

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

3
4 GOOGLE LLC,

5 Petitioner,

6 v.

7 SINGULAR COMPUTING LLC,

8 Patent Owner.

9 Patent No. 11,169,775

10 Patent No. 10,754,616

11 Case No. IPR2023-00397

12 VIA ZOOM

13 9:00 a.m.

14 DEPOSITION OF PAUL FRANZON, PhD

15 Tuesday, October 3, 2023

16
17
18
19
20
21
22 REPORTED STENOGRAPHICALLY BY:

23 Jennifer Miller, RMR, CRR, CCR-NJ, CCR-NM,

24 CCR-WA

25 Job No: 8042

1 A P P E A R A N C E S

2

3 ON BEHALF OF GOOGLE LLC

4 WOLF, GREENFIELD & SACKS, P.C.

5 By: Gregory S. Nieberg

6 Elisabeth Hunt

7 600 Atlantic Avenue

8 Boston, Massachusetts 02210

9 (212) 849-3338

10 Gregory.Nieberg@WolfGreenfield.com

11 Elisabeth.Hunt@WolfGreenfield.com

12

13 ON BEHALF OF PATENT OWNER:

14 Fabricant, LLP

15 by: Peter Lambrianakos

16 411 Theodore Fremd Avenue

17 Suite 206 South

18 Rye, New York 10580

19 (212) 257-5797

20 plambrianakos@fabricantllp.com

21

22

23

24

25

1 I N D E X

2 WITNESS PAGE

3 PAUL D. FRANZON, PH.D.

4 BY ATTORNEY LAMBRIANAKOS 4

5 E X H I B I T S

6 Franzon 1 Declaration of Paul 5
7 Franzon, PhD, related to
8 395 IPR8 Franzon 2 Declaration of Paul 6
9 Franzon, PhD, related to
10 397 IPR

10 Franzon 3 CV of Paul D. Franzon 24

11 Franzon 4 Tong et al. paper entitled 54
12 Reducing Power by
13 Optimizing the Necessary
14 Precision/Range of
15 Floating-Point Arithmetic14 Franzon 5 International Publication 69
15 Number WO 2005/03726 A215 Franzon 6 Document entitled 140
16 Quantitative Analysis of
17 Floating Point Arithmetic
18 on FPGA Based Custom
19 Computing Machines

18

19

20

21

22

23

24

25

1 P R O C E E D I N G S

2 ATTORNEY LAMBRIANAKOS: Peter
3 Lambrianakos on behalf of the patent
4 owners.

5 ATTORNEY NIEBERG: Gregory
6 Nieberg on behalf of petitioner Google.
7 And joining me is Elisabeth Hunt from Wolf
8 Greenfield.

9 PAUL FRANZON, PhD, after
10 having been first duly sworn, was
11 examined and testified as follows:

12 - - -

13 E X A M I N A T I O N

14 - - -

15 BY ATTORNEY LAMBRIANAKOS:

16 Q. Okay. Is your name pronounced
17 Franzon?

18 A. Yes.

19 Q. Thank you.

20 Are you ready, sir?

21 A. Yes.

22 Q. Good morning, Dr. Franzon.

23 A. Good morning to you.

24 Q. You understand that we're here today
25 with respect to two pending inter partes

1 reviews, IPR2023-395 and 397?

2 A. Yes.

3 Q. And do you understand that those IPRs
4 cover patents 10,754,616 and 11,169,775?

5 A. As I recall, yes.

6 Q. And is it your understanding that in
7 those IPRs the petitioner is asserting grounds
8 for invalidity based on obviousness?

9 A. Yes.

10 ATTORNEY LAMBRIANAKOS: For
11 today's deposition, I'm going to be using
12 the documents from the 395 IPR.

13 In the chat window, I just put
14 Exhibit 1003 from that IPR.

15 Please let me know when you have
16 it open in front of you.

17 - - -

18 (Whereupon, Exhibit 1 was marked
19 for identification.)

20 - - -

21 ATTORNEY LAMBRIANAKOS: And,
22 Dr. Franzon, I also put your declaration
23 from the 397 IPR into the chat. That's
24 Exhibit 1003 in that proceeding.

25 - - -

1 (Whereupon, Exhibit 2 was marked
2 for identification.)

3 - - -

4 ATTORNEY LAMBRIANAKOS: Please
5 let me know when you receive that one as
6 well.

7 THE WITNESS: I'm getting an
8 error. I need to close down Acrobat.

9 ATTORNEY LAMBRIANAKOS: Go off
10 the record.

11 - - -

12 (Whereupon, a short recess was
13 taken.)

14 - - -

15 THE WITNESS: '616 is open.
16 Do you want me to open '775?

17 ATTORNEY LAMBRIANAKOS: Yes,
18 please.

19 - - -

20 (Whereupon, there was an
21 off-the-record discussion.)

22 - - -

23 ATTORNEY LAMBRIANAKOS: Let's
24 say Exhibit 1 for the deposition is
25 Exhibit 1003 from the 395 proceeding, and

1 Exhibit 2 is Exhibit 1003 from the
2 397 proceeding.

3 - - -

4 (Whereupon, there was an
5 off-the-record discussion.)

6 - - -

7 THE WITNESS: Can you hear me?

8 ATTORNEY LAMBRIANAKOS: Yes, I
9 can.

10 THE WITNESS: Can you hear me?

11 I can hear you now.

12 BY ATTORNEY LAMBRIANAKOS:

13 Q. Do you have both of those exhibits in
14 front of you, sir?

15 A. You want me to open both of them?

16 Q. Yes, I would. We're referring to the
17 exhibit numbered 1003 from the 395 proceeding
18 as Exhibit 1 and Exhibit 1003 from the 397 as
19 Exhibit 2.

20 Would you please open those and
21 let me know if those are the declarations that
22 you submitted in these proceedings.

23 A. Yes, they are.

24 Q. Are all of your obviousness opinions
25 in connection with these patents contained in

1 these declarations?

2 ATTORNEY NIEBERG: Object to
3 form.

4 THE WITNESS: At the time of
5 writing, this was my opinion. However, I
6 reserve the right to file a supplementary
7 declaration.

8 BY ATTORNEY LAMBRIANAKOS:

9 Q. Is all of the evidence that you have
10 to support the opinions in these declarations
11 cited to or included in these declarations?

12 ATTORNEY NIEBERG: Object to
13 form.

14 THE WITNESS: I reserve the
15 right to file a supplementary petition.

16 BY ATTORNEY LAMBRIANAKOS:

17 Q. Sir, are all of the facts that
18 support the opinions in your declaration cited
19 to or set forth in these declarations? Yes or
20 no?

21 ATTORNEY NIEBERG: Object to
22 form.

23 THE WITNESS: There is POSA
24 knowledge -- knowledge of person of
25 ordinary skill in the art that comes into

1 play as well.

2 In addition, I do reserve to
3 file a supplementary declaration.

4 BY ATTORNEY LAMBRIANAKOS:

5 Q. So are you saying that there's
6 knowledge of a person of ordinary skill in the
7 art that you rely on but which is not included
8 in your declaration?

9 ATTORNEY NIEBERG: Object to
10 form.

11 THE WITNESS: As you ask
12 questions, the knowledge of person of
13 ordinary skill in the art that I might
14 consider to be relevant.

15 BY ATTORNEY LAMBRIANAKOS:

16 Q. So are you saying that you're going
17 to answer questions today using the knowledge
18 of a person of ordinary skill in the art which
19 you did not use when you submitted these
20 declarations?

21 ATTORNEY NIEBERG: I'll object
22 to form.

23 THE WITNESS: I may or may not
24 do that.

25 In addition, I reserve the right

1 to file a supplementary report.

2 BY ATTORNEY LAMBRIANAKOS:

3 Q. You're under some belief, sir, that
4 you have some right to file another report in
5 these proceedings? Is that it?

6 ATTORNEY NIEBERG: Object to
7 form. Scope.

8 THE WITNESS: It is common
9 practice, as an expert, I file a
10 supplementary report.

11 BY ATTORNEY LAMBRIANAKOS:

12 Q. Really? Why would you file a
13 supplementary report in this case?

14 ATTORNEY NIEBERG: Object to
15 form. Scope.

16 THE WITNESS: I haven't decided
17 that yet.

18 BY ATTORNEY LAMBRIANAKOS:

19 Q. Do you have new opinions that you
20 want to put into a supplementary report?

21 A. I reserve the right --

22 ATTORNEY NIEBERG: Object to
23 form.

24 THE WITNESS: -- to present new
25 opinions in a supplementary report.

1 ATTORNEY LAMBRIANAKOS: Object
2 as nonresponsive.

3 BY ATTORNEY LAMBRIANAKOS:

4 Q. Do you have opinions which you intend
5 to set forth in a supplemental report?

6 A. I --

7 ATTORNEY NIEBERG: Object to
8 form.

9 THE WITNESS: In response to
10 your -- sorry.

11 ATTORNEY NIEBERG: Thank you.

12 THE WITNESS: In response to
13 your questions, I may or may not bring up
14 opinions related to person of ordinary
15 skill in the art, and I may or may not
16 elect to file a supplementary report that
17 presents new opinions.

18 BY ATTORNEY LAMBRIANAKOS:

19 Q. Do you have opinions, sitting here
20 today, which you intend to include in a
21 supplemental report?

22 ATTORNEY NIEBERG: Object to
23 form.

24 THE WITNESS: I have not formed
25 any opinions yet for a supplementary

1 report, but I anticipate that I might need
2 to do so after consideration of your
3 response and -- in response to your
4 questions today.

5 BY ATTORNEY LAMBRIANAKOS:

6 Q. Do you have facts in mind which you
7 wish to set forth in a supplemental report?

8 ATTORNEY NIEBERG: Object to
9 form. Scope.

10 THE WITNESS: I've yet to decide
11 what may or may not be included in a
12 supplementary report or what that may or
13 may not include --

14 - - -

15 (Stenographer clarification.)

16 - - -

17 THE WITNESS: I may or may not
18 decide what -- can you reask the question,
19 please?

20 BY ATTORNEY LAMBRIANAKOS:

21 Q. Do you currently have any facts in
22 mind which I intend to set forth in a
23 supplemental report?

24 ATTORNEY NIEBERG: Object to
25 form. Scope.

1 THE WITNESS: I have not decided
2 yet what will appear in a supplementary
3 report.

4 BY ATTORNEY LAMBRIANAKOS:

5 Q. When do you intend to prepare your
6 supplemental report?

7 ATTORNEY NIEBERG: Object to
8 form. Scope.

9 THE WITNESS: I have not decided
10 when to prepare it.

11 BY ATTORNEY LAMBRIANAKOS:

12 Q. Did you prepare the declarations that
13 are Exhibit 1 and 2 to this deposition?

14 ATTORNEY NIEBERG: Object to
15 form.

16 THE WITNESS: These are -- these
17 are my opinions at the time of -- these
18 are my opinions that I decided to put in
19 this report.

20 This declaration I present
21 represents my opinions -- these reports, I
22 mean.

23 BY ATTORNEY LAMBRIANAKOS:

24 Q. Did you prepare the declarations that
25 are Exhibits 1 and 2 to this deposition?

1 ATTORNEY NIEBERG: Object to
2 form.

3 THE WITNESS: Are you asking
4 about the process in which I prepared
5 these positions?

6 BY ATTORNEY LAMBRIANAKOS:

7 Q. I asked you about the declarations.
8 Did you prepare them?

9 ATTORNEY NIEBERG: Object to
10 form.

11 THE WITNESS: These declarations
12 present my opinions that -- at the time of
13 writing the declaration, and I stand by
14 these opinions.

15 BY ATTORNEY LAMBRIANAKOS:

16 Q. Did you personally write the words in
17 your declarations?

18 ATTORNEY NIEBERG: Object to
19 form.

20 And I'll just caution,
21 Dr. Franzon, not to reveal any
22 attorney-client communications.

23 THE WITNESS: The -- there was a
24 lot of discussion over many months on my
25 opinions on these patents.

1 And the actual report, while it
2 was authored by me, some of the words were
3 drafted by attorneys, some of the words
4 were originally drafted by me.

5 But I had final editorial
6 control over the report, and the report
7 reflects my opinions and presents my
8 opinions.

9 BY ATTORNEY LAMBRIANAKOS:

10 Q. Did you have any assistance from a
11 non-attorney in preparing the report -- the
12 reports, plural?

13 ATTORNEY NIEBERG: Object to
14 form.

15 THE WITNESS: The attorneys may
16 or may not have used non-attorney
17 assistance in helping draft their input to
18 the report.

19 But the report was authored by
20 me and presents my opinions.

21 BY ATTORNEY LAMBRIANAKOS:

22 Q. Did you yourself have an assistant or
23 a student or a staff member assist you in
24 preparing your report?

25 A. No.

1 ATTORNEY NIEBERG: Object to
2 form.

3 THE WITNESS: No. I had no
4 assistants hired by me or retained by me
5 to prepare this report -- by me
6 personally.

7 BY ATTORNEY LAMBRIANAKOS:

8 Q. Did you conduct any prior art
9 searches against the '616 or '775 patents?

10 ATTORNEY NIEBERG: Object to
11 form.

12 And I also caution, Dr. Franzon,
13 not to reveal any attorney-client
14 communications.

15 THE WITNESS: Yes.

16 BY ATTORNEY LAMBRIANAKOS:

17 Q. What was the result of your prior art
18 searches?

19 ATTORNEY NIEBERG: Object to
20 form.

21 And I'm going to caution,
22 Dr. Franzon, not to reveal any
23 attorney-client communication.

24 THE WITNESS: I don't recall
25 exactly which references that I use in the

1 report or which references that are not
2 being used in the report were -- resulted
3 from my search or, resulted in my
4 searches.

5 BY ATTORNEY LAMBRIANAKOS:

6 Q. So you did find prior art references
7 in your searches?

8 ATTORNEY NIEBERG: Object to
9 form. Scope.

10 THE WITNESS: Yes.

11 BY ATTORNEY LAMBRIANAKOS:

12 Q. But you don't know whether this prior
13 art that you found was ultimately incorporated
14 into your declarations?

15 ATTORNEY NIEBERG: Object to
16 form.

17 THE WITNESS: I think -- this
18 case originally started in early last
19 year.

20 We had a lot of discussions. I
21 did several searches. The results of the
22 searches were presented to me.

23 I don't remember which articles
24 and which other evidence presented was
25 discovered originally by me and which was

1 originally discovered by an attorney or
2 their assistants.

3 BY ATTORNEY LAMBRIANAKOS:

4 Q. Is it your understanding that the
5 grounds for invalidity in this case involve
6 combinations of prior art in obviousness
7 grounds?

8 ATTORNEY NIEBERG: Object to
9 form.

10 THE WITNESS: In the -- in
11 Ground 1B, I combined Stuttard with
12 Shirazi.

13 In Ground 1A, I say claims 1 to
14 5 obviousness started in Shirazi.

15 I'm looking at the 397 report.

16 BY ATTORNEY LAMBRIANAKOS:

17 Q. Let's go ahead and use Exhibit 1,
18 which is the 395 report for the deposition, so
19 that you and I are looking at the same
20 documents.

21 Is that all right?

22 A. Okay.

23 Q. So was it your idea to combine
24 Stuttard with Shirazi?

25 ATTORNEY NIEBERG: Object to

1 form.

2 And, again, I'll caution,
3 Dr. Franzon, not to reveal any
4 attorney-client communications.

5 THE WITNESS: We discussed
6 various grounds, various combinations over
7 a period of several months.

8 BY ATTORNEY LAMBRIANAKOS:

9 Q. Do you recall --

10 A. And what you're asking me to opine on
11 in those discussions, I believe, are
12 attorney-client privilege.

13 Q. Were you part of the discussion that
14 ultimately yielded the Stuttard-Shirazi
15 combination that is asserted in these
16 proceedings?

17 ATTORNEY NIEBERG: Object to
18 form.

19 I'm going to caution,
20 Dr. Franzon, not to reveal any
21 attorney-client communications.

22 THE WITNESS: As I said, there
23 were numerous discussions over a long
24 period of time. And in those discussions,
25 I formed an opinion that this is a good

1 combination.

2 BY ATTORNEY LAMBRIANAKOS:

3 Q. When were you retained for these
4 proceedings?

5 A. As I already said, it was early part
6 of last year.

7 Q. Early 2022; is that right?

8 A. Yes.

9 Q. Do you remember what month it was?

10 A. I don't exactly.

11 Q. Who retained you?

12 ATTORNEY NIEBERG: Object to
13 form.

14 THE WITNESS: What do you mean
15 by "who"?

16 BY ATTORNEY LAMBRIANAKOS:

17 Q. Were you retained by Google? Were
18 you retained by a law firm or someone else?

19 A. I'd have to look at the paperwork,
20 whether it was directly from the law firm or
21 directly from Google.

22 Q. Have you been retained in connection
23 with other proceedings involving Google and
24 Singular?

25 A. No.

1 Q. So your only representation with
2 respect to the Singular patents is with respect
3 to the proceedings that we're discussing today,
4 right?

5 ATTORNEY NIEBERG: Object to
6 form.

7 THE WITNESS: You know, I'd
8 rather double-check that by going back
9 over my records over -- of discussions
10 I've had.

11 I've been involved in numerous
12 cases over the years. Some of them may or
13 may not have involved Singular.

14 But I'd actually want to check
15 my records.

16 BY ATTORNEY LAMBRIANAKOS:

17 Q. Have you ever been deposed before,
18 sir?

19 A. Yes.

20 Q. How many times?

21 A. Over 20.

22 Q. Have you been deposed in connection
23 with IPR proceedings?

24 A. Yes.

25 Q. Do you understand the deposition

1 process here?

2 ATTORNEY NIEBERG: Object to
3 form.

4 THE WITNESS: I'm familiar with
5 the process.

6 BY ATTORNEY LAMBRIANAKOS:

7 Q. You understand you're under oath,
8 right?

9 A. Yes. Which is why I'd like to check
10 records when you ask specific questions like
11 that.

12 Q. And you understand that if I ask you
13 a question and you don't understand it, you'll
14 let me know; otherwise, I'll assume you
15 understood it?

16 A. Yes.

17 ATTORNEY NIEBERG: Object to
18 form.

19 BY ATTORNEY LAMBRIANAKOS:

20 Q. Is there any reason --

21 A. Sorry. As the question develops, it
22 might become clear to me that I didn't
23 understand the question as originally asked.

24 These depositions go for a long
25 time, and I get fatigued.

1 Q. All right. Well, if at any time you
2 feel fatigued and you need a break, you can let
3 us know. We'll finish up the pending line of
4 questions, and you can take a break.

5 Is that okay?

6 A. Okay.

7 Q. And, again, if I ask you a question
8 and you don't understand it or you need
9 clarification, you should ask me. All right?

