70:8, 71:22, 75:12, 75:20, 78:13, 79:17 examples 11:17, 13:16, 31:12, 36:5, 62:2, 71:14, 73:3, 74:11 exclude 14:21 execute 18:17, 64:12, 72:18, 74:13 executing 18:20, 20:22, 64:4, 64:11, 76:5, 78:14 execution 32:22, 76:13, 76:19 exhibit 6:5, 6:9, 6:15, 6:17, 8:4, 8:21, 41:5, 45:18, 45:21, 45:22, 51:18, 56:11, 56:12, 68:14 exhibits 4:9 expect 17:11, 17:17 experience 19:10, 19:16, 23:9, 71:8,	71:18, 72:6, 72:20, 74:7 expert 18:15, 23:11, 64:22, 70:12 explain 24:5, 76:2, 80:21, 81:14 explained 52:12 explanation 41:2 extent 52:3 F fact 59:10, 81:22 familiar 11:10, 20:5, 20:16 far 27:21, 44:15 fashion 18:20, 64:16, 64:17, 65:3, 65:4, 67:4, 67:6, 67:10, 67:12, 67:15 fast 69:6 feeding 63:22 feeling 5:19 ferris 3:12 fetch 17:2, 17:9, 17:12, 17:13, 17:18, 17:19, 18:10, 18:16, 18:19, 82:8 field 65:1, 70:14 fifo 14:6, 14:13, 14:18, 14:21,
---	--	---	--

15:6, 15:10, 16:5, 16:18, 16:20, 21:7, 22:5, 22:10, 23:14, 24:14, 80:22, 81:2, 81:21, 82:1, 83:2, 83:3, 83:8 fifos 22:3, 23:21, 81:1, 81:19 figure 15:4, 15:7, 15:15, 15:18, 15:21, 16:1, 16:8, 16:17, 18:8, 19:1, 19:6, 21:11, 23:6, 60:7, 62:20, 63:4, 63:7, 63:9, 63:11, 63:15, 63:21, 63:22, 76:3, 79:13, 80:20, 81:10, 81:12, 83:2 fine 5:10 finish 40:6 first 5:3, 9:4, 14:10, 24:20, 24:21, 25:9, 27:11, 33:12, 33:17, 33:19, 34:1, 34:14, 34:15, 42:4, 43:2, 43:21, 57:22, 59:3, 66:15, 73:12 fit 12:5 fix 17:15 follow 27:16, 34:19 following 28:5, 30:20,	54:15, 54:16 follows 5:4 foregoing 84:3, 85:10 form 25:4, 40:11, 40:19, 58:12, 58:20, 59:5, 59:16, 67:18, 83:9 formed 77:6 forming 45:14 formulate 47:7, 77:15 formulated 47:8, 77:16 forward 38:6, 62:3, 65:7 fragments 74:1 friday 1:18 full 5:21 full-fledged 72:4 function 21:16, 54:18, 55:12, 55:14, 56:3, 58:3, 58:18, 75:7 further 44:21, 83:14 fusion 63:6, 63:11, 63:12 G gave 12:9, 12:11, 21:1, 44:20 gbs 82:17, 82:19, 83:10	general 16:15, 68:8 generalization 31:8 generally 79:14, 79:15 getting 39:12 give 5:15, 23:20, 36:5, 51:11, 70:21 given 12:3, 31:21, 32:5, 32:14, 33:10, 34:5, 43:15, 76:6, 76:11, 84:5, 85:14 giving 5:20, 33:13, 40:2 glovsky 3:13 go 76:18, 79:16, 80:19, 82:15 goes 6:19, 51:21, 76:19, 81:2 going 6:2, 26:18, 35:16, 36:18, 38:13, 44:4, 56:10, 81:21, 82:1 good 5:7, 5:8, 5:11, 62:14, 69:14 gpu 20:13 gpus 20:5, 20:17 grab 79:10 graphic 60:16, 72:4 graphical 73:11	graphics 10:4, 22:15, 38:3, 65:12, 65:20, 76:22, 77:4, 77:5, 77:7, 77:8, 77:13, 77:16, 77:17, 77:19, 77:21, 78:1, 78:5, 82:18 group 51:4 guess 24:3 guidance 45:4, 45:11, 52:4 H hand 56:10, 86:2 handed 6:4, 6:8 happening 81:12 happens 54:17, 75:11 happenstance 29:22, 58:5, 59:11, 75:9 hardware 21:17 hart 1:16, 2:1, 4:3, 4:12, 5:2, 5:7, 40:7, 79:10, 83:15, 84:2 head 36:13 hear 26:17, 27:3 heard 51:3 held 2:1 here 11:17, 23:11, 39:11, 46:18,
--	---	---	---

47:9, 47:18, 49:9, 51:17, 52:9, 55:18, 82:6 hereby 84:2, 85:5 herein 5:3, 85:9 hereto 85:20 hereunto 86:1 heterogeneous 61:22 hold 21:5, 58:7, 58:8, 58:9 hotel 2:6 hour 36:19 houston 3:6	68:7 improve 65:14, 65:22 included 52:10, 52:15 includes 53:11 inconsistent 11:5 increase 76:22 indeed 43:4 index 36:10 indicate 17:5 indirectly 85:20 individual 38:3, 38:17, 39:13, 40:9, 61:6 information 58:7 informed 41:20 initial 7:19, 28:13, 44:18, 45:12 input 14:12, 82:20 instructed 51:6 instruction 35:15, 39:5, 58:10, 61:12, 62:10, 62:11, 62:16, 63:19, 63:22, 64:4, 64:11, 64:13, 69:20, 69:22, 74:15, 76:6, 76:11, 76:18 instructions 19:9, 39:13, 67:4, 67:10, 69:7, 70:5,	70:15, 71:10, 71:21, 72:8, 72:22, 74:10 interested 85:20 interpretation 35:18, 46:10, 47:12, 48:7, 50:15, 66:12, 80:14 interpreted 46:22, 48:2, 52:16 interpreting 80:10 introducing 55:8 invention 14:3, 14:15, 14:16, 16:12, 20:11 investigation 41:14, 42:18, 44:19, 45:13, 56:5, 56:11 involve 78:19, 83:3 involvement 20:21 involves 74:2 ipr 1:12, 42:7, 56:17 issue 55:2, 56:4 issues 6:3 itc 41:14, 45:5 item 61:4, 63:7 items 14:11, 62:12, 76:7, 82:14 iv 51:20	jeff 69:14 jeffrey 3:3, 3:8 job 1:20 john 1:16, 2:1, 4:3, 4:12, 5:2, 84:2 johnson 3:3, 4:4, 5:6, 21:4, 21:6, 33:5, 33:6, 36:18, 37:1, 41:1, 56:14, 69:16, 69:18, 72:19, 74:6, 79:4, 80:15, 81:8, 83:4, 83:14 johnson@bakerbot- ts 3:8 judge 45:13 justified 75:19
I			K
identified 15:12 identifies 57:1 identify 33:17 illinois 1:17, 2:8, 2:16, 85:5, 86:3 illuminated 50:19 illustrate 55:20, 59:14, 69:12 illustration 62:20 illustrative 72:2 image 73:15 implement 22:20, 72:15 implementation 22:20, 68:2,			keep 5:20 kind 26:9, 70:21, 82:12, 83:12 kinds 53:12 know 5:13, 6:18, 7:12, 10:1, 14:6, 22:3, 22:4, 23:3, 31:7, 35:2, 38:22, 52:7, 55:5, 56:4, 61:5, 61:19, 61:20, 68:22, 69:19, 69:21, 70:4, 70:17,
		J	
		january 7:4	

71:1, 71:6, 74:14, 77:2, 79:6, 81:11 knowing 68:16 known 14:2, 14:14, 16:11, 20:10, 71:20 knows 68:10	46:12, 46:16, 47:14, 48:12, 57:2, 80:12, 80:13 legal 51:11, 51:22, 52:6, 52:11, 52:14, 52:15, 55:2 less 68:4, 71:5, 71:9, 71:20, 72:7, 72:22, 74:9, 74:18, 74:22 let's 9:2, 79:4 levin 3:12 light 9:15, 31:10, 54:22 lighting 74:3 limitation 24:20 limited 23:22, 66:12 limiting 13:3 line 8:1, 10:12, 14:10, 32:21, 60:14, 63:8 list 7:9, 7:22, 8:5 listed 41:21, 42:4, 45:16, 45:18 load 72:17, 74:13 local 69:6 location 2:2 look 8:18, 8:20, 15:4, 22:19,	42:2, 54:4, 63:4, 70:7 looked 11:16, 20:1, 61:21, 70:7, 71:2 looking 24:19, 28:6, 45:20, 52:20 looks 35:4 lot 22:19, 52:9 louisiana 3:5	70:5, 70:15, 74:14, 76:9 marked 6:4, 6:8, 6:16, 6:20, 56:10 marks 43:13 markush 51:4 massoud 3:20 matched 44:15 materials 7:9, 8:1, 45:17 matter 5:13, 45:17, 59:11, 77:22 matters 52:8, 85:9 maybe 26:17, 76:1 mean 9:21, 18:14, 20:20, 25:13, 28:10, 28:16, 29:1, 32:7, 33:16, 38:18, 41:18, 49:5, 50:5, 50:12, 50:20, 51:8, 51:14, 53:18, 59:15, 67:15, 69:13, 76:15, 81:10, 82:2, 83:7 meaning 9:9, 9:12, 9:14, 10:9, 10:20, 11:6, 11:22, 12:15, 12:19, 13:4, 13:10, 13:15, 43:15, 44:2, 54:1, 54:14, 58:6, 69:5 means 28:3, 28:9,
L		M	
labeled 15:18, 15:19, 16:1, 63:11 language 8:21, 11:10, 26:4, 26:11, 27:16, 27:22, 28:19, 29:18, 30:4, 30:20, 31:14, 39:9, 39:21, 47:13, 47:16, 47:17, 47:20, 48:18, 49:17, 49:21, 50:4, 50:21, 50:22, 60:1, 79:1, 79:16 larger 50:8, 64:17, 65:3, 68:1, 68:6 last 52:21 later 29:8, 29:10, 44:18, 64:12 law 52:4 lawyer 51:9, 55:4 leading 80:15, 81:8, 83:4 least 9:4, 24:20, 28:20, 30:16,			

28:14, 29:3, 39:3, 49:20, 50:3, 55:7, 55:10, 55:11, 69:10, 78:7 meant 50:1, 50:10, 56:6 medicines 5:19 meet 81:10, 82:5 meeting 16:14 memories 21:14, 21:20, 23:16, 24:16 mention 38:4, 40:13 mentioned 28:1 mere 59:11, 75:8 merely 29:18, 58:3, 58:19 merit 2:14 michelle 1:22, 2:12, 85:3, 86:9 might 8:13, 12:5, 22:2, 51:14 mind 69:15 minimal 70:10 mintz 3:12 missing 8:13 mistakes 8:12 misunderstood 76:1 mm-hm 9:1	module 68:19 more 24:1, 41:3 morning 5:7, 5:8 mountain 3:14 much 14:17, 24:10 multiple 15:11, 21:2, 32:19, 61:6, 61:13, 62:11, 62:22, 75:20, 76:6 multithreading 64:8, 67:3, 67:9, 67:14, 67:19, 75:16, 78:7, 78:18 must 30:8, 31:5, 37:11, 37:13, 46:11, 46:15, 47:13, 48:12, 48:16, 53:21 N necessarily 20:2, 52:10 need 8:15, 22:17, 25:8, 25:22, 35:2, 35:18, 35:21, 47:7, 49:9, 55:22, 62:13, 62:16, 63:17 needed 24:10, 35:3, 44:16, 50:11, 50:12, 74:14 needs 29:11, 29:14, 30:1, 55:13, 57:19, 57:20, 58:2, 58:22,	59:12 negative 26:17 never 23:10, 29:20, 39:17, 44:9 new 73:14 next 73:20 non-interleaved 67:3, 67:9 none 16:2 nonresponsive 33:5 notary 2:15 nothing 5:20, 5:22, 83:14 notice 2:12, 37:4 number 6:16, 45:18, 60:8, 60:11, 60:15, 60:20, 61:15, 76:4 numeral 51:20 O objection 33:5, 72:9, 73:1, 80:15, 81:8, 83:4 objective 76:21, 77:3 objects 73:11 obvious 57:11, 65:10, 65:18, 66:1, 66:2 obviously 30:22, 82:13 occurred 66:19	offered 58:16, 70:17 office 1:1, 86:2 often 73:12 oh 53:3 okay 5:17, 6:14, 7:3, 15:21, 26:19, 26:20, 29:1, 36:5, 36:11, 36:14, 42:2, 48:1, 51:6, 51:18, 54:20, 55:15, 60:18, 61:5, 63:5, 76:1, 77:4, 79:4, 79:11, 81:3, 81:22 one 8:14, 9:4, 10:12, 10:15, 13:15, 13:17, 23:6, 23:20, 24:4, 24:10, 24:20, 25:15, 25:21, 29:3, 30:16, 35:12, 35:15, 36:7, 37:16, 44:13, 50:11, 50:12, 52:14, 53:18, 57:2, 57:3, 61:1, 64:5, 64:12, 64:16, 65:3, 67:5, 67:11, 75:11, 75:20, 76:11, 76:18, 81:15 only 38:3, 40:17, 50:11, 50:12, 53:8, 69:1 operable 28:14, 28:21,
--	--	--	--