10 ATTORNEY NIEBERG: Object to
11 form.

12 THE WITNESS: Yes. But the
13 request for clarification might come as
14 the question develops.

15 BY ATTORNEY LAMBRIANAKOS:

16 Q. Is there any reason why you can't
17 give truthful and accurate testimony today?

18 A. No.

19 Q. Are you under any medications that
20 would prevent you from giving truthful and
21 accurate testimony?

22 A. No.

23 ATTORNEY LAMBRIANAKOS: I'm
24 putting in the chat a document which we'll
25 mark as Exhibit 3 for this deposition.

1

- - -

2

(Whereupon, Exhibit 3 was marked

3

for identification.)

4

- - -

5

ATTORNEY LAMBRIANAKOS: It is

6

Exhibit 1004 in the 395 proceedings.

7

BY ATTORNEY LAMBRIANAKOS:

8

Q. When that document is available to

9

you, would you please open it and let me know

10

when you have it open in front of you.

11

A. It's opened.

12

Q. Is this your CV, sir?

13

A. This is the CV I supplied for this

14

petition.

15

Q. Can you look through it and verify

16

that.

17

A. It's the CV I supplied for this

18

petition.

19

Q. Your understanding is that this CV

20

was accurate as of the date that you submitted

21

it in this case -- in these proceedings?

22

A. I've had a long career, and there's

23

things that might be missing or titles that are

24

incorrect.

25

In addition, I actually don't

1 keep track of all my consulting work on this
2 CV.

3 Q. It says you have a bachelor of
4 science in physics and mathematics which you
5 obtained in 1983.

6 Do you see that?

7 A. Yes.

8 Q. And you have another bachelor, this
9 one of engineering, with first class honors in
10 electrical and electronic engineering which you
11 obtained in 1984?

12 A. Yes.

13 Q. So were you going to school
14 concurrently for both of these bachelor's
15 degrees?

16 A. Yes. Two years of the science --
17 bachelor of science degree were -- overlapped
18 the first two years of the bachelor -- first
19 three years of bachelor of engineering degree
20 and took an additional year to get the bachelor
21 of science and then -- which go into the
22 electrical engineering department to complete
23 my bachelor degree of engineering.

24 Q. So how many years in total did you
25 spend getting your bachelor's degrees?

1 A. Five years.

2 Q. Then you have a doctor of philosophy
3 in electrical and electronic engineering which
4 you obtained in 1989; is that right?

5 A. Yes.

6 Q. And is this all the education you
7 have?

8 A. Yes.

9 ATTORNEY NIEBERG: Object to
10 form.

11 THE WITNESS: All the formal
12 education I have.

13 BY ATTORNEY LAMBRIANAKOS:

14 Q. Would you turn back to Exhibit 1,
15 which is your declaration in the
16 395 proceedings, Exhibit 1003 in that
17 proceeding.

18 A. Got it.

19 Q. Would you please turn to page 19.

20 A. Yes.

21 Q. Do you see, beginning at that page
22 and at paragraph 33, you're discussing a person
23 of ordinary skill in the art or a POSA?

24 A. Yes.

25 Q. And then at the bottom of page 20,

1 paragraph 36, you set forth your opinion of the
2 level of skill of a POSA in 2009 or 2010?

3 A. Yes.

4 Q. According to paragraph 36, it's your
5 opinion that [as read]:

6 "A POSA would have had at least
7 a bachelor's degree in electrical
8 engineering, computer engineering,
9 applied mathematics, or the
10 equivalent and at least two years of
11 academic or industry experience in
12 computer architecture."

13 A. Yes.

14 Q. And you say that [as read]:

15 "More education could
16 substitute for experience and vice
17 versa."

18 A. Yes.

19 Q. In paragraph 37, you state that as of
20 2009 you were a person of more than ordinary
21 skill in the art during the relevant time
22 frame, right?

23 A. Yes.

24 Q. And that's because you held a PhD in
25 electrical engineering and you had over

1 20 years of experience in computer
2 architecture?

3 ATTORNEY NIEBERG: Object to
4 form.

5 THE WITNESS: Yes.

6 BY ATTORNEY LAMBRIANAKOS:

7 Q. Now, in your definition of a POSA,
8 what do you mean when you say "computer
9 architecture"?

10 ATTORNEY NIEBERG: Object to
11 form.

12 THE WITNESS: The design of -- I
13 haven't formed an opinion on that exactly.

14 But it would include design and
15 process, design chips that -- design of
16 digital chips that perform computer tasks,
17 design of systems that perform computer
18 tasks.

19 Those are examples of
20 experiences it would include.

21 BY ATTORNEY LAMBRIANAKOS:

22 Q. So computer architecture, as you set
23 forth in your declaration, includes not just
24 designing a computer system but also designing
25 components of the system, such as a processor?

1 ATTORNEY NIEBERG: Object to
2 form.

3 THE WITNESS: It would
4 include -- as I said, I haven't formed --
5 I don't have an exact answer to your
6 question.

7 But it -- it would -- experience
8 in computer architecture includes the
9 design of microprocessors, includes the
10 design of parallel processing systems,
11 includes the design of chips for those,
12 includes the design of logic for those,
13 includes programming at the systemic
14 level, includes programming simulation of
15 architectures.

16 There are a number of activities
17 that would be considered experience in
18 computer architecture.

19 BY ATTORNEY LAMBRIANAKOS:

20 Q. As of 2009, you had far more
21 experience in computer architecture than a
22 person of ordinary skill.

23 Is that fair?

24 ATTORNEY NIEBERG: Object to
25 form.

1 THE WITNESS: As I say in my
2 report [as read]:

3 "Therefore, I was a person of
4 more than ordinary skill in the art
5 during the relevant time frame."

6 BY ATTORNEY LAMBRIANAKOS:

7 Q. But you had over 20 years' experience
8 as of 2009, correct?

9 A. I --

10 ATTORNEY NIEBERG: Object to
11 form.

12 THE WITNESS: -- have over
13 20 years' experience, including my PhD,
14 including things I did as an undergraduate
15 student.

16 BY ATTORNEY LAMBRIANAKOS:

17 Q. So when you set forth the level of
18 ordinary skill in the art as having a
19 bachelor's degree in one of the enumerated
20 areas and two years of academic or industry
21 experience, it was your intention to say that
22 the two years of experience could have taken
23 place while the person of ordinary skill was
24 studying for their bachelor's degree?

25 ATTORNEY NIEBERG: Object to

1 form.

2 THE WITNESS: While even
3 studying for bachelor's degree, one does
4 internships, one does complex projects.

5 I would -- those are examples of
6 more education that would substitute for
7 experience and vice versa.

8 BY ATTORNEY LAMBRIANAKOS:

9 Q. So a student's educational
10 experiences and academic work in pursuing a
11 bachelor's degree could, in your mind, provide
12 the two years of academic or industry
13 experience in computer architecture that would
14 be necessary to meet your definition of a
15 person of ordinary skill in the art?

16 ATTORNEY NIEBERG: Object to
17 form.

18 THE WITNESS: Could you state
19 the question again, please?

20 BY ATTORNEY LAMBRIANAKOS:

21 Q. Can a student's academic work in
22 pursuing a bachelor's degree provide the two
23 years of academic or industry experience in
24 computer architecture that is necessary to meet
25 your definition of a person of ordinary skill

1 in the art?

2 ATTORNEY NIEBERG: Object to
3 form.

4 THE WITNESS: All I'm saying is
5 that while a student is an undergraduate,
6 often he or she does complex projects that
7 are sometimes the equivalent of graduate
8 projects and he or she does internships.

9 That experience can count,
10 whether it's -- it accounts for two years
11 or not depends on the individual's
12 experience.

13 BY ATTORNEY LAMBRIANAKOS:

14 Q. So as of 2009, you not only had a
15 PhD, you also had 20-plus years of experience
16 in computer architecture, correct?

17 - - -

18 (Stenographer clarification.)

19 - - -

20 THE WITNESS: I had a PhD, and I
21 had 20-plus years in computer
22 architecture. And this includes
23 experiences through my PhD and experiences
24 during my undergraduate tenure.

25

1 BY ATTORNEY LAMBRIANAKOS:

2 Q. And aside from --

3 A. For most of my undergraduate tenure,
4 I had a degree already, the last two years --
5 the last year, I mean.

6 Q. Since 2009, have you continued to
7 work in the area of computer architecture?

8 A. Yes, I have.

9 ATTORNEY NIEBERG: Object to
10 form.

11 THE WITNESS: I'm a professor of
12 electrical engineering, and I'm a
13 professor of computer engineering.

14 BY ATTORNEY LAMBRIANAKOS:

15 Q. Aside from your work as a professor,
16 do you have other experience in computer
17 architecture, such as performing projects or
18 doing research?

19 ATTORNEY NIEBERG: Object to
20 form.

21 THE WITNESS: Yes, I do research
22 projects, and also I'm a consultant with
23 the industry.

24 ATTORNEY NIEBERG: Dr. Franzon,
25 so we can have a clean transcript, if you

1 could let me get my objection in --

2 THE WITNESS: Thank you. Sorry.

3 ATTORNEY NIEBERG: -- first.

4 Thank you.

5 BY ATTORNEY LAMBRIANAKOS:

6 Q. So your experience through 2009
7 included processor architecture; is that right?

8 ATTORNEY NIEBERG: Object to
9 form.

10 THE WITNESS: My experience in
11 2009 included processor architecture,
12 included design of microprocessors and
13 parallel processing systems, included
14 design of computer chips, included
15 programming of computer chips.

16 It included many aspects of
17 computer systems.

18 BY ATTORNEY LAMBRIANAKOS:

19 Q. Is there anything on your CV that you
20 can point me to that collaborates your
21 experience in processor architecture?

22 ATTORNEY NIEBERG: Object to
23 form.

24 THE WITNESS: I'll give you
25 examples from my CV.

1 I'll start off with teaching.
 2 2009, ECE 520 ASIC design --
 3 - - -
 4 (Stenographer clarification.)
 5 - - -
 6 THE WITNESS: Okay. Let's start
 7 with teaching.
 8 ECE 520 ASIC design is design of
 9 logic chips, including computing chips.
 10 ECE 464 ASIC design is design of
 11 logic chips, including computing chips.
 12 ECE -- turning to the next page,
 13 page 7.
 14 ECE 520 ASIC design includes the
 15 design of computing chips -- logic chips,
 16 including computer chips.
 17 And ECE 733 digital circuits
 18 includes the circuit-level design of
 19 computing chips.
 20 I taught that in 2008 and 2007
 21 and 2006.
 22 Now, 2006, I taught again 520
 23 and 464 --
 24 - - -
 25 (Stenographer clarification.)

1 - - -

2 THE WITNESS: -- and 733 in
3 2006, 2005, 2004, 2003.

4 In 2002, I taught ECE 464 Design
5 complex of digital systems. This is an
6 undergraduate class in which we design a
7 microprocessor.

8 I taught that again in 2000.

9 In 2000, I also taught design
10 for tests which is how to test digital
11 chips, including computing chips.

12 In 2000, I taught ASIC design
13 again --

14 - - -

15 (Stenographer clarification.)

16 - - -

17 THE WITNESS: I taught ASIC
18 Design again and also both 520 and 492B.
19 I taught ECE 342 again.

20 Similarly, in 1998 and 1997, I
21 taught 342, which is design of computer
22 chips for undergraduates.

23 I list other teachings.

24 And, similarly, in 1997, I
25 taught ASIC design.

1 I list in bullet point form some
2 of my prior teaching experience before I
3 put it in tabular form.

4 This isn't complete, by the way.
5 I left out the earlier courses.

6 - - -

7 (Stenographer clarification.)

8 - - -

9 THE WITNESS: This included
10 fundamentals of logic -- 342, design of
11 complex digital systems; ASIC design
12 again.

13 544 is regarding packaging and
14 computing chips. That's 1999.

15 520, fundamentals of logic
16 design, a graduate class in fall 1995.

17 ECE 218, computer organization
18 and microprocessors, teaches organization
19 architecture of microprocessors. I taught
20 that in 1995. I taught that again in an
21 earlier year which I haven't listed.

22 Before 1994, I teach computer
23 design and technology, which is a computer
24 architecture class. I taught that several
25 times, actually, going back to my joining

1 NC State in 1999.

2 In 1995, I taught --

3 - - -

4 (Stenographer clarification.)

5 - - -

6 THE WITNESS: -- VLSI

7 microprocessing project in which we

8 designed a two-issue microprocessor.

9 I taught 691P, superscalar
10 processor design --

11 - - -

12 (Stenographer clarification.)

13 - - -

14 THE WITNESS: Yes, I'm reading
15 off the CV, pages 6 through 8.

16 I will try to slow down.

17 - - -

18 (Whereupon, there was an
19 off-the-record discussion.)

20 - - -

21 THE WITNESS: I taught a project
22 entitled VLSI microprocessor project. In
23 this project, we designed a two-issue
24 superscalar computer chip.

25 I taught computer design

1 technology again in 1994. I actually
2 taught that class continuously since
3 joining NC State in 1989.

4 I taught superscalar processor
5 design, which was the top computer chip,
6 in 1994.

7 As I said, my CV -- doesn't go
8 back to 1989, but I recall very
9 specifically teaching computer design and
10 technology in my years going back to 1989.

11 I also taught the
12 microprocess -- the -- I forget the class
13 name -- design of complex digital systems,
14 which are -- and 218 and 318, which aren't
15 listed, which are microprocessor design.

16 Oh, there it is. ECE 218,
17 computer organization of microprocessors.
18 I taught that off and on for a number of
19 years going back to 1989. In this, we
20 look at the computer organization of the
21 microprocessor and how to program it.

22 I'll continue on.

23 So I've taught aspects of
24 computer architecture on computing design
25 since joining NC State in 1989 pretty

1 regularly year after year, semester after
2 semester.

3 - - -

4 (Stenographer clarification.)

5 - - -

6 THE WITNESS: On page 9, I
7 described how I developed ECE 342 and
8 ECE 520 into varying formats.

9 And ECE 544, which is the design
10 of interfaces -- it is design of
11 interconnects on computer chips and
12 between computer chips.

13 I also point at -- going back to
14 my professional experience on page 1. As
15 well as being a professor continuously
16 from 1989 to present teaching computing
17 courses, also I worked as a technical
18 director of Rambus.

19 - - -

20 (Stenographer clarification.)

21 - - -

22 THE WITNESS: Part-time in a
23 consulting role at Rambus.

24 And this involved computer chip
25 design and computer interface design and

1 then 3D architectures and other things.

2 So just on the teaching side --
3 the 20 years of teaching experience,
4 including all the graduate-level classes
5 from 1989 to 2009.

6 On page 3, in -- there's some
7 but not all of my consulting experience.

8 About halfway down the page,
9 consultant to DARPA, exascale computing
10 study, 2007 to '9.

11 This was actually a major
12 activity. It's a very highly cited
13 publication.

14 DARPA, of course, is Defense
15 Advanced Research Project Agency, the Jedi
16 Knight of the defense R&D role.

17 I was -- I worked with DARPA in
18 many different forms over the years.

19 In this two-year span, I was a
20 consultant. We actually did an intensive
21 study of the aspect way of exascale
22 computing.

23 "Exascale computing" means
24 computing at more than 10 to the 18
25 floating point operations per second and

1 is very necessary for high-scale parallel
2 computing, for example, for computing a
3 large number of problems, including
4 weather, including effects of different
5 weapons, including nuclear explosions.

6 Exascale computing is very
7 important technology to the United States.

8 I was employed by DARPA as a
9 consultant to assist in this study, to be
10 part of the team performing this study.
11 We visited several -- many campuses and
12 companies and learned what they were doing
13 towards exascale computing. And we wrote
14 a report which is now being published as a
15 book.

16 The class you see here, I taught
17 ASIC design. It says "consultant to NTU,
18 ASIC design." This was to -- because of
19 my success in teaching on campus, they
20 wanted me to teach more broadly. This is
21 an online system that existed at the time.

22 You see Tessera, Irvine Systems.
23 This had to do with the 3D chip --
24 computer chip design. Irvine Systems was
25 trying to secure a chip design.

1 Similarly, Talon Logic, 2005,
2 secure chip design.

3 In 1997, I helped Ericsson with
4 a synthesis methodology. Synthesis is a
5 process in computer chip design where you
6 turn the register transfer language code
7 into a netlist.

8 - - -

9 (Stenographer clarification.)

10 - - -

11 THE WITNESS: I served on the
12 technical advisory board of Cadence and
13 Mentor Systems in 1992 to 1996.

14 These are electronic design
15 automation companies. Electric design
16 automation is a key aspect of computer
17 chip design, which I didn't really serve
18 on but is an important aspect.

19 And this was advising them on
20 future directions and where they needed to
21 improve what they were offering.

22 - - -

23 (Stenographer clarification.)

24 - - -

25 THE WITNESS: 1995 to 1996, ASIC

1 design, the -- at DCT. DCT was designing
2 media systems -- media computer chip --
3 the video processing in computer chips.
4 And I was an adviser, and I actually
5 assisted in the designs and
6 architectures --

7 - - -

8 (Stenographer clarification.)

9 - - -

10 THE WITNESS: -- architectures
11 and MPEG -- MPEG-2 system and helped in
12 other chip designs.

13 Continuing on.

14 - - -

15 (Whereupon, there was an
16 off-the-record discussion.)

17 - - -

18 THE WITNESS: So we got to DCT.

19 BY ATTORNEY LAMBRIANAKOS:

20 Q. Do you have more to add, sir, or do
21 you think you've given us a fair summary of the
22 highlights of your experience?

23 A. No. We haven't got to research
24 experience.

25 Q. Why don't you tell us the two or

1 three most relevant bits of research experience
2 you've done, and then let's move on.

3 A. Well, I can't think of the two or
4 three most relevant.

5 Q. Well, why don't you do your best.
6 I don't want to hear about all
7 of them. We only have seven hours.

8 ATTORNEY NIEBERG: Object to
9 form.

10 THE WITNESS: Well, your
11 question -- I'm trying to answer your
12 question.

13 Are you abandoning your
14 question?

15 BY ATTORNEY LAMBRIANAKOS:

16 Q. Go ahead, sir. Tell us all about
17 your experience.

18 A. So let's start -- let's start
19 August 1st, page 64.

20 I have three projects with
21 regard to CAD tools.

22 As I mentioned, computer-aided
23 design tools, C-A-D tools, are important in
24 digital chip design. This is related to
25 tools -- to the design of multichip modules

1 which we design computing chips on later and
2 computer-aided design tools for teaching.

3 I've already talked about how
4 important they are.

5 I designed for testability.
6 This is design -- number 89 there, design for
7 testability, testing computer chips.

8 I had a project in 1991 ordered
9 by IBM on low-energy computing. The power
10 consumption in computing is very important.

11 Interconnect models for
12 computer-aided design of high-speed multichip
13 models and integrated circuits. High-speed
14 computer chips are very important.

15 - - -

16 (Whereupon, there was an
17 off-the-record discussion.)