29:3, 29:4, 29:12, 29:14, 29:21, 30:4, 37:14, 54:8, 54:13, 55:10, 57:19, 59:12, 79:17, 80:3 operate 64:16, 65:2 operates 66:14 operating 64:17, 65:4 operation 66:13 operations 72:16, 78:3 operative 24:21, 25:1, 25:9, 25:11, 25:15, 25:18, 26:3, 26:4, 26:14, 27:11, 27:13, 27:22, 28:1, 28:8, 29:1, 34:15, 34:17, 54:7, 54:13, 55:3, 55:7, 55:10, 56:6, 57:20, 59:2, 59:14, 59:15, 60:1, 69:4, 69:10, 69:13, 75:5, 75:13 opines 40:11 opinion 21:12, 23:6, 24:13, 24:17, 25:4, 28:2, 28:8, 30:7, 37:11, 38:22, 39:7, 40:15, 46:15, 46:21, 47:6, 47:7, 48:1, 48:9, 50:6, 53:6,	57:3, 57:7, 57:10, 58:12, 58:15, 58:16, 58:17, 58:20, 59:5, 59:10, 59:16, 61:3, 61:19, 62:6, 62:21, 63:3, 64:21, 65:7, 66:14, 68:9, 68:12, 71:3, 77:18 opinions 12:21, 13:22, 15:3, 23:3, 23:4, 23:5, 27:20, 36:16, 44:10, 44:16, 44:17, 45:14, 47:8, 47:22, 48:4, 48:5, 48:10, 59:9, 59:22, 60:2, 61:4, 64:20, 65:6, 70:3, 71:4, 77:2, 77:6, 77:16, 82:11 options 21:18, 24:5, 24:6, 36:17 order 8:6, 14:12, 45:17, 69:8, 83:11 ordinary 9:8, 9:9, 9:12, 9:13, 9:14, 9:17, 10:3, 10:7, 10:9, 10:20, 10:21, 11:1, 11:6, 11:15, 11:19, 11:22, 12:7, 12:15, 12:19, 13:4, 13:7, 13:10, 13:11, 13:15, 13:18,	17:4, 17:11, 17:16, 18:4, 18:7, 18:15, 18:18, 19:2, 19:5, 19:11, 19:16, 19:20, 19:22, 20:4, 20:15, 23:12, 26:12, 27:8, 27:9, 27:15, 29:2, 31:2, 31:9, 31:15, 43:15, 44:2, 47:19, 53:14, 55:17, 57:15, 59:6, 59:17, 64:22, 65:9, 65:17, 67:16, 70:4, 70:12, 73:19, 77:11, 78:2 other 8:15, 21:18, 22:1, 23:14, 23:18, 25:21, 36:11, 44:12, 44:15, 67:6, 67:11, 67:18, 67:19, 71:15, 73:17, 73:18, 74:3 out 14:11, 49:11, 81:1, 82:17 outcome 85:21 output 14:11, 73:15, 81:20, 82:1, 83:8 over 5:16, 5:17, 22:17, 23:3, 37:20, 38:9, 38:14, 38:18, 38:20, 39:8, 39:18, 39:20, 40:18	overlap 76:14 overlapping 76:16 own 51:1, 62:16, 66:22 owner 1:10, 3:10, 7:7, 7:13 owner's 6:11, 7:10 P page 4:2, 4:9, 6:15, 6:16, 6:20, 6:21, 8:1, 8:4, 10:11, 26:19, 40:4, 41:4, 41:5, 41:6, 41:21, 42:3, 45:20, 45:21, 45:22, 51:18, 51:19, 60:14, 63:8, 68:13, 68:14, 80:9, 82:16 pages 1:21, 6:19 paper 10:2, 11:13, 12:4, 12:12 paragraph 41:7, 41:11, 42:4, 42:16, 43:11, 45:2, 46:6, 46:7, 46:19, 48:3, 48:10, 49:5, 49:20, 50:3, 51:17, 51:20, 51:21, 53:1, 53:3, 54:4, 55:9, 55:19, 56:9, 68:14, 80:8, 81:5, 82:15
--	---	--	--

paragraphs 73:8	57:12, 61:20, 62:2, 64:19, 64:20, 65:6, 65:7, 68:15	53:14, 55:17, 57:15, 59:6, 59:17, 64:21, 65:8, 65:17, 67:16, 70:4, 70:11, 73:19, 77:11, 78:1	43:8, 43:19, 46:3, 46:12, 46:16, 47:14, 48:12, 48:20, 49:2, 49:7, 49:12, 50:9, 53:9, 53:12, 54:2, 57:4, 57:8, 57:17, 57:20, 58:14, 59:2, 59:19, 65:10, 65:18, 66:4, 66:6, 66:8, 66:20, 70:18, 73:21, 73:22, 75:13, 77:9, 77:10, 79:19, 79:20, 80:4, 80:13, 81:17
parallel 61:8, 61:10		personal 74:7, 85:13	pixels 74:1, 74:5, 78:3
parallelism 63:3	pedram's 6:13, 12:21, 13:21, 15:2, 23:5, 35:5, 36:15, 40:15, 44:10, 44:17, 47:9, 48:4, 48:10, 50:6, 50:14, 58:16, 61:4, 70:3, 71:4	perspective 73:16	place 69:15, 85:16
paraphrasing 60:13		petitioner 1:5, 3:2	places 32:20
part 26:18, 35:10, 59:9, 65:5	perform 53:12, 54:18, 55:12, 55:14, 56:2, 58:3, 58:18, 75:7	ph 1:16, 2:1, 3:20, 4:3, 5:2, 84:2	placing 50:16
partial 35:8	performed 65:5, 78:4	phased 66:13, 66:15	plain 9:8, 9:11, 9:13, 10:8, 10:20, 11:5, 11:21, 12:14, 12:19, 13:4, 13:10, 13:14, 43:15, 44:2, 48:18
particular 47:17, 47:21, 61:4, 75:11, 82:10	performing 64:7, 67:3, 67:9, 83:12	phrase 9:6, 11:22, 12:15, 46:11, 46:21, 48:2, 48:7, 48:18, 49:22, 50:2, 50:7, 50:8	please 15:4, 79:16
parties 85:19	performs 67:14, 68:20, 82:12	physical 10:14, 10:17, 11:3, 12:9, 21:8	pluralities 28:15, 29:5, 37:15
parts 23:16, 38:9	person 9:7, 9:14, 9:17, 10:1, 10:2, 10:7, 10:21, 11:1, 11:15, 11:18, 12:6, 12:12, 13:7, 13:11, 13:18, 17:4, 17:11, 17:16, 18:4, 18:7, 18:15, 18:18, 19:2, 19:5, 19:10, 19:16, 19:20, 19:22, 20:4, 20:15, 23:12, 26:12, 27:7, 27:9, 27:15, 29:2, 31:1, 31:9, 31:14, 47:18,	piece 10:2, 11:3, 12:3, 12:12	plurality 24:22, 25:1, 25:9, 25:11, 25:16, 25:18, 27:11, 27:13,
pass 79:6, 83:13		pieces 10:14, 10:17, 21:8	
patent 1:1, 1:2, 1:10, 1:13, 3:10, 4:10, 4:13, 6:3, 6:5, 6:11, 7:7, 7:10, 7:13, 8:19, 9:19, 10:11, 14:10, 14:21, 15:5, 15:16, 16:7, 28:9, 32:20, 41:12, 52:16, 71:20, 72:3, 72:22, 74:9, 79:10, 80:19, 81:4		pixel 17:21, 18:14, 18:17, 19:4, 19:8, 19:12, 19:18, 20:3, 20:7, 20:19, 20:22, 21:3, 24:22, 25:10, 25:16, 26:8, 27:1, 27:12, 29:10, 29:12, 30:5, 34:13, 34:16, 37:12,	
patents 51:1			
patterns 22:15			
pedram 3:20, 13:19, 38:5, 38:15, 40:11, 40:20, 53:10, 57:1,			

29:12, 29:14, 30:5, 34:16, 34:17, 43:8, 43:9, 43:19, 43:20, 46:2, 46:3, 48:20, 48:21, 49:1, 49:3, 49:7, 49:8, 49:12, 49:13, 50:9, 50:10, 79:19, 79:20, 80:4, 80:5, 80:11, 81:6, 81:17, 81:18 point 29:6, 29:8, 82:17 points 57:12 pool 46:12, 46:16, 47:13 popeo 3:13 portion 24:21, 25:1, 25:9, 25:10, 25:15, 25:17, 25:21, 26:14, 27:11, 27:12, 29:6, 29:7, 29:9, 29:11, 29:13, 30:15, 30:17, 30:21, 31:1, 31:4, 33:15, 34:14, 34:15, 34:17, 39:4, 57:22 portions 21:13, 21:19, 22:10, 23:1, 23:15, 24:15, 25:6, 25:8, 25:14, 25:22, 26:14, 29:20, 58:1, 59:4, 69:1 posita 26:5, 26:21	position 27:17, 73:13, 73:14 possibilities 23:14, 23:18, 23:19 possible 22:7, 22:9, 22:13, 23:1, 23:4, 36:16, 74:18 preparation 7:8, 7:17 prepare 8:7 present 3:19, 48:14, 48:16, 49:9 presented 53:22, 54:1, 56:12 presenting 83:11 previous 27:3, 41:19, 42:12, 42:22, 44:8, 85:6 previously 41:13, 41:17, 75:15 principles 52:12, 52:13, 52:14 prior 4:11, 13:1, 13:19, 15:19, 44:10, 48:5, 56:16, 71:14, 72:4 priorities 43:10 probability 54:17, 58:4, 59:11, 75:8 proceed 37:2 proceedings 85:14	process 19:4, 19:12, 19:18, 20:2, 53:22 processed 69:8 processes 66:15, 66:20 processing 10:4, 52:22, 53:7, 53:8, 53:11, 53:13, 53:16, 53:18, 53:20, 54:2, 60:6, 60:7, 60:9, 60:12, 60:15, 60:19, 60:22, 61:1, 61:6, 61:9, 61:11, 61:13, 61:14, 61:15, 61:18, 62:1, 62:4, 62:7, 62:9, 62:20, 62:22, 63:1, 63:9, 63:10, 63:13, 64:2, 64:3, 64:11, 64:15, 65:2, 65:13, 65:21, 66:4, 66:6, 66:8, 66:19, 66:20, 66:21, 72:17, 73:5, 73:6, 73:13, 73:21, 73:22, 75:21, 76:3, 76:5, 76:7, 76:12, 76:19, 76:20, 77:1, 77:4, 77:5, 77:7, 77:8, 77:19, 77:20, 77:22, 78:1, 78:5, 78:8, 78:9, 78:11 processor 17:9, 17:14,	17:18, 18:16, 18:20, 19:8, 20:6, 20:7, 20:18, 20:19, 21:3, 62:17, 62:18, 62:19, 64:6, 74:17, 74:21 processors 20:8, 20:20, 22:15, 63:14, 63:18, 63:20, 68:20, 75:20, 76:8, 76:17 professional 2:14 professor 23:12 programming 72:14, 72:18 programs 72:1 propose 50:4, 50:22 provide 13:13, 44:16, 48:8, 48:9 provided 17:8, 17:9, 45:12, 52:3, 60:16, 63:10, 82:9 public 2:15 purposes 71:13, 71:17, 72:2 pursuant 2:12 put 62:2, 65:7 puts 38:6 Q question 19:14, 20:2, 26:18, 27:4,
---	---	--	---