18 - - -

19 BY ATTORNEY LAMBRIANAKOS:

20 Q. Let's move on to something else.

21 Dr. Franzon, would you please
22 turn to Exhibit 1 again, which is your
23 declaration in the 395 proceeding?

24 - - -

25 (Whereupon, there was an

1 off-the-record discussion.)

2 - - -

3 BY ATTORNEY LAMBRIANAKOS:

4 Q. Do you have your declaration in front
5 of you, sir?

6 A. Yes.

7 Q. Would you please turn to page 48.

8 A. Yes.

9 Q. You see there's a section there,
10 "Stuttard-Shirazi Combination." And then below
11 it, it says "Reduced-bitwidth Poly PEs."

12 Do you see that?

13 A. Yes.

14 Q. And do you see that section runs
15 through page 56 of your declaration?

16 A. Yes.

17 Q. In paragraph 84, at the top of
18 page 48, you say [as read]:

19 "In my opinion, a POSA had
20 reasons to adapt the PEs in
21 Stuttard's poly unit to perform
22 floating-point math (for example,
23 floating-point multiplication) using
24 Shirazi's custom reduced-bitwidth
25 floating-point values."

1 Right?

2 A. Yes.

3 Q. And is it fair to say that the
4 remainder of this section presents evidence and
5 opinions that you believe support that opinion?

6 ATTORNEY NIEBERG: Object to
7 form.

8 THE WITNESS: In combination
9 with other sections of my report, I
10 present evidence that supports this.

11 BY ATTORNEY LAMBRIANAKOS:

12 Q. Is it your contention that any of the
13 references that you discuss in this section
14 disclose explicitly a processing array
15 compromised of reduced-bitwidth floating-point
16 operators?

17 ATTORNEY NIEBERG: Object to
18 form.

19 THE WITNESS: I would have to
20 review the section and review the
21 references.

22 BY ATTORNEY LAMBRIANAKOS:

23 Q. You can go ahead and review the
24 section and answer my question.

25 ATTORNEY NIEBERG: Object to

1 form.

2 THE WITNESS: As I said, I'd
3 have to review the references as well.

4 BY ATTORNEY LAMBRIANAKOS:

5 Q. I'm not asking you, sir, whether your
6 references make that disclosure.

7 I'm asking you whether you take
8 the position you contend in your declaration
9 that any of the references cited in this
10 section explicitly disclose a processing array
11 with reduced-bitwidth processing elements.

12 ATTORNEY NIEBERG: Object to
13 form.

14 THE WITNESS: Can you ask the
15 question again, please?

16 BY ATTORNEY LAMBRIANAKOS:

17 Q. Is it your contention in this portion
18 of your declaration that any of the references
19 that you cite here explicitly disclose a
20 processing array comprised of
21 reduced-bitwidth floating-point operators?

22 ATTORNEY NIEBERG: Object to
23 form.

24 THE WITNESS: You've asked if
25 any of the references. That means I have

1 to review the references as well.

2 BY ATTORNEY LAMBRIANAKOS:

3 Q. Sir, I'm asking you whether you
4 contend -- on pages 48 through 56, you make an
5 argument in here.

6 Do you give an opinion that any
7 of the references that you're discussing in
8 this section explicitly disclose a processing
9 array with reduced-bitwidth operators,
10 floating-point operators?

11 ATTORNEY NIEBERG: Object to
12 form.

13 THE WITNESS: As I said, I would
14 need to review the references as well.
15 You asked if the reference is disclosed.

16 BY ATTORNEY LAMBRIANAKOS:

17 Q. No, sir. I'm asking you whether you
18 contend in your declaration -- do you
19 understand what those words mean, sir?

20 ATTORNEY NIEBERG: Object to
21 form.

22 BY ATTORNEY LAMBRIANAKOS:

23 Q. So Exhibit 1 is your declaration.

24 You know that, right?

25 A. Yes.

1 Q. Okay. And the section I refer to is
2 from pages 48 through 56.

3 You understand that, right?

4 A. Yes. But I have to review my
5 declaration, not just those pages. I have to
6 review the other parts of the declaration as
7 well.

8 Q. No, sir. I get to ask the questions,
9 and then you answer them. You don't make up
10 your own questions.

11 I'm asking you whether in that
12 section -- whether in that section you
13 contend -- you say the words that any of the
14 references that you're discussing in that
15 section explicitly disclose a processing array
16 with reduced-bitwidth floating-point operators?

17 ATTORNEY NIEBERG: Object to
18 form.

19 Counsel, are you refusing to
20 allow Dr. Franzon to answer your question
21 in the manner he thinks appropriate?

22 ATTORNEY LAMBRIANAKOS: Counsel,
23 don't talk during my deposition. If you
24 want to object, object.

25 I'm asking a question, and I

1 deserve an answer to the question I'm
2 asking and not some other question that
3 the witness wants to cook up.

4 ATTORNEY NIEBERG: Object to
5 form.

6 ATTORNEY LAMBRIANAKOS: Object
7 away.

8 THE WITNESS: So I just started
9 reviewing my declaration regarding your
10 question. I do note one example in
11 paragraph 86 towards the end. [As read]:

12 "Tong also taught that
13 minimizing the number of precision
14 (mantissa) bits reduces power
15 consumption of each processing
16 element because a 'reduced precision
17 FP unit' has a 'small size' compared
18 to higher-precision units."

19 I notice he's -- refers to each
20 process -- I refer to each processing unit
21 with the clear implication there's more
22 than one. That's one example.

23 BY ATTORNEY LAMBRIANAKOS:

24 Q. Does Tong disclose a parallel
25 processing array with reduced-bitwidth

1 floating-point operations?

2 A. Can I finish the answer to the
3 question, please, before you ask follow-on
4 questions?

5 Q. You can answer my question, sir.

6 ATTORNEY NIEBERG: Object to
7 form.

8 BY ATTORNEY LAMBRIANAKOS:

9 Q. Does Tong disclose --

10 A. Do you abandon your previous
11 question?

12 Q. Does Tong disclose an array of
13 processors that are reduced-bitwidth
14 processors?

15 A. Ah. Well, now it's about Tong.

16 - - -

17 (Stenographer clarification.)

18 - - -

19 THE WITNESS: You asked what
20 does Tong disclose.

21 ATTORNEY NIEBERG: It's Tong,
22 T-O-N-G.

23 BY ATTORNEY LAMBRIANAKOS:

24 Q. Are you looking at a document, sir?

25 A. I'm reading Tong.

1 ATTORNEY LAMBRIANAKOS: For the
2 record, I'm putting as Exhibit 4 in the
3 chat Exhibit 1034, which is the Tong
4 reference.

5 - - -

6 (Whereupon, Exhibit 4 was marked
7 for identification.)

8 - - -

9 BY ATTORNEY LAMBRIANAKOS:

10 Q. Sir, have you ever read Tong before?

11 ATTORNEY NIEBERG: Object to
12 form.

13 THE WITNESS: Repeat the
14 question, please.

15 BY ATTORNEY LAMBRIANAKOS:

16 Q. Have you ever read Tong before?

17 ATTORNEY NIEBERG: Object to
18 form.

19 THE WITNESS: Yes. But I
20 haven't read it in its entirety for
21 several months now.

22 BY ATTORNEY LAMBRIANAKOS:

23 Q. And you don't remember whether or not
24 Tong discloses an array of reduced-bitwidth
25 processors?

1 ATTORNEY NIEBERG: Object to
2 form.

3 THE WITNESS: I didn't memorize
4 Tong.

5 BY ATTORNEY LAMBRIANAKOS:

6 Q. Sorry. I didn't hear that.

7 Would you repeat your answer.

8 A. I did not memorize Tong.

9 ATTORNEY LAMBRIANAKOS: Object
10 as nonresponsive.

11 BY ATTORNEY LAMBRIANAKOS:

12 Q. Do you not recall whether or not Tong
13 discloses an array of reduced-bitwidth
14 processing elements?

15 ATTORNEY NIEBERG: Object to
16 form.

17 THE WITNESS: I have -- you
18 asked me if something is in Tong. I'm
19 trying to answer the question. I have to
20 read Tong to answer that question.

21 BY ATTORNEY LAMBRIANAKOS:

22 Q. And you have to read Tong because,
23 sitting here today, you don't remember whether
24 or not Tong discloses that there's an array of
25 the reduced-bitwidth processing elements,

1 right?

2 ATTORNEY NIEBERG: Object to
3 form.

4 THE WITNESS: It is not my job
5 to memorize these references.

6 BY ATTORNEY LAMBRIANAKOS:

7 Q. So you didn't remember whether or not
8 Tong discloses an array of reduced-bitwidth
9 processing elements, right?

10 ATTORNEY NIEBERG: Object to
11 form.

12 THE WITNESS: I don't remember
13 in Tong either way.

14 BY ATTORNEY LAMBRIANAKOS:

15 Q. And you'll agree that in paragraph 86
16 of your declaration you don't reference Tong as
17 having disclosed an array of reduced-bitwidth
18 processing elements, right?

19 ATTORNEY NIEBERG: Object to
20 form.

21 THE WITNESS: As I said in
22 paragraph 86 [as read]:

23 "Tong also taught that
24 minimizing number of precision
25 (mantissa) bits reduces the power

1 consumption of each processing
2 element because a 'reduced precision
3 FP unit' has a 'small size' compared
4 to higher-precision units."

5 One way to interpret this is
6 that there is more than one processing
7 element.

8 BY ATTORNEY LAMBRIANAKOS:

9 Q. So do you think that that sentence of
10 your declaration that describes Tong suggests
11 that there's more than one Tong processing
12 element?

13 Is that your testimony?

14 ATTORNEY NIEBERG: Object to
15 form.

16 - - -
17 (Stenographer clarification.)

18 - - -
19 THE WITNESS: I'm saying it may
20 suggest that.

21 ATTORNEY NIEBERG: We've been
22 going over an hour and, I think, over an
23 hour on the record as well. Maybe now is
24 a good time for a break and then --

25 ATTORNEY LAMBRIANAKOS: Not when

1 there's a question pending.

2 ATTORNEY NIEBERG: I'm sorry.

3 Is there a question pending?

4 ATTORNEY LAMBRIANAKOS: I think
5 your witness is looking at Tong to figure
6 out what the answer to my question is.

7 THE WITNESS: So one example in
8 Tong, in Section C, it refers to DCT
9 processing on blocks of 8-by-8 pixels,
10 forward and fast DCT and inverse DCT.

11 BY ATTORNEY LAMBRIANAKOS:

12 Q. Which --

13 A. Tong defines -- on page -- pages 279
14 and 280.

15 And in Table IV, it describes a
16 direct -- in "Fast DCT" [as read]:

17 "A direct implementation of
18 both two-dimensional forward
19 discrete cosine transform and
20 inverse DCT on blocks of 8-by-8
21 pixels."

22 It doesn't define DCT that I can
23 find.

24 But to a person of ordinary
25 skill in the art, including in my experience,

1 DCT is discrete cosine transform, a process
2 used in image processing and video processing.

3 In my experience, designing a
4 discrete transfer -- cosine transfer process
5 for video data rates are -- requires parallel
6 processing to keep up with the -- the fast
7 pixel rate in video.

8 So a person of ordinary skill in
9 the art would know that and would know the DCT
10 unit has to be a parallel unit with multiple
11 PEs -- with multiple multipliers.

12 BY ATTORNEY LAMBRIANAKOS:

13 Q. Do you know what explicit disclosure
14 is?

15 ATTORNEY NIEBERG: Object to
16 form.

17 THE WITNESS: Where it comes to
18 bringing the person of ordinary skill in
19 the art knowledge, I can't say I can give
20 a legal definition. I can't define legal
21 terms at all in these proceedings.

22 BY ATTORNEY LAMBRIANAKOS:

23 Q. Does this document explicitly
24 disclose a parallel processing array?

25 A. Now you're --

1 ATTORNEY NIEBERG: Object to the
2 form.

3 THE WITNESS: -- returning to
4 the broader question. I have to continue
5 reading the document.

6 - - -

7 (Stenographer clarification.)

8 - - -

9 THE WITNESS: Now that you're
10 returning to the broader question, I have
11 to return to the document.

12 In addition to that, Tong has a
13 number of references that I'd have to
14 review to see if they disclose parallel
15 architectures.

16 For example, 26, Ackland and
17 D'Arcy, "A new generation of DSP
18 architectures."

19 BY ATTORNEY LAMBRIANAKOS:

20 Q. Could you repeat your answer because
21 the Court Reporter couldn't understand what you
22 were saying.

23 A. Tong has a number of references of
24 units that use floating-point hardware, and
25 some of those references may or may not have

1 multiple PEs. For example, reference 26,
2 reference 4. I'd have to review those
3 references as well.

4 Q. I'm just asking you whether Tong
5 himself discloses an array of these
6 reduced-bitwidth floating-point operators.

7 A. Well, as I said --

8 ATTORNEY NIEBERG: Object to the
9 form.

10 THE WITNESS: As I said, Tong,
11 in conjunction with knowledge of a person
12 with ordinary skill in the art, does.

13 BY ATTORNEY LAMBRIANAKOS:

14 Q. Does Tong actually explicitly say
15 anything about a processing array of those
16 processing elements?

17 Is there something you can point
18 me to in the document that says that?

19 A. Tong is a long --

20 ATTORNEY NIEBERG: Object to the
21 form.

22 THE WITNESS: -- document. I'm
23 reading that to see if that appears there.

24 Tong is a careful read. Because
25 it isn't a question of -- I don't believe

1 that I've considered it.

2 I also note, on page 283, in the
3 left-hand column, about halfway down
4 [as read]:

5 "the Intel MMX instructions
6 allow arithmetic operations on
7 multiple narrow subfields of a data
8 word simultaneously."

9 That is referring to some sort
10 of parallel processing.

11 BY ATTORNEY LAMBRIANAKOS:

12 Q. So are you contending that the Tong
13 processor is being -- strike that.

14 Are you contending that the Tong
15 processing element is being used in a parallel
16 processing system, based on that sentence?

17 ATTORNEY NIEBERG: Object to
18 form.

19 THE WITNESS: I'm contending
20 that Tong is -- Tong has a number of
21 references.

22 It refers to DCT which a person
23 of ordinary skill in the art knows has to
24 be done in parallel to support video data
25 rate. It refers to the MMX

1 instructions --

2 - - -

3 (Stenographer clarification.)

4 - - -

5 THE WITNESS: Could you ask the
6 question again, please?

7 BY ATTORNEY LAMBRIANAKOS:

8 Q. Are you contending that the Tong
9 processing element is being used in a parallel
10 processing system, based on that sentence?

11 ATTORNEY NIEBERG: Object to
12 form.

13 THE WITNESS: I'm contending
14 that Tong is motivated by parallel
15 processors, including the MMX processor,
16 including how a person of ordinary skill
17 in the art would build a discrete cosine
18 transfer unit to keep up with real-time
19 video and including probably a number of
20 the references that it refers to.

21 I'd have to go out and look for
22 those references.

23 BY ATTORNEY LAMBRIANAKOS:

24 Q. Are you saying that Tong is using a
25 reduced-bitwidth processor in a parallel

1 processing system when he tested his processing
2 element in a fast DCT application?

3 ATTORNEY NIEBERG: Object to
4 form.

5 THE WITNESS: Could you ask the
6 question again, please?

7 BY ATTORNEY LAMBRIANAKOS:

8 Q. Are you saying that Tong is using a
9 reduced-bitwidth processor in a parallel
10 processing system when he tested his processing
11 element in a fast DCT application?

12 ATTORNEY NIEBERG: Object to
13 form.

14 THE WITNESS: Now, I'll ask
15 you -- sorry.

16 BY ATTORNEY LAMBRIANAKOS:

17 Q. Do you need me to repeat it again?

18 Sir, did you hear my question?

19 A. Could you repeat the question,
20 please?

21 Q. Are you saying that Tong is using the
22 reduced-bitwidth processor in a parallel
23 processing system when he tested his processor
24 in a fast DCT application?

25 ATTORNEY NIEBERG: Object to

1 form.

2 THE WITNESS: What I am saying
3 is Tong is motivated by parallel
4 processing systems, including
5 parallelization needed for DCT, including
6 parallelization in the known MMX
7 architecture and including, most likely,
8 parallel units in some of the references
9 he cites.

10 BY ATTORNEY LAMBRIANAKOS:

11 Q. So now you know that the references
12 he cites discuss parallel architecture?

13 ATTORNEY NIEBERG: Object to
14 form.

15 THE WITNESS: I would have to
16 look at those references.

17 BY ATTORNEY LAMBRIANAKOS:

18 Q. So do you know or do you not know,
19 sir, what those references say regarding
20 parallel processing?

21 ATTORNEY NIEBERG: Object to
22 form.

23 THE WITNESS: Reviewing the list
24 of references, a number of references
25 refer to digital and video SIO

1 architectures for signal processing or
2 digital signal processing architectures.

3 It was common at the time for
4 such digital processors to include
5 parallel multipliers.

6 I was involved in the design of
7 a digital signal processor in the
8 mid-1980s, and that had parallel
9 arithmetic units.

10 So Tong is motivated by parallel
11 units.

12 I mean, in addition, Tong is
13 motivated to reduce the area and power.
14 And that is highly relevant in parallel
15 units, as I opine elsewhere in my report,
16 particularly area reduction.

17 BY ATTORNEY LAMBRIANAKOS:

18 Q. Do you see -- in Tong, on page 278,
19 on the right-hand side, near the bottom, you
20 see he's discussing the results of testing
21 particular applications on the Tong processor?

22 ATTORNEY NIEBERG: Object to
23 form.

24 THE WITNESS: No.

25

1 BY ATTORNEY LAMBRIANAKOS:

2 Q. Do you have any understanding of what
3 Tong's testing was about in this article? Can
4 you explain --

5 A. In this section, Tong was testing
6 floating-point programs for signal processing
7 applications. And the results were referring
8 to the testing of those floating-point
9 programs, not the floating-point architecture.

10 Tong talks about reducing area
11 and energy required to do floating-point
12 computation. And it does it in the context of
13 the literature. And the literature probably
14 includes parallel processors, and Tong is
15 motivated by that.

16 Tong is motivated by the need
17 for area reduction, which, as I opine elsewhere
18 in my report, is a motivator to build more
19 parallelism.

20 Q. And you can't find a single reference
21 in Tong to parallel processing, can you?

22 ATTORNEY NIEBERG: Object to
23 form.

24 THE WITNESS: A number of the
25 references refer to DSP and single

1 processing units.

2 You don't -- I would need to
3 read those references, but there's -- they
4 may include parallel processes because
5 that was common in DSP units at the time.