32:16, 33:20, 33:21, 34:19, 38:7, 38:8, 38:11, 40:5, 44:4, 45:9, 47:5, 47:6, 65:15, 67:7 questions 79:12 quickly 58:8, 58:11 quotation 43:13	reason 62:21, 81:15, 81:19 reasons 45:7 recall 7:15, 8:14, 15:1, 21:10, 27:21, 28:11, 51:17, 60:10, 63:2, 79:14 receive 83:8 receives 80:21, 82:19 receiving 83:2, 83:6, 83:10 recess 36:21, 69:17 recited 30:12, 53:7 recites 9:3 recognize 56:18 recollection 28:20 record 6:14, 56:15, 85:13 reduced 85:12 redundancy 63:1, 63:2 refer 52:19, 77:13 reference 4:11, 38:1, 44:16, 56:17, 78:2 referred 7:22, 33:19, 73:12, 78:22 referred-to 26:15 referring 28:4, 34:8	refers 33:13 regarding 4:13, 48:5, 51:14 registered 2:13, 2:14 related 6:3, 43:21 relative 43:9, 85:17, 85:18 relevant 73:8 rely 60:2 relying 52:11 remotely 3:20 render 57:11 rendering 73:11 repeat 33:21, 65:15, 67:7 report 6:13, 7:9, 7:17, 7:20, 8:2, 10:15, 47:9, 52:21, 54:5, 80:8, 82:16 reported 1:22, 85:11 reporter 2:13, 2:14, 2:15, 85:4, 86:10 represent 27:7, 35:13, 56:15, 74:15 representation 35:4, 35:21, 36:2 represented 63:7 represents 35:6, 36:4	require 24:1, 26:6, 26:22, 47:6 required 25:5, 39:1, 80:3, 82:3, 82:12 requirement 28:14 requirements 16:14, 81:11 requires 34:13, 35:1, 80:12, 81:6 requiring 80:11 research 70:13 reservation 10:13, 33:1 resource 17:1, 17:2, 17:12, 18:10, 18:11, 19:7, 19:9, 82:6, 82:8 resources 82:7, 82:8 respect 25:5, 37:16, 75:4 respond 12:21, 13:21 responding 64:20 response 6:11, 6:12, 7:7, 7:10, 7:13, 23:4, 45:8, 47:8, 48:9, 58:16, 65:6, 70:3, 71:4 rest 55:9 restate 79:22 result 81:20 retrieving 67:21, 68:1,
R			
ramifications 51:12 random 68:4, 68:6 range 70:21, 71:2, 71:4 rather 82:19 rdokhanchy@mintz 3:17 read 9:15, 18:8, 31:8, 54:22, 84:3 readily 60:15 reading 19:6, 50:18, 55:16 reads 46:1 ready 37:2 really 21:15, 21:16, 35:5, 36:15, 70:7, 71:2, 72:2, 77:15, 77:21 realtek 1:4 realtime 2:15			

68:3, 68:5 returned 33:4 returns 32:22 review 8:9 reviewed 7:7, 7:13, 8:6 reza 3:11 right 8:18, 10:6, 39:16, 40:5, 69:11, 70:11, 79:22, 80:6 rmr 1:22, 86:9 road 3:14 roman 51:20 rules 5:13 run 22:16, 78:8, 78:10 running 62:7, 62:10, 62:11, 62:15, 63:18, 67:4, 67:10, 76:14, 78:7	25:20, 26:16, 26:19, 28:15, 28:17, 29:5, 29:9, 29:16, 30:6, 37:13, 37:15, 37:19, 40:4, 50:12, 59:20, 61:18, 62:3, 62:5, 62:8, 62:11, 62:15, 63:18, 64:4, 68:1, 68:5, 73:1, 76:5, 84:4 san 3:15 satisfies 15:20 satisfy 16:2, 25:7, 29:17, 35:14, 39:9, 39:20 say 11:9, 13:2, 18:1, 18:3, 21:15, 22:12, 26:18, 29:7, 29:9, 30:3, 31:4, 34:21, 41:17, 53:17, 53:20, 54:11, 60:18, 75:12 saying 24:7, 26:16, 33:14, 34:1, 34:12, 39:19, 40:1, 83:1 says 14:16, 24:20, 41:11, 54:7, 59:10, 61:11, 63:8 scheduling 68:19 scope 49:15 screen 73:11, 73:15	seal 86:2 search 61:10 second 24:22, 25:10, 25:17, 27:12, 34:17, 43:18, 57:22, 59:4, 78:9 section 41:7, 46:6, 51:19, 52:5, 52:13, 52:15, 52:18, 52:21 see 7:10, 19:9, 24:19, 28:7, 30:14, 30:15, 36:1, 41:15, 42:4, 42:8, 46:14, 46:18, 51:17, 61:4, 61:22, 62:19, 63:14, 64:18, 71:6, 78:12, 78:21, 79:2, 82:21 seems 38:15, 60:8 select 16:9, 16:17, 43:7, 43:18, 46:1, 46:12, 46:16, 47:13, 48:19, 49:11, 50:8, 79:18, 80:3, 80:12, 82:18, 83:7 selected 50:13 selecting 68:11, 76:18, 79:3, 81:3, 81:6, 81:15, 81:16, 82:2, 82:5, 82:14, 83:3, 83:6	selection 48:11, 48:14, 48:16, 68:20, 78:20, 78:22, 81:12, 82:12, 83:9, 83:12 selects 79:2, 79:14 semiconductor 1:4 sending 38:12, 76:10 sent 17:12, 17:13, 17:17 sentence 49:11, 54:15, 55:8 sentences 49:15, 54:15 separate 20:6, 20:7, 20:17, 20:18, 24:16, 65:13, 65:21 separately 65:10, 65:18 sequence 31:18, 31:21, 32:5, 32:9, 32:13, 32:17, 33:8, 34:4, 34:8, 34:10, 35:6, 35:10, 35:19, 37:17, 38:15 sequences 37:19 serving 14:22 set 31:21, 32:5, 32:7, 43:13, 86:1 several 22:5, 28:2 shader 53:11, 53:16,
S			
said 13:6, 20:13, 20:15, 23:17, 24:4, 26:9, 32:1, 32:8, 36:3, 49:11, 58:15, 59:21, 74:11, 75:3, 85:15 same 5:15, 21:13, 21:19, 22:11, 23:1, 23:15,			