6 BY ATTORNEY LAMBRIANAKOS:

7 Q. So I asked you about Tong and not the
8 references that Tong cites to.

9 In Tong, is there any reference
10 anywhere to parallel processing?

11 ATTORNEY NIEBERG: Object to
12 form.

13 THE WITNESS: Yeah. Now I'm
14 confused.

15 You asked me to -- is there any
16 reference, and I'm not allowed to use the
17 references?

18 BY ATTORNEY LAMBRIANAKOS:

19 Q. I asked you whether Tong discloses --
20 refers to parallel processing using the Tong
21 processing elements.

22 ATTORNEY NIEBERG: Object to
23 form.

24 THE WITNESS: As I discuss -- as
25 I discuss, the DCT, to a person of

1 ordinary skill in the art, to keep up with
2 real-time video, I need parallel
3 processing. That has been my experience.

4 The -- and some of the
5 references that Tong uses to motivate this
6 work and explain the background in the
7 area are in a field of study where
8 parallel processing was commonly used at
9 the time.

10 ATTORNEY LAMBRIANAKOS: Let's
11 take a break.

12 - - -
13 (Whereupon, a short recess was
14 taken.)

15 - - -
16 ATTORNEY LAMBRIANAKOS: Okay.
17 Dr. Franzone, in the chat, there's a
18 document which we're marking as Exhibit 5
19 for the deposition. It is Exhibit 1006.

20 - - -
21 (Whereupon, Exhibit 5 was marked
22 for identification.)

23 - - -

24 BY ATTORNEY LAMBRIANAKOS:

25 Q. Would you please open that document.

1 A. Yes.

2 Q. Do you recognize this document, sir?

3 A. This is the Stuttard reference I've
4 used in my report.

5 Q. Have you read this document before,
6 sir?

7 A. Yes.

8 Q. When's the first time you saw the
9 Stuttard reference?

10 ATTORNEY NIEBERG: Object to
11 form.

12 THE WITNESS: I don't recall.
13 Sometime last year.

14 BY ATTORNEY LAMBRIANAKOS:

15 Q. You discuss the Stuttard reference
16 beginning at page 42 of your declaration.

17 Would you please turn to that
18 section?

19 A. Yes. Or more accurately, I've turned
20 to it.

21 Q. And do you see that from
22 paragraphs 76 through 81 you discuss Stuttard?

23 A. I discuss --

24 ATTORNEY NIEBERG: Object to
25 form.

1 - - -

2 (Stenographer clarification.)

3 - - -

4 THE WITNESS: These paragraphs
5 discuss Stuttard, but Stuttard is referred
6 to many times in this report.

7 BY ATTORNEY LAMBRIANAKOS:

8 Q. What was the problem that Stuttard
9 was attempting to solve?

10 ATTORNEY NIEBERG: Object to
11 form.

12 THE WITNESS: I don't present a
13 problem statement in this section of my
14 report.

15 BY ATTORNEY LAMBRIANAKOS:

16 Q. Would you please turn to the page
17 numbered 1 in the Stuttard reference.

18 A. I've turned to it.

19 Q. I'm sorry. What did you say, sir?

20 A. I have turned to it.

21 Q. Do you see, on page 1, Stuttard
22 discloses that in his system there's a host
23 computer and an array controller that controls
24 a SIMD array?

25 ATTORNEY NIEBERG: Object to

1 form.

2 THE WITNESS: Repeat the
3 question, please.

4 BY ATTORNEY LAMBRIANAKOS:

5 Q. Do you see on page 1 that Stuttard
6 discloses that in his system there is a host
7 computer and an array controller that controls
8 a SIMD array?

9 ATTORNEY NIEBERG: Object to
10 form.

11 THE WITNESS: Which lines are
12 you referring to?

13 BY ATTORNEY LAMBRIANAKOS:

14 Q. Generally, lines 16 through 24.

15 ATTORNEY NIEBERG: Object to
16 form.

17 THE WITNESS: Say the question
18 again, please.

19 BY ATTORNEY LAMBRIANAKOS:

20 Q. Do you see that Stuttard discloses
21 that in his system there is a host computer and
22 an array controller that controls a SIMD array?

23 ATTORNEY NIEBERG: Object to
24 form.

25 THE WITNESS: In those lines in

1 this patent Stuttard discloses that there
2 is [as read]:

3 "an array of SIMD processing
4 elements fed with instructions and
5 data by a dedicated controller.
6 Often the array controller is not
7 itself 'intelligent' and is, in
8 turn, controlled by a general
9 purpose processor, which also runs
10 the bulk of the application
11 software. The host processor will
12 execute most of the application
13 code; it will send data to be
14 processed to the SIMD array with an
15 indication of the function to be
16 performed, typically a pointer to
17 the start of a sequence of array
18 instructions or microinstructions."

19 BY ATTORNEY LAMBRIANAKOS:

20 Q. Do you see that following that
21 section, beginning at line 25 on page 1,
22 Stuttard discloses two programming problems?

23 A. I see that Stuttard states [as read]:

24 "This introduces two
25 programming problems."

1 Q. Now, what's your understanding of the
2 programming problems that Stuttard is referring
3 to here?

4 ATTORNEY NIEBERG: Object to
5 form. Scope.

6 THE WITNESS: Where do you find
7 that in my report, please?

8 ATTORNEY LAMBRIANAKOS: That
9 doesn't answer my question, sir.

10 Object to that answer as
11 nonresponsive.

12 THE WITNESS: Can you ask the
13 question again, please?

14 BY ATTORNEY LAMBRIANAKOS:

15 Q. What is your understanding of the
16 programming problems that Stuttard is referring
17 to here?

18 ATTORNEY NIEBERG: Object to
19 form. Scope.

20 THE WITNESS: Well, Stuttard
21 himself describes that [as read]:

22 "Firstly, the array controller
23 can only be programmed at a very low
24 level: a series of microcode, or
25 possibly assembler, instructions to

1 be executed by the array. This is
2 because the array controller is not
3 designed to work with the compiler.

4 "Secondly, this programming is
5 completely separated from the main
6 application code running on the host
7 processor. This may be 'wrapped up'
8 by providing C or C++ classes which
9 makes them appear more integrated
10 and reduces the complexity of
11 passing control between the host
12 processor and the SIMD array."

13 BY ATTORNEY LAMBRIANAKOS:

14 Q. So how does Stuttard propose to solve
15 that problem?

16 ATTORNEY NIEBERG: Object to
17 form. Scope.

18 THE WITNESS: Where do I cite --
19 discuss that in my report, please?

20 ATTORNEY LAMBRIANAKOS: Object
21 as nonresponsive.

22 BY ATTORNEY LAMBRIANAKOS:

23 Q. How does Stuttard propose to solve
24 that problem?

25 ATTORNEY NIEBERG: Object to

1 form. Scope.

2 THE WITNESS: I'd ask you to
3 clarify as to where I discuss that in my
4 report, please.

5 BY ATTORNEY LAMBRIANAKOS:

6 Q. The question pending is: How does
7 Stuttard propose to solve that problem?

8 Do you not know the answer to
9 that question, sir?

10 ATTORNEY NIEBERG: Object to
11 form. Scope.

12 THE WITNESS: One way in which
13 Stuttard addresses the specific problem
14 discussed in those few lines of
15 Stuttard -- Stuttard is a lot broader than
16 just programming problems and solutions.

17 Stuttard describes a -- one
18 embodiment of a solution on the next page.
19 So it's page 2, beginning at line 4.

20 [as read]:

21 "A preferable solution is to
22 provide a fully integrated
23 architecture where the same
24 processor can transparently process
25 both scalar and SIMD operations in a

1 fully integrated fashion. This
2 means a single program can be
3 written in the standard high-level
4 language such as C, which includes
5 all parts of the application - both
6 'normal' (scalar) data and parallel
7 data processing."

8 BY ATTORNEY LAMBRIANAKOS:

9 Q. And do you agree that Stuttard
10 discusses this approach in more detail at the
11 bottom of page 2, beginning at line 28, the
12 "Summary of the Invention," through at least
13 line 6 on page 3?

14 ATTORNEY NIEBERG: Object to
15 form.

16 THE WITNESS: Can you state the
17 question again, please?

18 BY ATTORNEY LAMBRIANAKOS:

19 Q. Do you agree that Stuttard discusses
20 this approach in more detail at the bottom of
21 page 2, beginning at line 28, the "Summary of
22 the Invention," through at least line 6 on
23 page 3?

24 ATTORNEY NIEBERG: Object to
25 form.

1 THE WITNESS: Stuttard might
2 also discuss this elsewhere in his
3 invention.

4 BY ATTORNEY LAMBRIANAKOS:

5 Q. Now, you create a combination of
6 Stuttard and Shirazi in your declaration,
7 right?

8 ATTORNEY NIEBERG: Object to
9 form.

10 THE WITNESS: The primary
11 reference is for the combination of
12 Shirazi and Stuttard.

13 BY ATTORNEY LAMBRIANAKOS:

14 Q. Would you please turn to page 68 of
15 your declaration.

16 Let me know when you're there,
17 please.

18 A. Sorry. Could you repeat that,
19 please?

20 Q. Could you please turn to page 68 of
21 your report.

22 A. I apologize.

23 Q. And let me know when you're there.

24 A. I apologize. I'm having problems
25 hearing.

1 Can you repeat that, please?

2 Q. Yes.

3 Would you please turn to page 68
4 of your declaration, and let me know when
5 you're there.

6 - - -

7 (Whereupon, there was an
8 off-the-record discussion.)

9 - - -

10 THE WITNESS: I'm on page 68.

11 BY ATTORNEY LAMBRIANAKOS:

12 Q. On the right-hand side, at the top,
13 is this your proposed combination of Stuttard
14 and Shirazi?

15 ATTORNEY NIEBERG: Object to
16 form.

17 THE WITNESS: I don't understand
18 the question.

19 BY ATTORNEY LAMBRIANAKOS:

20 Q. Is the figure on page 68 on the
21 right, the one that says "Stuttard-Shirazi"
22 above it, is that an illustration of your
23 combination of Stuttard with Shirazi?

24 ATTORNEY NIEBERG: Object to
25 form.

1 THE WITNESS: I discuss
2 combinations of -- I discuss the
3 Stuttard-Shirazi combination in multiple
4 places in the report, including in
5 paragraph -- pages 48 to 62, that proceed
6 the detailed claim analysis of -- this is
7 one aspect of one of the combinations I
8 present.

9 BY ATTORNEY LAMBRIANAKOS:

10 Q. So is -- the figure on page 68 on the
11 right entitled "Stuttard-Shirazi," is that
12 supposed to be a representation of the
13 combination that you are arguing renders the
14 claims obvious?

15 ATTORNEY NIEBERG: Object to
16 form.

17 THE WITNESS: This figure is
18 presented solely in the analysis of why
19 Stuttard-Shirazi discloses claim
20 element 1C.

21 1C is [as read]:

22 "a processing element array
23 compromising 'first' and 'second'
24 edge processing element[s]
25 positioned at the first edge of the

1 processing element array and 'first'
2 and 'second' interior processing
3 element[s] positioned at [first and
4 second] location[s] in the interior
5 of the processing array."

6 As I go on [as read]:
7 "Stuttard's 'processing
8 elements' (PEs) are in SIMD
9 'array.'"

10 Reference to Stuttard.

11 [As read]:

12 "Having a full range of
13 addressing modes and completely
14 separate memory blocks in each PE
15 make it simple to support poly
16 structures and poly pointers on the
17 SIMD array. Each processing element
18 of the SIMD array may comprise one
19 or more function units, a register
20 file, said local memory, and I/O
21 means."

22 I refer to a data processor as
23 claimed in claims 1, 3, or 5 [as read]:

24 "wherein the execution unit
25 comprises a SIMD part comprising an

1 array of processing elements adapted
2 to operate on said parallel data and
3 a scalar part adapted to operate on
4 said scalar data."

5 BY ATTORNEY LAMBRIANAKOS:

6 Q. Would you turn to page 62 of your
7 declaration, please.

8 A. Can I finish my answer, please?

9 Q. Oh, I thought you were done since you
10 stopped talking.

11 A. I go on.

12 On the bottom of page 67

13 [as read]:

14 "As discussed (Section" -- I
15 refer to the above analysis -- "and
16 illustrated below right, POSAs have
17 reason to make the array
18 two-dimensional in the
19 Stuttard-Shirazi processor."

20 I -- going to the next page,
21 I -- I bring in that aspect of that combination
22 as a figure. I repeat that figure from the
23 analysis and [as read]:

24 "As annotated above (right),
25 this obvious implementation of

1 Stuttard-Shirazi has a first edge PE
2 (red) and a second HP in (orange),
3 both positioned at the first edge of
4 the PE array (i.e., the left-hand
5 edge of the 2D array common to these
6 two PEs) and a first interior PE
7 (blue) at a first location in the
8 interior of the PE array (i.e. PEs
9 that are no longer along an outer
10 edge of the array) and a second
11 interior PE (green) located at the
12 second location in the interior of
13 the PE array, as claimed."

14 So this figure and the
15 discussion in this figure is in reference to
16 why this combination discloses claim
17 element 1C.

18 Q. Could you please turn to page 62 and
19 look at paragraph 105.

20 A. Yes.

21 Q. You see you say [as read]:

22 "Applying the above-discussed
23 principles to Stuttard-Shirazi would
24 have resulted in a two-dimensional
25 layout of poly PEs, an exemplary

1 design of which is depicted below
2 (right, which I adapted from
3 Stuttard Figure 7, left)."

4 Did I read that correctly, sir?

5 A. You're reading that paragraph
6 correctly, yes.

7 Q. And then going to page 63, do you
8 see, on the left, there is Stuttard's Figure 7;
9 and on the right is the exemplary design of the
10 Stuttard-Shirazi combination?

11 A. Yes.

12 Q. I have some questions about this
13 figure, sir.

14 Have you seen this figure
15 before?

16 A. Well, I include --

17 ATTORNEY NIEBERG: Object to
18 form.

19 - - -

20 (Stenographer clarification.)

21 - - -

22 THE WITNESS: I included it in
23 my report.

24 BY ATTORNEY LAMBRIANAKOS:

25 Q. Right.

1 Have you seen this figure
2 before?

3 ATTORNEY NIEBERG: Object to
4 form.

5 THE WITNESS: Before today?
6 Obviously.

7 BY ATTORNEY LAMBRIANAKOS:

8 Q. Did you prepare the Stuttard-Shirazi
9 figure on page 63?

10 ATTORNEY NIEBERG: Object to
11 form.

12 THE WITNESS: That's -- this is
13 getting into discussions with attorneys.

14 BY ATTORNEY LAMBRIANAKOS:

15 Q. It's a yes-or-no question, sir.

16 Did you or did you not prepare
17 the Stuttard-Shirazi figure on page 63?

18 ATTORNEY NIEBERG: Object to
19 form.

20 And I'll just caution
21 Dr. Franzon to answer the question to the
22 extent he can without revealing
23 attorney-client communications.

24 THE WITNESS: I don't understand
25 how I can do that.

1 ATTORNEY LAMBRIANAKOS: Counsel,
2 do you need to go off the record and
3 explain to your client, you know, how to
4 answer a yes-or-no question without
5 disclosing attorney-client communications?

6 ATTORNEY NIEBERG: Well, it may
7 be helpful to discuss with Dr. Franzon
8 this question, if we could take a moment
9 break.

10 ATTORNEY LAMBRIANAKOS: Sure.
11 I'll be happy to do that.

12 Thank you.

13 - - -

14 (Whereupon, a short recess was
15 taken.)

16 - - -

17 BY ATTORNEY LAMBRIANAKOS:

18 Q. Dr. Franzon, did you prepare the
19 figure on page 63 showing the Stuttard-Shirazi
20 combination?

21 ATTORNEY NIEBERG: Object to
22 form.

23 THE WITNESS: The figure was
24 provided to me by attorney after results
25 of discussions.

1 BY ATTORNEY LAMBRIANAKOS:

2 Q. And you're familiar with all the
3 details of this figure?

4 ATTORNEY NIEBERG: Object to
5 form.

6 THE WITNESS: I might need to
7 refer to Stuttard-Shirazi to clarify some
8 details -- correction, to the Stuttard
9 patent.

10 - - -

11 (Stenographer clarification.)

12 - - -

13 THE WITNESS: I need to -- I
14 might need to refer to the Stuttard patent
15 to refresh my mind on some details.

16 BY ATTORNEY LAMBRIANAKOS:

17 Q. In this figure, do you see below the
18 first row of PEs there's -- there are buses
19 which run horizontally in the figure?

20 ATTORNEY NIEBERG: Object to
21 form.

22 THE WITNESS: I don't understand
23 the question.

24 BY ATTORNEY LAMBRIANAKOS:

25 Q. Do you have the Stuttard-Shirazi

1 figure in front of you?

2 A. Yes.

3 Q. Do you see the first row of PEs shown
4 in that figure?

5 A. Yes.

6 Q. Part of the poly execution unit,
7 right?

8 A. Yes.

9 Q. And along the bottom part of those
10 PEs, do you see that there are two buses shown?

11 A. I see two arrows on this figure.

12 Q. Do you know what those arrows
13 represent, sir?

14 A. I was trying to find a reference in
15 my report or Stuttard that makes it explicit.

16 But my understanding is they
17 refer to the ClearConnect bus.

18 Q. Do you see in the figure that there
19 are arrows labeled with the number 64 that
20 appear to connect the PE in the middle of the
21 first row with those buses?

22 A. Where were we in my report again,
23 please?

24 Q. We're at page 63, at the top right,
25 the Stuttard-Shirazi combination figure.

1 A. And what was the question again,
2 please?

3 Q. Do you see the PE in the middle of
4 the first row of the poly execution unit?

5 A. I need to zoom in.

6 Repeat the question, please.

7 Q. I asked you if you see the PE in the
8 middle of the first row of the poly execution.

9 A. Yes.

10 Q. Do you see, toward the bottom of that
11 PE, there are two arrows or lines with arrows
12 at each end which appear to show connections
13 between the PE and the two buses?

14 ATTORNEY NIEBERG: Object to
15 form.

16 THE WITNESS: I don't understand
17 the question.

18 There's horizontal arrows and
19 there's vertical arrows, and there's no
20 unit labeled "bus."

21 BY ATTORNEY LAMBRIANAKOS:

22 Q. Do you see there are two arrows that
23 are vertical-labeled with the number 64 which
24 appear to show a connection between the PE in
25 the middle and the two buses?

1 A. I see an arrow 64 between the PIO
2 node and the SIO node and the two horizontal
3 directional lines that I think was the
4 ClearConnect bus -- that was most likely the
5 ClearConnect bus.

6 Q. And what's your understanding of what
7 those two arrows represent?

8 ATTORNEY NIEBERG: Object to
9 form.

10 THE WITNESS: On page 23 of
11 Stuttard and in the section "MTAP
12 Processor," it refers to [as read]:

13 "One PIO channel. AVCI port:
14 32-bit address, 64-bit data.
15 Transfer byte size: 4, 8, 16,
16 32 bytes per PE. Address modes:
17 directed and strided. One SOI
18 channel. AVCI port: 32-bit address,
19 64-bit data. Transfer size: Up to
20 128 bytes per PE."