74:13 shading 74:3 sheet 84:7 short 72:1, 74:12, 74:22, 75:11 shorthand 2:13, 85:4, 86:10 should 46:21, 48:2 show 50:14 showing 43:2, 43:12, 63:13, 78:13 shown 15:7, 16:16, 63:9, 64:3 shows 6:15, 40:9, 60:7 signature 6:22, 7:1, 7:2, 84:10 signature-mig2k 86:7 signed 7:3, 7:6, 84:7 signing 8:10 simd 61:12, 64:16, 64:17, 65:3, 65:4 similar 83:1 simple 72:15 simply 48:6, 83:2 since 65:11, 65:19 single 24:15, 46:6, 61:12, 74:15	single-thread 63:21 sit 23:11 situation 15:1, 39:12, 44:9 size 22:4, 22:14, 61:2, 69:19, 69:21, 70:1, 70:2, 70:9, 70:10 skill 9:8, 9:15, 9:18, 10:3, 10:7, 10:21, 11:2, 11:15, 11:19, 12:7, 13:7, 13:11, 13:18, 17:4, 17:11, 17:16, 18:5, 18:7, 18:16, 18:18, 19:2, 19:5, 19:11, 19:17, 19:20, 19:21, 19:22, 20:4, 20:15, 23:12, 26:12, 27:8, 27:10, 27:15, 29:2, 31:2, 31:9, 31:15, 47:19, 53:15, 55:17, 57:15, 59:6, 59:17, 64:22, 65:9, 65:17, 67:16, 70:4, 70:12, 73:19, 77:12, 78:2 skin 73:20 skinning 73:18 skipping 21:4 small 58:7, 69:6	smaller 64:15, 65:2, 67:22, 68:4 solely 63:1 some 6:3, 8:20, 11:17, 20:21, 35:10, 35:21, 36:5, 57:5, 60:8, 73:10, 78:19, 79:12 somebody's 11:14 someone 70:13 something 7:17, 12:12, 35:14, 36:3, 51:3, 55:21, 55:22, 60:3, 72:14, 83:7 sorry 17:15, 18:14, 45:21, 53:3, 73:7 sort 51:16, 56:9, 78:19 sorting 78:19, 78:21, 79:3 south 2:7 space 73:13, 73:15 span 22:5 speak 5:17 speaking 5:16, 32:2, 62:19 specific 68:17 specifically 52:19, 56:22 specification 9:16, 11:11,	12:10, 31:11, 31:13, 55:1 specifications 50:19 specified 71:13, 85:16 speed 22:16, 22:17, 76:22 stack 64:2 stage 73:12, 73:20, 73:22 standard 52:6 standards 51:22 start 9:2 started 8:19 starting 41:6, 53:1 starts 8:1, 51:20 state 2:16, 49:9, 50:7, 53:14, 85:5 stated 21:10, 45:7, 46:18, 47:9, 47:18, 52:4, 67:20 statement 46:20, 81:5 states 1:1, 49:5 stating 39:1, 48:15 station 10:13, 33:2 stenographically 85:11 step 66:17, 66:18 steps 73:10, 73:18,
---	--	--	---

78:14 stick 27:21 still 40:16, 40:20 stopping 69:15 storage 26:7, 27:1, 27:18, 35:1, 39:2, 65:13, 65:21, 66:5, 66:7, 70:8 store 24:10, 24:21, 25:1, 25:9, 25:11, 25:16, 25:18, 25:21, 26:14, 27:11, 27:13, 28:15, 29:4, 29:12, 29:14, 30:5, 30:8, 34:16, 34:17, 35:16, 35:18, 35:21, 37:14, 37:19, 37:20, 37:21, 38:2, 38:5, 38:8, 38:20, 39:8, 39:10, 39:19, 57:8, 57:14, 57:20, 58:22, 59:1, 59:2, 65:10, 65:18, 66:5, 66:8, 69:5, 69:7, 75:13 stored 10:13, 10:15, 29:15, 34:12, 34:14, 34:22, 35:3, 35:9, 35:15, 37:13, 38:10, 38:18, 38:19, 38:21, 39:13, 40:10, 50:11, 75:1 stores 29:7, 29:9,	31:20, 32:4, 32:12, 33:8, 34:3, 38:3, 39:17, 40:19, 57:4 storing 9:20, 9:22, 11:7, 12:1, 12:16, 14:2, 14:14, 15:7, 15:11, 16:21, 28:17, 29:18, 31:22, 32:2, 32:6, 32:14, 32:17, 33:10, 34:6, 37:9, 37:17, 39:3, 39:4, 39:15, 40:17, 57:11, 57:17, 58:13, 58:21, 59:8, 59:19, 60:4, 67:21, 67:22, 68:3, 68:5, 69:1 street 2:7, 3:5 strike 14:5, 17:20, 20:13, 22:8, 66:10, 69:20 stuff 21:5 stuttard 4:11, 56:16, 56:20, 56:22, 57:8, 57:10, 60:5, 60:7, 60:11, 60:13, 60:22, 61:5, 61:18, 61:22, 62:3, 62:7, 62:9, 62:22, 63:8, 66:3, 66:12, 66:14, 67:2, 67:8, 67:13, 67:16, 67:17, 67:19, 67:20, 68:12,	68:17, 75:4, 76:22, 77:3, 78:17 stuttard's 57:16, 58:13, 59:7, 59:18, 63:3, 66:3, 68:10, 68:15, 68:22, 75:15, 78:15 subject 77:22 submitted 6:10, 6:12 substance 37:7 suffice 39:14 sufficiency 65:14 sufficient 12:21, 13:20, 39:6, 59:12, 75:9 suggested 61:20 suite 3:14 sum 52:7 support 6:10 supported 61:22 supports 78:17 sure 5:14, 9:21, 15:2, 26:19, 28:4, 32:7, 33:12, 33:16, 36:20, 37:5, 40:4, 62:18, 65:16, 67:8, 69:16, 70:1, 76:15, 79:5 sworn 5:1, 5:4, 85:8	synonymous 54:8, 75:5 system 10:5, 22:21, 24:9, 24:12, 55:11, 56:1, 58:17, 60:16, 63:17, 68:15, 75:6, 75:16, 77:7, 77:8, 78:1, 78:12, 78:14, 78:15, 78:16 systems 23:22, 72:5 T table 42:3, 42:16 take 36:19, 45:10, 47:7, 62:13, 66:11, 69:15, 79:4 taken 27:17, 85:15 talk 8:20 talking 30:21, 30:22, 33:22, 34:9, 37:9, 43:22, 71:11, 71:12, 73:5 talks 30:15, 30:16, 30:17, 30:18 tandem 64:16, 65:2 task 62:8 tasks 65:13, 65:21 teaches 70:13 teaching 72:13 technical 73:9
---	---	---	---

technologies 1:9 tell 21:22, 23:13, 33:22, 34:1, 60:21, 63:6 ten 60:18, 60:20, 60:22, 61:2, 61:13, 71:5, 71:10, 71:20, 72:7, 72:22, 74:9 term 15:17, 26:2, 27:4, 27:20, 28:5, 28:11, 31:4, 42:2, 42:4, 42:20, 43:6, 46:1, 51:7, 51:15, 52:15, 52:19, 52:21, 59:13, 63:2 terminology 47:2, 47:3 terms 41:12, 42:3, 43:5, 43:12, 43:14, 44:7, 44:20, 44:21 testified 5:4, 75:15 testify 85:8 testimony 37:7, 76:2, 84:4, 84:5, 85:14 texas 3:6 text 18:17 texture 17:2, 17:9, 17:12, 17:13, 17:18, 17:19, 18:10, 18:12,	18:16, 18:19, 82:7 textures 74:2 th 7:4 thank 83:15 thanks 41:2 thereafter 85:12 thing 26:16, 33:19, 34:1, 43:18, 43:21, 82:9 things 22:22, 43:3, 71:15, 73:17, 79:14 think 6:18, 8:13, 8:19, 10:2, 11:15, 11:17, 12:3, 18:7, 18:18, 19:5, 23:17, 26:2, 26:9, 26:12, 26:16, 27:4, 28:21, 31:1, 32:1, 36:12, 38:15, 39:1, 39:11, 44:3, 52:9, 55:8, 66:1 thinks 40:20 third 78:10 three 15:21, 16:1, 43:12, 43:14 through 6:15, 6:19, 73:8, 78:13 time 14:3, 14:15, 16:12, 19:21, 20:5, 20:6,	20:10, 20:16, 20:17, 28:15, 28:17, 29:5, 29:8, 29:10, 29:16, 30:6, 37:13, 37:15, 37:20, 38:9, 38:14, 38:18, 38:21, 39:9, 39:18, 39:20, 40:18, 44:18, 47:7, 48:14, 57:5, 59:20, 64:12, 73:9, 76:6, 76:11, 76:14, 76:16, 76:18, 85:16 time-interleaved 64:8, 64:10, 67:14, 67:20, 75:16, 76:10, 78:6, 78:17 times 28:2, 61:2, 63:12 title 61:8 to" 75:6 today 5:15, 5:19, 6:2, 23:11 together 40:19 took 45:3, 49:10 top 36:13 total 6:19, 52:8 totality 50:18 toy 72:12, 73:3 trademark 1:1 transcript 85:10	transcription 84:5 trial 1:2 true 84:4, 85:13 truth 85:8 truthful 5:21 try 5:16, 12:13, 27:21 trying 13:9, 55:5 turn 8:21, 41:4, 80:9, 80:20 two 10:14, 18:22, 21:8, 21:13, 21:19, 21:20, 22:10, 23:1, 23:7, 23:14, 23:15, 23:16, 24:5, 24:6, 24:15, 25:6, 25:8, 25:13, 26:13, 29:19, 36:12, 43:1, 43:3, 44:11, 46:12, 46:13, 46:16, 46:17, 47:14, 48:12, 48:13, 49:15, 80:13 type 9:20, 9:21, 11:7, 11:9, 11:13, 12:1, 12:16, 14:18, 17:10, 17:17, 18:6, 50:11, 50:12, 53:15, 53:17, 68:10, 68:13, 68:21, 77:4, 77:19, 80:11, 81:3,
--	---	---	---