21 So I believe it's referring to
22 those channels.

23 BY ATTORNEY LAMBRIANAKOS:

24 Q. So are you saying that the two
25 vertical arrows labeled with the number 64

1 going from the PE in the middle of the first
2 row to the two buses below are SIO channel and
3 PIO channel?

4 ATTORNEY NIEBERG: Object to
5 form.

6 THE WITNESS: These are
7 channels -- my interpretation of this
8 figure -- my current interpretation of
9 this figure, this is channels connecting
10 the PIO node and the SIO node to the
11 ClearConnect bus.

12 This is consistent with
13 Figure 8, which shows SIO and PIO
14 connected to the ClearConnect bus.

15 BY ATTORNEY LAMBRIANAKOS:

16 Q. Do you see, in the second row of PEs,
17 there are also arrows which go from the top of
18 that PE to those same buses?

19 A. I see two arrows, one of which is
20 marked "PEi."

21 Q. Is it your understanding that this
22 shows that the PE in the middle of the second
23 row of the poly execution unit is also
24 connected to the buses?

25 ATTORNEY NIEBERG: Object to

1 form.

2 THE WITNESS: So example in
3 paragraph 101, which is -- discussing a
4 slightly different representation of the
5 architecture but is consistent.

6 On page 59 [as read]:

7 "The red line in each figure
8 represents a channel connected to
9 each PE (e.g. Stuttard's PIO
10 channel)."

11 And I'm referring to the
12 two-dimensional layout on the next page,
13 which continues to be a ClearConnect bus
14 through the second row PEs, which the
15 signal we're referring to does not.

16 But the -- correction.

17 The dotted lines there are the
18 east-west connections, which the figure
19 we're referring to are solid on.

20 The -- the red channel -- the
21 red channels from the lower PE are
22 connecting PIO and it's reasonable to be
23 adding the SIO to the ClearConnect bus.

24 BY ATTORNEY LAMBRIANAKOS:

25 Q. Looking at the figure on page 63 for

1 the Stuttard-Shirazi combination, is it your
2 understanding that the arrows emanating from
3 the top portion of the PE in the middle of the
4 second row of the poly execution unit depicts
5 connections between the PE and the buses?

6 ATTORNEY NIEBERG: Object to
7 form.

8 THE WITNESS: The arrow PEi and
9 the unlabeled arrow represent PIO and SIO
10 channels from the -- from one example of
11 the PE array in the second row --
12 sub-array in the second row to the
13 ClearConnect bus.

14 BY ATTORNEY LAMBRIANAKOS:

15 Q. Is it your understanding of your
16 figure -- your Stuttard-Shirazi figure that
17 each of the PEs depicted in that figure is
18 connected to the buses?

19 ATTORNEY NIEBERG: Object to
20 form.

21 THE WITNESS: That is the idea
22 in drawing this figure, yes.

23 - - -

24 (Stenographer clarification.)

25 - - -

1 THE WITNESS: In drawing these
2 figures, all the PEs are connected to the
3 ClearConnect buses.

4 BY ATTORNEY LAMBRIANAKOS:

5 Q. You see that there are arrows shown
6 between the PEs in this figure, many of them
7 labeled with the number 32?

8 ATTORNEY NIEBERG: Object to
9 form.

10 THE WITNESS: Repeat the
11 question, please.

12 BY ATTORNEY LAMBRIANAKOS:

13 Q. Do you see that there are arrows
14 shown between the PEs in this figure, many of
15 which are labeled with the number 32?

16 A. There are multiple arrows with 32
17 written next to them? 32 is not a label. It's
18 a reference to the width of the data path.

19 - - -

20 (Whereupon, there was an
21 off-the-record discussion.)

22 - - -

23 BY ATTORNEY LAMBRIANAKOS:

24 Q. Do you see, sir, on the figure the
25 arrows which are located between the PEs to

1 their left and right, for the most part --

2 A. Yes.

3 Q. -- with the number 32 written on most
4 of them?

5 A. Yes.

6 Q. Do those arrows represent connections
7 between the PEs?

8 ATTORNEY NIEBERG: Object to
9 form.

10 THE WITNESS: In paragraph 101
11 of my report, I refer to the linear
12 layout, and the green lines -- the dotted
13 lines represent the swazzle path
14 connection between nearest neighbor PEs.

15 BY ATTORNEY LAMBRIANAKOS:

16 Q. Are -- the arrows that I was
17 referring to in my question between the PEs in
18 the Stuttard-Shirazi figure on page 63, are
19 those intended to illustrate the swazzle paths?

20 ATTORNEY NIEBERG: Object to
21 form.

22 THE WITNESS: They represent the
23 path -- swazzle path connections between
24 the nearest neighbor PEs.

25

1 BY ATTORNEY LAMBRIANAKOS:

2 Q. Those connections only go from left
3 to right.

4 Is that fair?

5 ATTORNEY NIEBERG: Object to
6 form.

7 THE WITNESS: The connections,
8 as drawn, are the connections for the
9 swazzle path connection left to right.

10 However, in paragraph 104 of my
11 report, I do refer to Exhibit 1081, which,
12 as I recall, is a ClearSpeed document.

13 [As read]:

14 "Further taught that 'a 2D
15 array with a two-dimensional
16 bidirectional (up, down, left,
17 right) nearest-neighbor
18 configuration, often known as a
19 mesh' was a 'common configuration'
20 and sometimes 'preferable to exploit
21 the 2D connectivity,' citing
22 Exhibit 1081 at 21.

23 So, you know, though this
24 particular figure doesn't show those
25 north-south connections, I have explained

1 that the -- that the -- Exhibit 1081,
2 which is contemporaneous with Stuttard,
3 is -- a scientist and his applicant,
4 ClearSpeed Technology, as I explain in
5 paragraph 104, also has north-south
6 connections.

7 BY ATTORNEY LAMBRIANAKOS:

8 Q. You're not proposing that the
9 Stuttard-Shirazi connection -- strike that.

10 You're not proposing that the
11 Stuttard-Shirazi combination includes the
12 north-south swazzle path connections, correct?

13 ATTORNEY NIEBERG: Object to
14 form.

15 THE WITNESS: A combination may
16 include north-south connections, as I just
17 explained, referring to paragraph 104 of
18 my report.

19 BY ATTORNEY LAMBRIANAKOS:

20 Q. Exhibit 1081 is not referencing your
21 obviousness combination, is it?

22 ATTORNEY NIEBERG: Object to
23 form.

24 THE WITNESS: It's a supporting
25 reference written by ClearSpeed -- it's a

1 supporting reference, as a scientist and
2 his applicant, ClearSpeed Technology, has
3 explained in paragraph 104.

4 BY ATTORNEY LAMBRIANAKOS:

5 Q. Exhibit 1081 is not part of your
6 grounds for obviousness, is it? Isn't your
7 combination just Stuttard and Shirazi?

8 ATTORNEY NIEBERG: Object to
9 form.

10 THE WITNESS: The primary
11 reference is Stuttard and Shirazi, but
12 this is a secondary reference.

13 It does support that a person of
14 ordinary skill in the art would be
15 motivated, seeing Exhibit 1108, to
16 introduce north-south connections to the
17 MTAP processor.

18 BY ATTORNEY LAMBRIANAKOS:

19 Q. Is it your testimony that the
20 Stuttard-Shirazi figure on page 63 incorporates
21 those north-south connections?

22 ATTORNEY NIEBERG: Object to
23 form.

24 THE WITNESS: So in this section
25 on two-dimensional PE arrays, I discuss in

1 paragraph 99, the bottom [as read]:

2 "A POSA would have understood
3 that the physical layout of an
4 actual computing chip was a matter
5 of design choice, as discussed
6 below."

7 And continue to the next page
8 [as read]:

9 "POSAs had reasons to
10 manufacture a physical chip using a
11 two-dimensional PE layout."

12 I then go on to explain reasons
13 for this, including the -- issues related
14 to resistance, heat dissipation, and
15 capacitance in paragraph 100.

16 In 101, I illustrate some of
17 those alternatives in the figure.

18 [As read]:

19 "As demonstrated below, both
20 layouts allow for linear-connected
21 swazzle path (only a connection to
22 one or two neighbors) but the
23 overall length of the channel can be
24 approximately half as long as the
25 length of the channel in the 1D

1 line."

2 This is referring to the
3 two-dimensional layout on top of page 60.

4 And I go on in this paragraph
5 [as read]:

6 "A POSA would have understood
7 that a 2D 'swazzle' path - i.e., an
8 interconnection between
9 north-east-west-south (so-called
10 'NEWS' connections) could also have
11 been conventional and advantageous
12 interconnection between PEs
13 physically arranged in two
14 dimensions, as I discuss below from
15 the Stuttard's applicant."

16 And 2D configurations were well
17 known at this time. I mean, I designed a
18 2D process as part of my PhD, which well
19 predates the -- this -- the -- 2009.

20 I go and explain that a POSA
21 would have been desirable to have chip
22 aspect ratios closer to 1 to reduce
23 stresses in paragraph 102. And that would
24 motivate 2D arrangements of processes.

25 And then I go on to explain that

1 [as read]:

2 "Other prior art corroborates
3 my opinion that a two-dimensional
4 interconnect technology (and
5 corresponding two-dimensional
6 physical technology) would have been
7 a conventional alternative to a
8 linear technology."

9 I cite Exhibit 1108, coauthored
10 by two of Stuttard's inventors, described
11 as a simple extension to the -- well, it
12 describes a SIMD array [as read]:

13 "including MTAP architectures
14 like Stuttard's and corroborates the
15 POSA's" -- position of person of
16 ordinary skill in the art --
17 "knowledge that with this
18 architecture, 'as the number PE
19 increases other (than linear)
20 interconnect technologies could be
21 introduced.'."

22 "1108 correlates that nonlinear
23 (e.g., 2D) interconnect technologies
24 would have been a well-known design
25 option for an MTAP architecture like

1 Stuttard's."

2 Then I explain [as read]:

3 "Similarly, Exhibit 1081 -
4 assigned to Stuttard's applicant
5 'ClearSpeed Technology' - teaches a
6 SIMD device similar to Stuttard's
7 SIMD processor for use with image
8 processing having a 'processing
9 element array' with 'PE
10 interconnections' that move data
11 'along the PE array (hereinafter
12 swazzled)' and discloses the array
13 would have its 'PE interconnection'
14 arranged in a '1D ring or line array
15 or 2D grid array.

16 "The interconnection techniques
17 are generally used: a 1D array/ring
18 and a 2D grid," quoting
19 Exhibit 1081.

20 Further quoting 1081 [as read]:

21 "a 2D array with
22 two-dimensional bidirectional (up,
23 down, left, right) nearest-neighbor
24 configuration, often known as mesh
25 was 'a common configuration' and

1 sometimes 'preferable to exploit the
2 2D connectivity.'"

3 Sometimes. There are
4 alternatives here.

5 [As read]:

6 "Thus, Exhibit 1108 and 1081
7 demonstrate that using a 2D array in
8 Stuttard-Shirazi would have been a
9 known technique (2D mesh) to improve
10 similar devices (parallel processor
11 having an array of PEs) in the same
12 way (by facilitating applications
13 that benefit full 2D connectivity
14 between PEs.

15 "Applying the above-discussed
16 principles to Stuttard-Shirazi will
17 result in a two-dimensional layout
18 of poly PEs, an exemplary design" --
19 so this is an example of -- "which
20 is depicted below (right, which I
21 adapted from Stuttard's Figure 7,
22 left)."

23 - - -

24 (Stenographer clarification.)

25 - - -

1 THE WITNESS: Okay.

2 -- "an exemplary design, which
3 is depicted below (right, which I
4 adapted from Stuttard's Figure 7,
5 left)."

6 So this figure is an exemplary
7 layout in a two-dimensional fashion.

8 BY ATTORNEY LAMBRIANAKOS:

9 Q. Does the Shirazi -- strike that.

10 Does the Stuttard-Shirazi figure
11 on page 63 incorporate the north-south
12 connections?

13 ATTORNEY NIEBERG: Object to
14 form.

15 THE WITNESS: The figure is an
16 example design. It doesn't directly
17 illustrate the north-south connections.

18 But, you know, a figure like
19 this is a block diagram, is the partial
20 representation of the design.

21 A person of ordinary skill in
22 the art, particularly given the other
23 disclosures I discussed, would have known
24 it's straightforward to add the
25 north-south connections to this figure in

1 a close variant of the drawing and figure.

2 BY ATTORNEY LAMBRIANAKOS:

3 Q. So is it your testimony that that
4 figure should be understood to include
5 north-south swazzle connections notwithstanding
6 that they're not drawn in the figure?

7 ATTORNEY NIEBERG: Object to
8 form.

9 THE WITNESS: That's not what I
10 said.

11 I said a person of ordinary
12 skill in the art, particularly given the
13 other disclosures that I just went
14 through, would have been motivated to add
15 north-south connections to this figure, as
16 I did when designing a 2D processor array
17 in the mid-1980s.

18 BY ATTORNEY LAMBRIANAKOS:

19 Q. So do you understand that the
20 Stuttard-Shirazi figure includes north-south
21 swazzle connections between the PEs?

22 ATTORNEY NIEBERG: Object to
23 form.

24 THE WITNESS: I believe I've
25 already answered that question.

1 BY ATTORNEY LAMBRIANAKOS:

2 Q. No, sir, you haven't.

3 A. The figure can be easily modified by
4 a person of ordinary skill in the art to
5 include north-south connections.

6 They are not explicitly shown in
7 the figure, but this figure is just a generic
8 general architecture showing a 2D array. It
9 would have been straightforward for a person of
10 ordinary skill in the art to add in north-south
11 connections.

12 Nor are north-south connections,
13 if I recall correctly, needed by the claims.

14 Q. So it would require a modification in
15 order for this figure to show north-south
16 swazzle connections between the PEs, correct?

17 ATTORNEY NIEBERG: Object to
18 form.

19 THE WITNESS: The figure, as
20 drawn, doesn't show the north-south
21 connections. It would have been a routine
22 modification to add the north-south
23 connections because it's very well known
24 to have architectures like that at this
25 time and well preceding this time.

1 BY ATTORNEY LAMBRIANAKOS:

2 Q. So in your view, a person with a
3 bachelor's degree and two years of computer
4 architecture experience would be able to add
5 north-south connections between these PEs.

6 Is that your testimony?

7 A. Yes, that's my testimony. That's
8 what I did about the same stage of my career.

9 Q. So two years out of school, you put
10 north-south swazzle connections between PEs.

11 Is that what you're saying under
12 oath?

13 ATTORNEY NIEBERG: Objection to
14 form. Outside the scope.

15 THE WITNESS: That's not what I
16 said.

17 I said, in the mid-1980s, during
18 my PhD, I designed a 2D mesh processor
19 that included north-south connections.

20 And that was, I think, three
21 years after I started my PhD. I don't
22 remember exactly. But somewhere two to
23 four years after I finished my bachelor's
24 degrees.

25

1 BY ATTORNEY LAMBRIANAKOS:

2 Q. But the way that you draw this
3 exemplary combination, you didn't draw
4 north-south connections between the PEs, right?

5 ATTORNEY NIEBERG: Object to
6 form.

7 THE WITNESS: In this exemplary
8 design, as I describe in paragraph 107 --
9 that I'm calling "exemplary design" --
10 it's my testimony that a person of
11 ordinary skill in the art would have been
12 aware of north-south connections, would
13 have been -- and, furthermore, would have
14 been motivated to include them by the
15 exhibits that I refer to that I --
16 ClearSpeed exhibits, specifically 1081.
17 And 1108 is coauthored by two Stuttard
18 inventors.

19 So it would have been a routine
20 modification that a person of skill in the
21 art could perform.

22 BY ATTORNEY LAMBRIANAKOS:

23 Q. So your combination includes the
24 north-south connections between the PEs, right?

25 ATTORNEY NIEBERG: Object to

1 form.

2 THE WITNESS: I present multiple
3 designs for this combination.

4 These designs include an example
5 with north-south connections, as described
6 in the text. It includes an example with
7 folded and round connections, as shown on
8 page 60, and would include repetitions of
9 the one-dimensional layout and
10 two-dimensional layouts, as specifically
11 illustrated.

12 BY ATTORNEY LAMBRIANAKOS:

13 Q. So the combination, as you present
14 it, includes the designs that you show in the
15 Stuttard-Shirazi figure and other designs which
16 you don't include in a figure that is
17 explicitly labeled a Stuttard-Shirazi
18 combination?

19 ATTORNEY NIEBERG: Object to
20 form.

21 THE WITNESS: And what I said
22 was it would have been routine
23 modifications to modify this figure to
24 support the designs.

25 And these are only designs --

1 this is a design choice up to the POSA --
2 that are consistent with the Stuttard
3 application and contemporaneous materials.

4 BY ATTORNEY LAMBRIANAKOS:

5 Q. So does the combination that you
6 present require north-south swazzle
7 connections?

8 ATTORNEY NIEBERG: Object to
9 form.

10 THE WITNESS: What I'm saying is
11 it would have been reasonable for a person
12 of ordinary skill in the art to make a
13 routine modification to include
14 north-south swazzle connections in a 2D
15 layout of PEs, and it would have been
16 reasonable for a person of ordinary skill
17 in the art to use a 2D layout of PEs.

18 And there's multiple ways of
19 connecting together, one of which is
20 illustrated in the Shirazi combination but
21 the others of which are described in my
22 report.

23 ATTORNEY LAMBRIANAKOS: Object
24 as nonresponsive.

25

1 BY ATTORNEY LAMBRIANAKOS:

2 Q. Does the combination that you present
3 for obviousness require north-south swazzle
4 connections?

5 ATTORNEY NIEBERG: Object to
6 form.

7 THE WITNESS: I don't understand
8 why you considered my previous response
9 nonresponsive.

10 It's a routine modification
11 to -- there's several -- there's several
12 layouts that are consistent with a 2D
13 array processor.

14 One of them is illustrated in --
15 as an example, in the figure we're
16 referring to. Others are referred to in
17 the text, including one alternative, which
18 would be you have north-south connections.

19 Other alternatives include
20 following around the swazzle path and, in
21 my opinion, include repeating the 1D
22 array.

23 These -- the advantages of the
24 2D layout were known to a person of
25 ordinary art in the skill at the time, and

1 these were routine modifications to the
2 original MTAP architecture.

3 ATTORNEY LAMBRIANAKOS: Object
4 as nonresponsive.

5 BY ATTORNEY LAMBRIANAKOS:

6 Q. Does --

7 A. I don't understand what you consider
8 nonresponsive.

9 Q. Does the combination of Stuttard and
10 Shirazi, as you presented in your invalidity
11 arguments, include north-south swazzle
12 connections between the processing elements?