81:6 types 16:21, 17:6, 48:15, 65:12, 65:20, 68:17, 82:3 typewriting 85:12 typical 69:19, 69:21, 70:1, 70:2, 70:5, 70:7, 70:18, 75:1 typically 70:15 typos 8:15	18:9, 27:6, 27:7, 27:9, 29:21, 31:6, 52:8, 54:12, 54:21, 55:6, 55:15, 70:14, 74:12 understood 5:18, 9:7, 9:14, 10:3, 10:21, 11:2, 12:7, 13:17, 31:8, 72:21, 74:8, 75:5, 77:11, 77:12 unified 53:10, 53:16 unit 57:1, 57:4, 66:22 united 1:1 use 12:4, 25:20, 27:20, 28:18, 44:4, 44:13, 47:2, 50:21, 51:12, 59:21, 71:15, 74:12 uses 28:5 using 30:3, 47:10, 60:16, 62:3, 63:2 utilized 45:16	vertex 17:22, 18:12, 18:14, 19:4, 19:8, 19:13, 19:18, 20:3, 20:6, 20:18, 20:22, 21:2, 25:1, 25:11, 25:18, 26:8, 27:2, 27:13, 29:8, 29:12, 29:15, 30:6, 34:18, 37:13, 43:9, 43:20, 46:3, 46:13, 46:17, 47:15, 48:13, 48:21, 49:3, 49:8, 49:13, 50:10, 53:9, 53:12, 54:2, 57:21, 59:3, 59:8, 59:19, 65:10, 65:18, 66:4, 66:6, 66:8, 66:16, 66:18, 70:6, 70:16, 70:18, 71:9, 71:11, 71:12, 71:19, 72:1, 72:7, 72:12, 72:13, 72:16, 72:18, 72:20, 73:5, 73:6, 73:12, 73:14, 74:8, 74:13, 74:22, 75:10, 75:14, 77:9, 79:21, 80:5, 80:13, 81:18 vertices 66:16, 78:3 viewer 73:16 virtue 80:10	want 8:19, 36:19, 37:5, 40:4, 44:6 waste 66:5, 66:7 way 6:1, 12:13, 31:9, 43:16, 77:11 we're 6:2, 26:16, 26:19, 40:4, 71:11, 71:12, 81:15, 81:16 we've 6:8, 36:18 went 44:20 wherein 10:14 whereof 86:1 whereupon 5:1, 36:21, 56:12, 69:17, 83:16 whether 7:12, 22:1, 23:6, 23:13, 24:13, 27:5, 39:7, 49:22, 51:7, 56:4, 56:5, 58:12, 58:20, 59:5, 59:16, 68:9, 68:22, 77:18, 79:13, 82:11 whichever 53:22 whole 49:19, 85:8 widely 71:16 williams 38:1, 38:2, 38:12, 39:12, 39:17, 40:1, 40:2, 40:3,
U	V	W	
ulc 1:9 ultimately 82:19 under 10:8, 22:16, 85:12 understand 10:8, 13:9, 18:5, 18:19, 19:3, 24:3, 24:6, 26:13, 28:2, 31:2, 31:10, 31:15, 33:16, 39:16, 41:12, 41:22, 43:11, 43:16, 44:6, 44:22, 46:10, 47:3, 47:5, 47:19, 51:10, 53:15, 54:7, 54:11, 55:6, 55:18, 57:16, 59:7, 59:18, 60:5, 67:17 understanding 11:19, 13:8, 13:21, 16:22,	variance 70:22 varies 24:12 variety 73:18 vary 70:19, 71:15 vast 23:8, 71:18	walk 78:13	

40:9, 40:12, 40:17, 82:17 withdrawn 80:1 within 10:13, 52:5, 60:11, 85:4 without 9:12 witness 4:2, 5:1, 5:3, 40:8, 56:13, 72:11, 73:2, 79:7, 80:16, 81:9, 83:5, 83:13, 85:7, 86:1 word 28:1, 30:12, 30:14, 38:4, 40:13, 49:6, 50:16, 50:20, 51:14 words 8:14, 47:20, 47:21, 47:22, 49:10 working 66:3 would've 9:11 wouldn't 40:16, 48:18, 66:2 write 10:1, 12:4 writing 7:13, 11:14, 12:12 written 49:18, 67:16 wrong 50:15 Y yeah 6:19, 9:4, 16:22, 32:16,	42:11, 69:16 yesterday 5:12, 5:14 yohler 1:22, 2:12, 85:3, 86:9 yourself 13:3 . .1234 3:7 .1500 3:16 0 00564 1:12 02 1:19 053 4:10, 6:2, 6:5, 9:19, 12:22, 13:17, 14:10, 14:21, 15:5, 15:16, 16:7, 19:1, 28:9, 41:12, 53:7, 56:6, 71:13, 72:3, 72:16, 72:22, 73:4, 73:5, 73:9, 74:9, 77:6, 77:7, 77:17, 77:22, 79:1, 79:10, 80:2, 80:19, 81:4 1 10 51:18, 60:14, 63:9 1001 4:10, 6:5, 8:21 1005 4:11, 56:11, 56:12 1010 45:18	102 16:4, 16:16, 63:21, 63:22 1024 57:1, 57:4, 69:4 1025 68:19 1026 63:14, 68:20 104 15:7, 15:11, 16:5, 16:18, 16:20, 17:1, 17:7, 21:7, 22:10, 24:14, 80:22 106 15:7, 15:11, 16:5, 16:18, 16:20, 17:2, 17:8, 21:8, 22:10, 24:14, 60:8, 63:7, 63:10, 63:11, 64:3, 80:22 11 83:17 112 15:12 114 15:12 116 15:13 1318 42:18, 44:19, 45:13, 45:17, 56:5 139 82:15 141 80:8, 81:5 16 24:8, 51:20 17 7:4 18 41:4, 41:6	19 41:21 1900 2:7 1st 2:7 2 2009 4:12, 6:9, 6:15, 41:5, 45:21, 45:22 2015 42:7 2023 1:12 2024 1:18, 7:4, 86:3 22 41:5 23 45:20, 51:21 24 45:22, 73:8 27 45:21, 73:8 28 45:22 2b 63:4 2d 73:11, 73:14, 77:4, 77:16, 77:19, 77:21 3 3's 62:20 300 3:14 31 45:18 325 42:7, 42:11 34 32:21 35 14:10
---	--	---	--

3580 3:14 381 44:11, 71:20 3d 73:11, 73:13, 77:13, 77:17, 78:5 4 40 41:7, 41:11, 68:13 41 42:4 42 42:16, 43:11 44 45:2, 68:14, 83:17 4531 2:16, 86:11 49 10:12 4995 3:6 5 530863 1:20 55 46:7, 46:19, 48:3, 48:10, 49:20, 50:3, 51:17, 53:1 56 4:11, 53:3 564 42:11 6 68 82:16 7 7,742,053 1:13, 4:14 70 80:9	713.229 3:7 77 6:16, 6:20, 6:21 77002 3:6 79 4:5 7th 86:3 8 81 6:16, 6:17, 6:19 84 2:16, 86:11 85 68:14 858.314 3:16 86 1:21 87 54:4, 55:19, 56:9 8x 63:11 9 9 1:19 910 3:5 92130 3:15	
--	---	--