13 A. I can't answer --

14 ATTORNEY NIEBERG: Object to
15 form.

16 THE WITNESS: I can't answer
17 the -- you want a yes-or-no answer. I
18 can't give a yes-or-no answer.

19 As I explained, I present
20 multiple examples of 2D layouts that would
21 have been consistent with the literature
22 at the time, would have been consistent
23 with a person of ordinary skill in the
24 art's interpretation of how to design --
25 how to lay out array processes.

1 BY ATTORNEY LAMBRIANAKOS:

2 Q. Sir, did you do anything to prepare
3 for today's deposition?

4 A. Yes.

5 ATTORNEY NIEBERG: Object to
6 form.

7 BY ATTORNEY LAMBRIANAKOS:

8 Q. Did you read your declaration?

9 A. Yes.

10 Q. Did you read the Shirazi and Stuttard
11 references?

12 A. Yes.

13 Q. Did you read the other references
14 that are cited in the declaration?

15 A. Not all of them.

16 Q. Did you speak with your attorneys,
17 meet with your attorneys to prepare?

18 ATTORNEY NIEBERG: I just want
19 to object to form.

20 Also you can answer "yes" or
21 "no" to this question, but I advise you to
22 not reveal the substance of any
23 attorney-client communications.

24 THE WITNESS: Yes.

25

1 BY ATTORNEY LAMBRIANAKOS:

2 Q. How long did you spend meeting with
3 your attorneys in preparation for today's
4 deposition?

5 A. As I recall --

6 ATTORNEY NIEBERG: Same
7 instruction --

8 Sorry, Dr. Franzon.

9 Just same instructions and same
10 objections.

11 THE WITNESS: I don't recall
12 exactly.

13 BY ATTORNEY LAMBRIANAKOS:

14 Q. Do you have any idea? Was it five
15 minutes or ten hours or somewhere in between?

16 A. Multiple hours over several days.

17 Q. How long did you spend reading your
18 declaration?

19 A. I don't recall.

20 Q. Was it in the order of hours or fewer
21 than -- less than an hour?

22 THE WITNESS: It was multiple
23 hours.

24 ATTORNEY NIEBERG: Just object
25 to form.

1 - - -

2 (Stenographer clarification.)

3 - - -

4 THE WITNESS: It was multiple
5 hours.

6 BY ATTORNEY LAMBRIANAKOS:

7 Q. And in the process of reading your
8 declaration, did you refresh your recollection
9 on what the grounds of obviousness are that
10 you're asserting here?

11 ATTORNEY NIEBERG: Object to
12 form.

13 THE WITNESS: Well, there's
14 multiple -- there's grounds which are
15 discussed for many, many pages here.

16 BY ATTORNEY LAMBRIANAKOS:

17 Q. Did you read them all so that you
18 could testify about them today?

19 ATTORNEY NIEBERG: Object to
20 form.

21 THE WITNESS: "Grounds" is a
22 legal term. I have a section here,
23 grounds -- Ground 1A, that goes on from
24 page 42 to page 103. This is -- this is
25 what's titled Ground 1A in my -- in my

1 report.

2 BY ATTORNEY LAMBRIANAKOS:

3 Q. Did you read those so that you could
4 testify for what they are?

5 ATTORNEY NIEBERG: Object to
6 form.

7 THE WITNESS: You want me to go
8 through this claim element by claim
9 element and discuss my grounds for what
10 have been disclosed that are obvious in
11 prior art in combination with a POSA's --
12 a person of ordinary skill in the art
13 knowledge?

14 BY ATTORNEY LAMBRIANAKOS:

15 Q. I asked you if you read them.

16 How does that question elicit
17 the response you just gave me?

18 ATTORNEY NIEBERG: Object to
19 form.

20 BY ATTORNEY LAMBRIANAKOS:

21 Q. Did you read the grounds? Yes or no?

22 "I read them"? "I didn't read
23 them"? Which is it?

24 ATTORNEY NIEBERG: Object to
25 form. Argumentative.

1 THE WITNESS: "Ground" is a
2 legal term. I am referring to it as the
3 complete discussion over that 60-odd
4 pages.

5 I read those 60-odd pages, yes.

6 BY ATTORNEY LAMBRIANAKOS:

7 Q. And do you understand what your
8 arguments are regarding obviousness and how you
9 combine the references to meet the asserted
10 claims?

11 ATTORNEY NIEBERG: Object to
12 form.

13 THE WITNESS: I've been
14 presenting that to you in the context of
15 the -- part of the -- in terms of 783, the
16 Stuttard-Shirazi combination.

17 BY ATTORNEY LAMBRIANAKOS:

18 Q. And does the Stuttard-Shirazi
19 combination, as you understand it, include
20 north-south swazzle connections between the
21 PEs?

22 ATTORNEY NIEBERG: Object to
23 form.

24 THE WITNESS: I've answered that
25 question multiple times. I give an

1 example where it doesn't include that and
2 an example where it does include that.

3 BY ATTORNEY LAMBRIANAKOS:

4 Q. So it's optional? It can either
5 include them or not?

6 A. Which claim element are you --

7 ATTORNEY NIEBERG: Object to
8 form.

9 THE WITNESS: Sorry.

10 Which claim element are you
11 referring to?

12 BY ATTORNEY LAMBRIANAKOS:

13 Q. I'm not referring to a claim element,
14 sir.

15 You have a figure which your
16 attorneys drew for you on page 63 that doesn't
17 show north-south swazzle connections. And I'm
18 asking you if they're there, even though I
19 can't see them.

20 ATTORNEY NIEBERG: Object to
21 form. Argumentative.

22 THE WITNESS: And as I've
23 answered multiple times, they're not
24 illustrated there. But I disclose in the
25 text combinations that are combined with

1 background knowledge, combined with other
2 Stuttard and ClearSpeed citations --
3 references that would have north-south
4 connections.

5 And it would have been routine
6 engineering for a person of ordinary skill
7 in the art to modify that figure to have
8 north-south connections.

9 BY ATTORNEY LAMBRIANAKOS:

10 Q. So in your view, the Stuttard-Shirazi
11 combination that you assert it validates the
12 claims includes north-south swazzle
13 connections, right?

14 ATTORNEY NIEBERG: Object to
15 form.

16 THE WITNESS: Now you're
17 referring to the claims.

18 Which claim element are you
19 referring to, please?

20 BY ATTORNEY LAMBRIANAKOS:

21 Q. I'm not referring to a claim element.

22 I'm asking you whether the
23 Stuttard-Shirazi combination that you assert it
24 validates the claims includes the north-south
25 swazzle connections.

1 ATTORNEY NIEBERG: Object to
2 form.

3 THE WITNESS: The claims
4 don't -- the claims don't need the
5 north-south swazzle connections.

6 But I'll just point out that a
7 POSA would have been motivated to include
8 them, as suggested by the other ClearSpeed
9 reference. And as was well known at that
10 time, it would have been a routine
11 modification.

12 But as I recall, the claims
13 don't actually require a north-south
14 connection. So I don't believe I discuss
15 this in the claim section. I'd have to
16 reread the claim section to verify that.

17 Let me start reading it.

18 BY ATTORNEY LAMBRIANAKOS:

19 Q. Looking at figure -- the figure --

20 A. You don't want me to answer the
21 question?

22 Q. I asked the questions.

23 A. You referred to --

24 Q. You're done answering, right? Were
25 you done?

1 A. No. I said I have to refer to the
2 claims, and that's what I'm about to do --

3 Q. There's no question --

4 A. -- in order to answer your question.

5 Q. There's no question pending.

6 A. You asked it in the context of the
7 claim, so I'm going to start reading the
8 claims.

9 Q. Looking at page 63, you -- back to
10 the Stuttard --

11 A. Can I finish my previous answer,
12 please?

13 ATTORNEY NIEBERG: Is there a
14 question pending at the moment?

15 ATTORNEY LAMBRIANAKOS: No,
16 there isn't. He just wants to talk. He's
17 got --

18 ATTORNEY NIEBERG: I think he
19 was answering the question. I think
20 you've withdrawn that question because you
21 didn't like the answer.

22 Is that what's happening here?

23 ATTORNEY LAMBRIANAKOS: No, not
24 at all.

25 He answered the question. He

1 wants to go off on some nonresponsive
2 discussion of some claim elements, which
3 we're not getting into because I'm not
4 going to spend the rest of this deposition
5 listening to nonresponsive speeches that
6 you've coached your witness to make on the
7 record.

8 So we're going to move on to
9 other questions that I have.

10 ATTORNEY NIEBERG: Well, I'm
11 going to respond to that.

12 THE WITNESS: So -- sorry. Go
13 ahead, Greg.

14 ATTORNEY NIEBERG: Well, you --
15 your opinion that he's been coached to
16 answer questions is inaccurate.

17 But beside the point, you asked
18 the question. He's answering it. If you
19 have -- if you want to wait until he's
20 finished and state an objection, and then
21 the board can rule on whether your
22 objection is proper.

23 But stop interrupting him while
24 he's answering. You can withdraw the
25 question then if you are not happy with

1 the answer he's given.

2 ATTORNEY LAMBRIANAKOS: Thank
3 you very much, Mr. -- is it Nieberg or
4 Nieberg?

5 ATTORNEY NIEBERG: Nieberg.

6 ATTORNEY LAMBRIANAKOS: Thank
7 you very much, Mr. Nieberg.

8 Moving on to the next question.

9 BY ATTORNEY LAMBRIANAKOS:

10 Q. Page --

11 THE WITNESS: Can we take a
12 break, please?

13 ATTORNEY LAMBRIANAKOS: Yeah.
14 Sure.

15 ATTORNEY NIEBERG: Can we break
16 for lunch?

17 ATTORNEY LAMBRIANAKOS: If you'd
18 like, sure.

19 - - -

20 (Whereupon, a lunch recess was
21 taken.)

22 - - -

23 BY ATTORNEY LAMBRIANAKOS:

24 Q. Going back to your declaration,
25 page 63, the Stuttard-Shirazi figure.

1 Do you have that in front of
2 you?

3 A. Yes.

4 Q. This combination shows that there
5 would be one PIO engine and one SIO engine in
6 the combination; is that right?

7 ATTORNEY NIEBERG: Object to
8 form.

9 THE WITNESS: Repeat the
10 question, please.

11 BY ATTORNEY LAMBRIANAKOS:

12 Q. Does the Stuttard-Shirazi
13 combination, as shown on page 63, include one
14 PIO engine and one SIO engine?

15 A. The figure shows one -- only one PE
16 with details -- with some details shown.

17 But it's my understanding that
18 each PE includes an SIO engine and a PIO
19 engine. For example, in Exhibit 1006, the
20 Stuttard invention, on page 6 [as read]:

21 "The streaming I/O means may
22 only used enabled PEs to take part
23 in the streaming operation."

24 That implies that all PEs are
25 able to -- implies to me that all PEs -- at

1 least to me, that all PEs are able to
2 participate in streaming I/O.

3 Q. Can you tell me what lines of page 68
4 of the -- Exhibit 1006 you're referring to?

5 A. Page -- lines 24 to 25.

6 And another example is on
7 page 10, starting with line 23. [As read]:

8 "The second mechanism is
9 streaming I/O (SIO), which allows
10 chunks of contiguous data to be
11 streamed directly into the memory
12 within PEs."

13 This is referring to PEs in
14 plural.

15 So I can bring in other support,
16 but it's my understanding that this -- these
17 I/O engines are present in all the PEs.

18 Q. Would you turn to figure 6 of
19 Stuttard, which is towards the end of the
20 document, page 4 of 6 of the figures.

21 A. Yes.

22 Q. Do you see Figure 6 shows a PE number
23 in -- on the x-axis and sine on the y-axis?

24 A. Yes.

25 Q. What does "sine" refer to here?

1 A. It refers to the sine function in
2 trigonometry.

3 Q. And what -- what is shown -- what is
4 the input of the sine function as shown on the
5 left on the y-axis?

6 ATTORNEY NIEBERG: Object to
7 form.

8 THE WITNESS: By the way,
9 there's an arrow in the figures in the
10 labeling in Stuttard, as I explained in my
11 report.

12 BY ATTORNEY LAMBRIANAKOS:

13 Q. Okay. Are you going to tell me what
14 the input of the sine function is in Figure 6?

15 ATTORNEY NIEBERG: Object to
16 form.

17 THE WITNESS: That question
18 didn't come up in my considerations.

19 I'm rereading Stuttard to see
20 what it says.

21 BY ATTORNEY LAMBRIANAKOS:

22 Q. I see your discussion of Figure 6 at
23 the bottom of page 12 of Stuttard, if that
24 helps.

25 A. That figure -- that citation with

1 Figure 6 is incorrect.

2 The figure is not indicating
3 power efficiency of MTAP architecture. It's
4 referring to the code on the previous page
5 where, in line 28, it calculates "angle = pe,"
6 which refers to the PE number, which is the
7 x-axis in the figure.

8 And then it calculates the sine
9 of the angle calculated by the PE number equals
10 PE times PI. PI is not a number. And then
11 sine is calculated with the sine of that angle.

12 So this figure is part of an
13 illustration, to quote line 17 [as read]:

14 "to give a feel for the way the
15 MTAP processor is programmed."

16 Q. All right. Let's go to your
17 declaration at page 77.

18 Let me know when you're there.

19 A. I'm there.

20 Q. You see here you're discussing
21 Figure 7 of Stuttard?

22 A. Yes.

23 Q. What are AVCIs?

24 A. The -- on page 76 of my report, I
25 describe --

1 Q. Page 77.

2 A. Yeah. But the -- you asked the --
3 what VCI says and --

4 Q. I apologize -- go ahead. You're
5 right.

6 A. [As read]:

7 "In Figure 7, the ClearConnect
8 nodes have corresponding virtual
9 component interfaces (VCIs) to the
10 processor core."

11 It goes on.

12 In paragraph 118 [as read]:

13 "Stuttard discloses that VCIs
14 are 'defined by the VSI Alliance.
15 The VSI Alliance teaches that VCI
16 provides a 'point-to-point
17 connection between two units.'"

18 And it cites 1088. And
19 paragraph 119 illustrates three advanced VCIs,
20 so AVCI, which stands for advanced virtual
21 component interface.

22 Q. All right. And then in
23 paragraph 119, little more than halfway down,
24 you write [as read]:

25 "The PIO and SIO AVCIs are for

1 PEs to exchange data with off-chip
2 devices (for example, the host)."

3 Do you see that?

4 A. Yes.

5 Q. And then you write [as read]:

6 "For example, the PIO is 'for
7 accessing memory external to the
8 MTAP core,' like accessing
9 'variable-sized data by the PEs.'"

10 Do you see that?

11 A. Yes.

12 Q. And then you say [as read]:

13 "Similarly, the SIO 'allows
14 chunks of contiguous data to be
15 streamed directly into the memory
16 within PEs.'"

17 Right?

18 A. Yes.

19 Q. All right. And then paragraph 120,
20 you say [as read]:

21 "Stuttard's Figure 7 shows that
22 these interfaces connect a
23 ClearConnect bus unit to respective
24 PIO/SIO 'engines,' which connect to
25 every PE in the poly-execution unit

1 array via the 'channels' discussed
2 above in this section."

3 Do you see that?

4 A. Yes.

5 Q. Now -- and then you confirm at the
6 end of paragraph 120, which is on page 78, you
7 say [as read]:

8 "Thus, the PIO/SIO AVCIs are
9 input-output interfaces that connect
10 to every PE in the processor core
11 (via their engines and channels)."

12 Right?

13 A. Yes.

14 Q. Now, if we turn to the Stuttard
15 reference, Exhibit 1006, it discusses the I/O
16 architecture on page 19 beginning at about
17 line 22; is that right?

18 A. It discusses it in multiple places.

19 Q. Do you agree that it discusses it --
20 it discusses the I/O architecture at least on
21 page 19 beginning at line 22?

22 A. This is one of the places where it
23 discusses I/O.

24 Q. Okay. At line 23, Stuttard says
25 [as read]:

1 "The I/O systems consist of
2 three parts: Controller, Engine,
3 and Node."

4 Do you see that?

5 A. Yes.

6 Q. And then it goes on to discuss the
7 controller, right?

8 A. Yes.

9 Q. In fact, there is a PIO controller
10 and an SIO controller, correct?

11 A. Yes.

12 Q. Those controllers decode I/O
13 instructions and coordinate with the rest of
14 the control unit and the mono processor, right?

15 A. Yes.

16 Q. So this indicates that the PIO and
17 SIO controllers manage the remainder of the I/O
18 system; is that right?

19 ATTORNEY NIEBERG: Object to
20 form.

21 THE WITNESS: I don't understand
22 the question.

23 BY ATTORNEY LAMBRIANAKOS:

24 Q. Well, let's move on a little.

25 So you see at line 28 it

1 mentions "engine"?

2 A. Yes.

3 Q. And it says [as read]:

4 "The I/O engines are basically
5 DMA engines which manage the actual
6 data transfer."

7 Right?

8 A. Yes.

9 Q. Then it says [as read]:

10 "There is a controller and
11 engine for each I/O channel. A
12 single controller can manage several
13 I/O engines."

14 Right?

15 A. Yes.

16 Q. So that means that the PIO and SIO
17 controllers manage their respective PIO and SIO
18 engines; is that right?

19 ATTORNEY NIEBERG: Object to
20 form.

21 THE WITNESS: Repeat your
22 question, please.

23 BY ATTORNEY LAMBRIANAKOS:

24 Q. I said: So that means that the PIO
25 and SIO controllers manage their respective PIO

1 and SIO engines; is that right?

2 ATTORNEY NIEBERG: Object to
3 form. Scope.

4 THE WITNESS: The -- Stuttard
5 says on line 25 -- starting at line 25
6 [as read]:

7 "The PIO and SIO controllers
8 decode I/O instructions and
9 coordinate with the rest of the
10 control unit and the mono processor.
11 The controllers synchronize with
12 software threads via semaphores.

13 "Engine. The I/O engines are
14 basically DMA engines which manage
15 the actual data transfer. There is
16 a control range for each I/O
17 channel. The single controller can
18 manage several I/O engines."

19 BY ATTORNEY LAMBRIANAKOS:

20 Q. Are you done?

21 A. Yes.

22 Q. So is it your understanding that the
23 PIO and SIO engines receive commands from the
24 PIO and SIO controllers?

25 ATTORNEY NIEBERG: Object to

1 form.

2 THE WITNESS: Repeat the
3 question, please.

4 BY ATTORNEY LAMBRIANAKOS:

5 Q. Is it your understanding that the PIO
6 and SIO engines receive commands from the PIO
7 and SIO controllers?

8 ATTORNEY NIEBERG: Object to
9 form.

10 THE WITNESS: They're under
11 control by the controllers.

12 I don't recall Stuttard
13 referring to them as commands. Let me
14 look for that.

15 No, Stuttard doesn't refer to
16 them as commands.

17 BY ATTORNEY LAMBRIANAKOS:

18 Q. How does the PIO controller, for
19 example, control the PIO engine?

20 A. The -- Stuttard is solid on that
21 level of detail, but person of ordinary skill
22 in the art would understand there's control
23 volumes coming from the I/O -- the controllers
24 to the engines.

25 Q. So referring to Figure 7, you're

1 pointing out that there are control lines from
2 the PIO controller to the PIO engine and the --
3 and a control line from the SIO controller to
4 the SIO engine; is that right?

5 A. Yes.

6 Q. And there are no other --

7 A. Let me rephrase that.

8 A set of control lines. I think
9 you said one control line.

10 Q. Okay. To be clear, there is a set of
11 control lines from the PIO controller to the
12 PIO engine, and there's a set of control lines
13 from the SIO controller to the SIO engine,
14 right?

15 A. Yes. A person of ordinary skill in
16 the art would understand that these control
17 lines are allowing a controller to control the
18 engine.

19 Q. I see.

20 And based on whatever control
21 information is received by the I/O engine, the
22 I/O engine then manages transfers of data along
23 the bus; is that right?

24 ATTORNEY NIEBERG: Object to
25 form.

1 THE WITNESS: The I/O engines
2 receive or transmit data to the AVCI
3 interfaces on the left of that figure and
4 also connect -- also communicate with the
5 ClearConnect bus that's shown on the
6 bottom of the figure.

7 BY ATTORNEY LAMBRIANAKOS:

8 Q. So just so I understand your
9 position, the I/O engine receives control
10 information from its respective controller, and
11 that engine will then cause the appropriate
12 data transfer to be executed; is that right?

13 ATTORNEY NIEBERG: Object to
14 form.

15 THE WITNESS: No. What I'd say
16 is that the I/O engines are connected to
17 the ClearConnect bus.

18 BY ATTORNEY LAMBRIANAKOS:

19 Q. Okay. But my question is different
20 than that.

21 I'm asking you whether the I/O
22 engine receives control information from its
23 respective controller and then causes a
24 particular data transfer to be executed along
25 the bus.

1 ATTORNEY NIEBERG: Object to
2 form. Scope.

3 BY ATTORNEY LAMBRIANAKOS:

4 Q. Is that correct?

5 A. I don't recall discussing that
6 specific question in my report.

7 Can you point in my report where
8 I discuss that?

9 Q. Let's look at Stuttard, which you
10 have reviewed.

11 At the bottom of page 19, we
12 read earlier that [as read]:

13 "The I/O engines are basically
14 DMA engines which manage the actual
15 data transfer."

16 A. Just a moment, please. It's
17 thinking.

18 Q. Line 29, it says [as read]:

19 "The I/O engines are DMA
20 engines which manage the actual data
21 transfer. There is a controller and
22 engine for each I/O channel."

23 Do you see that?

24 A. Yes.

25 Q. Does that mean that for a PIO channel

1 it has a controller and an engine?

2 A. Yes. This is in context of the
3 previous paragraph.

4 Q. And the same is true for the SIO
5 channel, correct?

6 ATTORNEY NIEBERG: Object to
7 form.

8 THE WITNESS: The controllers --
9 the PIO controller controls the PIO I/O
10 channel and the SIO I/O channel.

11 BY ATTORNEY LAMBRIANAKOS:

12 Q. Then on the next question page,
13 page 20, it says [as read]:

14 "Node. There is an I/O node in
15 each PE. The I/O engine activates
16 each node in turn allowing to
17 serialize the data transfers. The
18 nodes provide buffering of data to
19 minimize the impact of I/O on the
20 performance of the PEs."

21 Do you see that?

22 A. I see that.

23 Q. So when there's a data transfer on
24 one of the I/O buses, the I/O engine will
25 activate the appropriate node to allow the

1 transfer of data; is that right?

2 ATTORNEY NIEBERG: Object to
3 form. Scope.

4 THE WITNESS: It says [as read]:
5 "The I/O engine activates each
6 node in turn allowing the
7 serialization of the data
8 transfers."

9 BY ATTORNEY LAMBRIANAKOS:

10 Q. Yeah, I read that.

11 But I asked you whether you
12 agree that when there's a data transfer on one
13 of the I/O buses, the I/O engine will activate
14 the appropriate node to allow the transfer of
15 data.

16 ATTORNEY NIEBERG: Object to
17 form. Scope.

18 THE WITNESS: That's what I just
19 read. That's what it says. [As read]:

20 "The I/O engine activates each
21 node in turn allowing it to
22 serialize the data transfers."

23 So the I/O engine activates the
24 nodes to allow -- to allow data transfers.

25 ATTORNEY LAMBRIANAKOS: I'm

1 going to put in the chat Exhibit 1036.

2 This will be Exhibit 6 to the
3 deposition.

4 - - -

5 (Whereupon, Exhibit 6 was marked
6 for identification.)

7 - - -

8 BY ATTORNEY LAMBRIANAKOS:

9 Q. Please let me know when you have that
10 open in front of you.

11 A. I have it open.

12 Q. Have you seen this document before?

13 A. Yes.

14 Q. This is a Shirazi reference that you
15 rely on in your Stuttard-Shirazi combination?

16 A. Yes.

17 Q. Shirazi discusses creating custom
18 computing machines or CCMs; is that right?

19 ATTORNEY NIEBERG: Object to
20 form.

21 THE WITNESS: That is included
22 in the Shirazi discussion. It discusses
23 other things.

24 BY ATTORNEY LAMBRIANAKOS:

25 Q. And CCMs are customized for

1 particular applications?

2 ATTORNEY NIEBERG: Object to
3 form.

4 THE WITNESS: In the abstract,
5 it says [as read]:

6 "Such computationally intensive
7 algorithms are candidates for
8 acceleration using custom computing
9 machines being tailored for the
10 application."

11 BY ATTORNEY LAMBRIANAKOS:

12 Q. Now, on page 156, which is the second
13 page of the document, he identifies two
14 specific applications, the 2D FFT application
15 and the FIR filter application; is that right?

16 A. Yes.

17 Q. And Shirazi designed custom operators
18 to use in CCM to perform computations necessary
19 for these specific applications.

20 Is that fair?

21 ATTORNEY NIEBERG: Object to
22 form.

23 THE WITNESS: Repeat the
24 question, please.

25

1 BY ATTORNEY LAMBRIANAKOS:

2 Q. Shirazi designed custom operators to
3 use in the CCM to perform the computations
4 necessary for the specific applications that we
5 just identified; is that right?

6 ATTORNEY NIEBERG: Object to
7 form.

8 THE WITNESS: Shirazi presents
9 arithmetic operators.

10 For example, page 155, on the
11 right-hand column, I'll read [as read]:

12 "Image and digital signal
13 processing applications typically
14 require high calculation throughput.
15 The arithmetic operators presented
16 here were implemented for real-time
17 signal processing on the Splash-2
18 CCM, which include a 2-D fast
19 Fourier transform and a systolic
20 array implementation of an FIR
21 filter."

22 So they design arithmetic
23 operators that can be used on a number of
24 algorithms, potentially, including the FFT
25 and FIR. And they design arithmetic

1 operators.

2 BY ATTORNEY LAMBRIANAKOS:

3 Q. Where does he say a number of
4 operations?

5 ATTORNEY NIEBERG: Object to
6 form.

7 THE WITNESS: Well, it says
8 "include."

9 BY ATTORNEY LAMBRIANAKOS:

10 Q. Well, I'm sorry. You said that he
11 designed arithmetic operators that could be
12 used for a number of algorithms.

13 A. I'm sorry.

14 Q. Did you say "that could be used in a
15 number of algorithms"?

16 A. The FFT and FIR are algorithms in
17 this context.

18 Q. Right.

19 A. Then it states [as read]:

20 "The arithmetic operators
21 presented here were implemented for
22 real-time signal processing on the
23 Splash-2 CCM, which include the 2D
24 fast Fourier transform (FFT) and a
25 systolic array implementation of FIR

1 filter."

2 So Shirazi does not exclude
3 other applications.

4 Q. And beginning in Section 2.0, below
5 that and continuing to the next page, he
6 identifies the 2D FFT application and the FIR
7 filter application as the two applications that
8 he investigated as part of his design of these
9 operators; is that right?

10 ATTORNEY NIEBERG: Object to
11 form.

12 THE WITNESS: He describes
13 the -- in the middle of the left-hand
14 column of 156 [as read]:

15 "The 18-bit floating-point
16 format was developed for the FFT
17 application."

18 And further down in the last
19 paragraph [as read]:

20 "The second floating-point
21 format investigated was a 16-bit
22 representation used by the FIR
23 filter application."

24 So he describes the employment
25 of these formats.

1 BY ATTORNEY LAMBRIANAKOS:

2 Q. And then he discusses in the -- in
3 the paper the design of the various
4 floating-point operators.

5 And then on the last page,
6 page 162, he says [as read]:

7 "Each of the floating-point
8 arithmetic units has been
9 incorporated into two applications:
10 a 2D FFT and a FIR filter."

11 Do you see that?

12 A. Yes, I see that.

13 Q. And then the last couple of sentences
14 describe Figure 7 and 8 where he says
15 [as read]:

16 "An FIR tap design using a
17 floating-point adder and multiplier
18 unit is shown in Figure 7. The
19 complex floating-point multiplier
20 used in the 2D FFT butterfly
21 calculation is shown in Figure 8."

22 Right?

23 A. He says that, but he doesn't preclude
24 on other applications.

25 ATTORNEY LAMBRIANAKOS: Pass the

1 witness.

2 ATTORNEY NIEBERG: If you can
3 give me a five -- let's take a five-minute
4 break. I'll confer with my colleague to
5 see if we have any redirect.

6 ATTORNEY LAMBRIANAKOS: Sure.

7 - - -

8 (Whereupon, the record was read
9 as requested.)

10 - - -

11 ATTORNEY NIEBERG: Petitioners
12 have no redirect.

13 THE STENOGRAPHER: Counsel,
14 would you like an immediate rough draft
15 and expedited final or regular two weeks?

16 MS. HUNT: We'll take the same
17 as the patent owner is taking.

18 - - -

19 (Whereupon, the deposition
20 was concluded at 1:55 p.m.)

21 - - -

22

23

24

25

ATTORNEY'S NOTES

1	
2	- - -
3	-----
4	-----
5	-----
6	-----
7	-----
8	-----
9	-----
10	-----
11	-----
12	-----
13	-----
14	-----
15	-----
16	-----
17	-----
18	-----
19	-----
20	-----
21	-----
22	-----
23	-----
24	-----
25	

1 CERTIFICATE

2 I HEREBY CERTIFY that the
3 proceedings, evidence and objections are
4 contained fully and accurately in the
5 stenographic notes taken by me upon the
6 deposition of PAUL FRANZON, PhD, taken on
7 October 3, 2023 and that this is
8 a true and correct transcript of same.

9

10

11

12

13

Jennifer Miller, RMR, CCR, CRR
and Notary Public

14

15

16

17

18

19

20

21

22

23

24

25

(The foregoing certification of
this transcript does not apply to any
reproduction of the same by any means
unless under the direct control and/or
supervision of the certifying reporter.)

2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

216 E. 45th Street, Suite #903
NEW YORK, NEW YORK 10017
(212) 400-8845

CASE: GOOGLE LLC vs. SINGULAR COMPUTING LLC
DATE: OCTOBER 3, 2023
WITNESS: PAUL FRANZON REF: 8042

PAGE	LINE	FROM	TO
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

PAUL FRANZON

Subscribed and sworn to before me
this ____ day of _____, 20__.

Notary Public

A				
a.m 1:13	66:12	82:23	apply 148:22	array 48:14
A2 3:14	additional 25:20	and/or 148:24	Applying 83:22	49:10,20 50:9
abandon 53:10	address 90:14	angle 127:5,9,11	103:15	51:15 52:25
abandoning	90:16,18	annotated 82:24	approach 77:10	53:12 54:24
45:13	addresses 76:13	answer 9:17	77:20	55:13,24 56:8
able 107:4	addressing	29:5 45:11	appropriate	56:17 59:24
124:25 125:1	81:13	48:24 51:9,20	51:21 136:11	61:5,15 71:23
above-discussed	advanced 41:15	52:1 53:2,5	138:25 139:14	71:24 72:7,8
83:22 103:15	128:19,20	55:7,19,20	approximately	72:22,22 73:3
abstract 141:4	advantageous	58:6 60:20	99:24	73:6,14,17
academic 27:11	100:11	74:9,10 76:8	architecture	74:22 75:1,2
30:20 31:10,12	advantages	82:8 85:21	27:12 28:2,9	75:12 80:22
31:21,23	111:23	86:4 112:13,16	28:22 29:8,18	81:1,5,17,18
acceleration	advise 113:21	112:17,18	29:21 31:13,24	82:1,17 83:4,5
141:8	adviser 44:4	113:20 120:20	32:16,22 33:7	83:8,10,13
accessing 129:7	advising 43:19	121:4,11,21	33:17 34:7,11	93:11 96:15
129:8	advisory 43:12	122:16 123:1	34:21 37:19,24	101:12 102:11
accounts 32:10	Agency 41:15	answered	39:24 65:7,12	102:12,14,15
accurate 23:17	agree 56:15 77:9	105:25 117:24	67:9 76:23	102:21 103:7
23:21 24:20	77:19 130:19	118:23 121:25	92:5 101:18,25	103:11 105:16
accurately 70:19	139:12	answering	106:8 107:4	106:8 111:13
148:4	Ah 53:15	120:24 121:19	112:2 127:3	111:22 112:25
Ackland 60:16	ahead 18:17	122:18,24	130:16,20	130:1 142:20
Acrobat 6:8	45:16 48:23	anticipate 12:1	architectures	143:25
activate 138:25	122:13 128:4	apologize 78:22	29:15 41:1	array' 102:9
139:13	al 3:11	78:24 128:4	44:6,10 60:15	array.' 81:9
activates 138:15	algorithms	APPEAL 1:2	60:18 66:1,2	array/ring
139:5,20,23	141:7 142:24	appear 13:2	101:13 106:24	102:17
activities 29:16	143:12,15,16	75:9 88:20	area 33:7 66:13	arrays 98:25
activity 41:12	Alliance 128:14	89:12,24	66:16 67:10,17	arrow 90:1 93:8
actual 15:1 99:4	128:15	appears 61:23	69:7	93:9 126:9
132:5 133:15	allow 51:20 62:6	applicant 97:3	areas 30:20	arrows 88:11,12
137:14,20	99:20 138:25	98:2 100:15	arguing 80:13	88:19 89:11,11
adapt 47:20	139:14,24,24	102:4	argument 50:5	89:18,19,22
adapted 82:1,3	allowed 68:16	application 64:2	Argumentative	90:7,25 91:17
84:2 103:21	allowing 135:17	64:11,24 73:10	116:25 118:21	91:19 93:2
104:4	138:16 139:6	73:12 75:6	arguments	94:5,13,16,25
add 44:20	139:21	77:5 110:3	112:11 117:8	95:6,16
104:24 105:14	allows 125:9	141:10,14,15	arithmetic 3:13	art 8:25 9:7,13
106:10,22	129:13	144:6,7,17,23	3:16 62:6 66:9	9:18 11:15
107:4	alternative	applications	142:9,15,22,25	16:8,17 17:6
adder 145:17	101:7 111:17	66:21 67:7	143:11,20	17:13 18:6
adding 92:23	alternatives	103:12 141:1	145:8	26:23 27:21
addition 9:2,25	99:17 103:4	141:14,19	arranged 100:13	30:4,18 31:15
24:25 60:12	111:19	142:4,13 144:3	102:14	32:1 58:25
	analysis 3:16	144:7 145:9,24	arrangements	59:9,19 61:12
	80:6,18 82:15	applied 27:9	100:24	62:23 63:17

69:1 98:14 101:2,16 104:22 105:12 106:4,10 108:11,21 110:12,17 111:25 116:11 116:12 119:7 134:22 135:16 art's 112:24 article 67:3 articles 17:23 ASIC 35:2,8,10 35:14 36:12,17 36:25 37:11 42:17,18 43:25 aside 33:2,15 asked 14:7 22:23 49:24 50:15 53:19 55:18 68:7,15 68:19 89:7 116:15 120:22 121:6 122:17 128:2 139:11 asking 14:3 19:10 49:5,7 50:3,17 51:11 51:25 52:2 61:4 118:18 119:22 136:21 aspect 41:21 43:16,18 80:7 82:21 100:22 aspects 34:16 39:23 assembler 74:25 assert 119:11,23 asserted 19:15 117:9 asserting 5:7 115:10 assigned 102:4 assist 15:23 42:9 assistance 15:10 15:17 assistant 15:22	assistants 16:4 18:2 assisted 44:5 assume 22:14 Atlantic 2:7 attempting 71:9 attorney 3:4 4:2 4:5,15 5:10,21 6:4,9,17,23 7:8 7:12 8:2,8,12 8:16,21 9:4,9 9:15,21 10:2,6 10:11,14,18,22 11:1,3,7,11,18 11:22 12:5,8 12:20,24 13:4 13:7,11,14,23 14:1,6,9,15,18 15:9,13,21 16:1,7,10,16 16:19 17:5,8 17:11,15 18:1 18:3,8,16,25 19:8,17 20:2 20:12,16 21:5 21:16 22:2,6 22:17,19 23:10 23:15,23 24:5 24:7 26:9,13 28:3,6,10,21 29:1,19,24 30:6,10,16,25 31:8,16,20 32:2,13 33:1,9 33:14,19,24 34:3,5,8,18,22 44:19 45:8,15 46:19 47:3 48:6,11,17,22 48:25 49:4,12 49:16,22 50:2 50:11,16,20,22 51:17,22 52:4 52:6,23 53:6,8 53:21,23 54:1 54:9,11,15,17 54:22 55:1,5,9	55:11,15,21 56:2,6,10,14 56:19 57:8,14 57:21,25 58:2 58:4,11 59:12 59:15,22 60:1 60:19 61:8,13 61:20 62:11,17 63:7,11,23 64:3,7,12,16 64:25 65:10,13 65:17,21 66:17 66:22 67:1,22 68:6,11,18,22 69:10,16,24 70:10,14,24 71:7,10,15,25 72:4,9,13,15 72:19,23 73:19 74:4,8,14,18 75:13,16,20,22 75:25 76:5,10 77:8,14,18,24 78:4,8,13 79:11,15,19,24 80:9,15 82:5 84:17,24 85:3 85:7,10,14,18 86:1,6,10,17 86:21,24 87:1 87:4,16,20,24 89:14,21 90:8 90:23 91:4,15 91:25 92:24 93:6,14,19 94:4,8,12,23 95:8,15,20 96:1,5 97:7,13 97:19,22 98:4 98:8,18,22 104:8,13 105:2 105:7,18,22 106:1,17 107:1 107:13 108:1,5 108:22,25 109:12,19 110:4,8,23	111:1,5 112:3 112:5,14 113:1 113:5,7,18 114:1,6,13,24 115:6,11,16,19 116:2,5,14,18 116:20,24 117:6,11,17,22 118:3,7,12,20 119:9,14,20 120:1,18 121:13,15,18 121:23 122:10 122:14 123:2,5 123:6,9,13,15 123:17,23 124:7,11 126:6 126:12,15,21 131:19,23 132:19,23 133:2,19,25 134:4,8,17 135:24 136:7 136:13,18 137:1,3 138:6 138:11 139:2,9 139:16,25 140:8,19,24 141:2,11,21 142:1,6 143:2 143:5,9 144:10 145:1,25 146:2 146:6,11 ATTORNEY'S 147:1 attorney-client 14:22 16:13,23 19:4,12,21 85:23 86:5 113:23 attorneys 15:3 15:15 85:13 113:16,17 114:3 118:16 August 45:19 authored 15:2 15:19	automation 43:15,16 available 24:8 AVCI 90:13,18 128:20 136:2 AVCIs 127:23 128:25 130:8 Avenue 2:7,16 aware 108:12 B B 3:5 bachelor 25:3,8 25:17,18,19,20 25:23 bachelor's 25:14 25:25 27:7 30:19,24 31:3 31:11,22 107:3 107:23 back 21:8 26:14 37:25 39:8,10 39:19 40:13 121:9 123:24 background 69:6 119:1 based 3:17 5:8 62:16 63:10 135:20 basically 132:4 133:14 137:13 beginning 26:21 70:16 73:21 76:19 77:11,21 130:16,21 144:4 behalf 2:3,13 4:3,6 belief 10:3 believe 19:11 48:5 61:25 90:21 105:24 120:14 benefit 103:13 best 45:5 bidirectional 96:16 102:22
---	--	---	---	---

bits 45:1 52:14 56:25	C	certifying 148:25	68:8 128:18	120:8
block 104:19	C 2:1 4:1 58:8	channel 90:13	citing 96:21	client 86:3
blocks 58:9,20 81:14	75:8,8 77:4	90:18 91:2,3	claim 80:6,19	close 6:8 105:1
blue 83:7	C-A-D 45:23	92:8,10,20	83:16 116:8,8	closer 100:22
board 1:2 43:12 122:21	CAD 45:21	99:23,25	118:6,10,13	coached 122:6 122:15
book 42:15	Cadence 43:12	132:11 133:17	119:18,21	coauthored 101:9 108:17
Boston 2:8	calculated 127:9 127:11	137:22,25	120:15,16	code 43:6 73:13 75:6 127:4
bottom 26:25 66:19 77:11,20	calculates 127:5 127:8	138:5,10,10	claimed 81:23 83:13	collaborates 34:20
82:12 88:9	calculation 142:14 145:21	channels 90:22	claims 18:13	colleague 146:4
89:10 99:1	calling 108:9	91:7,9 92:21	80:14 81:23	column 62:3 142:11 144:14
126:23 136:6	campus 42:19	93:10 130:11	106:13 117:10	combination 19:15 20:1
137:11	campuses 42:11	chat 5:13,23	119:12,17,24	47:10 48:8
break 23:2,4	candidates 141:7	23:24 54:3	120:3,4,12	78:5,11 79:13
57:24 69:11	capacitance 99:15	69:17 140:1	121:2,8	79:23 80:3,13
86:9 123:12,15	career 24:22 107:8	check 21:14 22:9	clarification 12:15 23:9,13	82:21 83:16
146:4	careful 61:24	chip 38:24 39:5	32:18 35:4,25	84:10 86:20
bring 11:13	case 1:11 10:13 17:18 18:5	40:24 42:23,24	36:15 37:7	88:25 93:1
82:21 125:15	24:21 149:4	42:25 43:2,5	38:4,12 40:4	97:11,15,21
bringing 59:18	cases 21:12	43:17 44:2,12	40:20 43:9,23	98:7 108:3,23
broader 60:4,10 76:15	cause 136:11	45:24 99:4,10	44:8 53:17	109:3,13,18
broadly 42:20	causes 136:23	100:21	57:17 60:7	110:5,20 111:2
buffering 138:18	caution 14:20 16:12,21 19:2	chips 28:15,16	63:3 71:2	112:9 116:11
build 63:17 67:18	CCM 141:18 142:3,18	29:11 34:14,15	84:20 87:11	117:16,19
bulk 73:10	143:23	35:9,9,11,11	93:24 103:24	119:11,23
bullet 37:1	CCMs 140:18 140:25	35:15,15,16,19	115:2	124:4,6,13
bus 88:17 89:20 90:4,5 91:11	CCR 148:13	36:11,11,22	clarify 76:3 87:7	140:15
91:14 92:13,23	CCR-NJ 1:23	37:14 40:11,12	class 25:9 36:6	combinations 18:6 19:6 80:2
93:13 129:23	CCR-NM 1:23	44:3 46:1,7,14	37:16,24 39:2	80:7 118:25
135:23 136:5	CCR-WA 1:24	choice 99:5 110:1	39:12 42:16	combine 18:23 117:9
136:17,25	CERTIFICA... 148:1	chunks 125:10 129:14	classes 41:4 75:8	combined 18:11 118:25 119:1
buses 87:18	certification 148:21	circuit-level 35:18	clean 33:25	come 23:13 126:18
88:10,21 89:13	CERTIFY 148:2	circuits 35:17 46:13	clear 22:22 52:21 135:10	comes 8:25 59:17
89:25 91:2,18		citation 126:25	ClearConnect 88:17 90:4,5	coming 134:23
91:24 93:5,18		citations 119:2	91:11,14 92:13	commands 133:23 134:6
94:3 138:24		cite 49:19 75:18 101:9	92:23 93:13	134:13,16
139:13		cited 8:11,18 41:12 49:9	94:3 128:7	
butterfly 145:20		113:14	129:23 136:5	
byte 90:15		cites 65:9,12	136:17	
bytes 90:16,20			ClearSpeed 96:12 97:4,25	
			98:2 102:5	
			108:16 119:2	

common 10:8 66:3 68:5 83:5 96:19 102:25	28:16,17,22,24 29:8,18,21 31:13,24 32:16	93:18 94:2 136:16	consultant 33:22 41:9,20 42:9 42:17	135:2,3,11,13 135:17 136:10 136:23 137:21 138:1,9
commonly 69:8	32:21 33:7,13	connecting 91:9 92:22 110:19	consulting 25:1 40:23 41:7	controllers
communicate 136:4	33:16 34:14,15 34:17 35:16	connection 7:25 20:22 21:22 89:24 95:14 96:9 97:9 99:21 120:14 128:17	consumption 46:10 52:15 57:1	131:12,17 132:17,25 133:7,11,24 134:7,11,23 138:8
communication 16:23	36:21 37:17,22 37:23 38:24,25 39:5,9,17,20 39:24 40:11,12 40:24,25 42:24 43:5,16 44:2,3 46:7,14 71:23 72:7,21 107:3	connections 89:12 92:18 93:5 95:6,23 96:2,7,8,25 97:6,12,16 98:16,21 100:10 104:12 104:17,25 105:5,15,21 106:5,11,12,16 106:21,23 107:5,10,19 108:4,12,24 109:5,7 110:7 110:14 111:4 111:18 112:12 117:20 118:17 119:4,8,13,25 120:5	contained 7:25 148:4	controls 71:23 72:7,22 138:9
communicatio... 14:22 16:14 19:4,21 85:23 86:5 113:23	computer-aided 45:22 46:2,12	compiling 1:7 3:17 35:9,11 35:15,19 36:11 37:14 39:24 40:16 41:9,22 41:23,24 42:2 42:2,6,13 46:1 46:9,10 99:4 140:18 141:8 149:4	contemporane... 97:2 110:3	conventional 100:11 101:7
companies 42:12 43:15	computing 1:7 3:17 35:9,11 35:15,19 36:11 37:14 39:24 40:16 41:9,22 41:23,24 42:2 42:2,6,13 46:1 46:9,10 99:4 140:18 141:8 149:4	consider 9:14 112:7	contend 49:8 50:4,18 51:13	cook 52:3
compared 52:17 57:3	concluded 146:20	consideration 12:2	contending 62:12,14,19 63:8,13	coordinate 131:13 133:9
compiler 75:3	concurrently 25:14	connectivity 96:21 103:13	contention 48:12 49:17	core 128:10 130:10
complete 25:22 37:4 117:3	conduct 16:8	connectivity.' 103:2	context 67:12 117:14 121:6 138:2 143:17	core,' 129:8
completely 75:5 81:13	confer 146:4	consider 9:14 112:7	contiguous 125:10 129:14	correct 30:8 32:16 97:12 106:16 131:10 137:4 138:5 148:8
complex 31:4 32:6 36:5 37:11 39:13 145:19	configuration 96:18 102:24	considerations 126:18	continue 39:22 60:4 99:7	correction 87:8 92:16
complexity 75:10	configuration' 96:19 102:25	considered 29:17 62:1 111:8	continued 33:6	correctly 84:4,6 106:13
component 128:9,21	configurations 100:16	considerations 126:18	continues 92:13	correlates 101:22
components 28:25	confirm 130:5	considered 29:17 62:1 111:8	continuing 44:13 144:5	corresponding 101:5 128:8
comprise 81:18	confused 68:14	consistent 91:12 92:5 110:2 111:12 112:21 112:22	continuously 39:2 40:15	corroborates 101:2,14
comprises 81:25	conjunction 61:11		control 15:6 75:11 131:14 133:10,16 134:11,19,22 135:1,3,8,9,11 135:12,16,17 135:20 136:9 136:22 148:24	cosine 58:19 59:1,4 63:17
comprising 81:25	connect 88:20 129:22,24 130:9 136:4		controlled 73:8	Counsel 51:19 51:22 86:1 146:13
compromised 48:15 49:20	connected 91:14 91:24 92:8		controller 71:23 72:7,22 73:5,6 74:22 75:2 131:2,7,9,10 132:10,12 133:17 134:18	count 32:9 couple 145:13 course 41:14 courses 37:5 40:17 Court 60:21 cover 5:4
compromising 80:23				
computation 67:12				
computational... 141:6				
computations 141:18 142:3				
computer 27:8 27:12 28:1,8				

create 78:5	declaration 3:6	deposed 21:17	designed 38:8	51:15 52:24
creating 140:17	3:8 5:22 8:7,18	21:22	38:23 46:5	53:9,12,20
CRR 1:23	9:3,8 13:20	deposition 1:14	75:3 100:17	59:24 60:14
148:13	14:13 26:15	5:11 6:24	107:18 141:17	118:24
current 91:8	28:23 46:23	13:13,25 18:18	142:2 143:11	disclosed 50:15
currently 12:21	47:4,15 49:8	21:25 23:25	designing 28:24	56:17 116:10
custom 3:17	49:18 50:18,23	51:23 69:19	28:24 44:1	discloses 54:24
47:24 140:17	51:5,6 52:9	113:3 114:4	59:3 105:16	55:13,24 56:8
141:8,17 142:2	56:16 57:10	122:4 140:3	designs 44:5,12	61:5 68:19
customized	70:16 78:6,15	146:19 148:6	109:3,4,14,15	71:22 72:6,20
140:25	79:4 82:7	depositions	109:24,25	73:1,22 80:19
CV 3:10 24:12	113:8,14	22:24	desirable 100:21	83:16 102:12
24:13,17,19	114:18 115:8	describe 108:8	detail 77:10,20	128:13
25:2 34:19,25	123:24 127:17	127:25 145:14	134:21	disclosing 86:5
38:15 39:7	declarations	described 40:7	detailed 80:6	disclosure 49:6
D	7:21 8:1,10,11	101:10 109:5	details 87:3,8,15	59:13
D 3:1,3,10 4:1	8:19 9:20	110:21	124:16,16	disclosures
D'Arcy 60:17	13:12,24 14:7	describes 57:10	developed 40:7	104:23 105:13
DARPA 41:9,14	14:11,17 17:14	58:15 74:21	144:16	discovered
41:17 42:8	decode 131:12	76:17 101:12	develops 22:21	17:25 18:1
data 59:5 62:7	133:8	144:12,24	23:14	discrete 58:19
62:24 73:5,13	dedicated 73:5	deserve 52:1	device 102:6	59:1,4 63:17
77:6,7 81:22	defense 41:14,16	design 28:12,14	devices 103:10	discuss 48:13
82:2,4 90:14	define 58:22	28:15,15,17	129:2	65:12 68:24,25
90:19 94:18	59:20	29:9,10,11,12	diagram 104:19	70:15,22,23
102:10 125:10	defined 128:14	34:12,14 35:2	different 41:18	71:5 75:19
129:1,9,14	defines 58:13	35:8,8,10,10	42:4 92:4	76:3 78:2 80:1
132:6 133:15	definition 28:7	35:14,15,18	136:19	80:2 86:7
135:22 136:2	31:14,25 59:20	36:4,6,9,12,18	digital 28:16	98:25 100:14
136:12,24	degree 25:17,19	36:21,25 37:10	35:17 36:5,10	116:9 120:14
137:15,20	25:23 27:7	37:11,16,23	37:11 39:13	131:6 137:8
138:17,18,23	30:19,24 31:3	38:10,25 39:5	45:24 65:25	discussed 19:5
139:1,7,12,15	31:11,22 33:4	39:9,13,15,24	66:2,4,7	76:14 82:14
139:22,24	107:3	40:9,10,25,25	142:12	99:5 104:23
date 24:20 149:4	degrees 25:15	42:17,18,24,25	dimensions	115:15 130:1
day 149:23	25:25 107:24	43:2,5,14,15	100:14	discusses 77:10
days 114:16	demonstrate	43:17 44:1	direct 58:16,17	77:19 130:15
DCT 44:1,1,18	103:7	45:23,24,25	148:24	130:18,19,20
58:8,10,10,16	demonstrated	46:1,2,6,6,12	directed 90:17	130:23 140:17
58:20,22 59:1	99:19	66:6 84:1,9	directional 90:3	140:22 145:2
59:9 62:22	department	99:5 101:24	directions 43:20	discussing 21:3
64:2,11,24	25:22	103:18 104:2	directly 20:20	26:22 50:7
65:5 68:25	depends 32:11	104:16,20	20:21 104:16	51:14 66:20
decide 12:10,18	depicted 84:1	108:8,9 110:1	125:11 129:15	92:3 127:20
decided 10:16	93:17 103:20	112:24 142:22	director 40:18	137:5
13:1,9,18	104:3	142:25 144:8	disclose 48:14	discussion 6:21
	depicts 93:4	145:3,16	49:10,19 50:8	7:5 14:24

19:13 38:19 44:16 46:17 47:1 79:8 83:15 94:21 117:3 122:2 126:22 140:22 discussions 17:20 19:11,23 19:24 21:9 85:13 86:25 dissipation 99:14 DMA 132:5 133:14 137:14 137:19 doctor 26:2 document 3:15 23:24 24:8 53:24 59:23 60:5,11 61:18 61:22 69:18,25 70:2,5 96:12 125:20 140:12 141:13 documents 5:12 18:20 doing 33:18 42:12 dotted 92:17 95:12 double-check 21:8 Dr 4:22 5:22 14:21 16:12,22 19:3,20 33:24 46:21 51:20 69:17 85:21 86:7,18 114:8 draft 15:17 146:14 drafted 15:3,4 draw 108:2,3 drawing 93:22 94:1 105:1 drawn 96:8 105:6 106:20 drew 118:16	DSP 60:17 67:25 68:5 duly 4:10 E E 2:1,1 3:1,5 4:1 4:1,13 149:2 e.g 92:9 101:23 earlier 37:5,21 137:12 early 17:18 20:5 20:7 easily 106:3 east-west 92:18 ECE 35:2,8,10 35:12,14,17 36:4,19 37:17 39:16 40:7,8,9 edge 80:24,25 83:1,3,5,10 editorial 15:5 education 26:6 26:12 27:15 31:6 educational 31:9 effects 42:4 efficiency 127:3 either 56:13 118:4 elect 11:16 Electric 43:15 electrical 25:10 25:22 26:3 27:7,25 33:12 electronic 25:10 26:3 43:14 element 52:16 57:2,7,12 62:15 63:9 64:2,11 80:20 80:22 81:1,17 83:17 102:9 116:8,9 118:6 118:10,13 119:18,21 element[s] 80:24 81:3	elements 49:11 55:14,25 56:9 56:18 61:16 68:21 73:4 82:1 112:12 122:2 elements' 81:8 elicit 116:16 Elisabeth 2:6 4:7 Elisabeth.Hun... 2:11 emanating 93:2 embodiment 76:18 employed 42:8 employment 144:24 enabled 124:22 energy 67:11 engine 124:5,5 124:14,14,18 124:19 131:2 132:1,11 133:13 134:19 135:2,4,12,13 135:18,21,22 136:9,11,22 137:22 138:1 138:15,24 139:5,13,20,23 engineering 25:9,10,19,22 25:23 26:3 27:8,8,25 33:12,13 119:6 engines 125:17 130:11 132:4,5 132:13,18 133:1,13,14,18 133:23 134:6 134:24 136:1 136:16 137:13 137:14,19,20 engines,' 129:24 entirety 54:20 entitled 3:11,15	38:22 80:11 enumerated 30:19 equals 127:9 equivalent 27:10 32:7 Ericsson 43:3 error 6:8 et 3:11 evidence 8:9 17:24 48:4,10 148:3 exact 29:5 exactly 16:25 20:10 28:13 107:22 114:12 examined 4:11 example 42:2 47:22 52:10,22 58:7 60:16 61:1 92:2 93:10 103:19 104:16 109:4,6 111:15 118:1,2 124:19 125:6 129:2,6 134:19 142:10 examples 28:19 31:5 34:25 112:20 exascale 41:9,21 41:23 42:6,13 exchange 129:1 exclude 144:2 execute 73:12 executed 75:1 136:12,24 execution 81:24 88:6 89:4,8 91:23 93:4 exemplary 83:25 84:9 103:18 104:2,6 108:3,7,9 exhibit 5:14,18 5:24 6:1,24,25 7:1,1,17,18,18	7:19 13:13 18:17 23:25 24:2,6 26:14 26:16 46:22 50:23 54:2,3,6 69:18,19,21 96:11,22 97:1 97:20 98:5,15 101:9 102:3,19 103:6 124:19 125:4 130:15 140:1,2,5 exhibits 7:13 13:25 108:15 108:16 existed 42:21 expedited 146:15 experience 27:11,16 28:1 29:7,17,21 30:7,13,21,22 31:7,13,23 32:9,12,15 33:16 34:6,10 34:21 37:2 40:14 41:3,7 44:22,24 45:1 45:17 58:25 59:3 69:3 107:4 experiences 28:20 31:10 32:23,23 expert 10:9 explain 67:4 69:6 86:3 97:4 99:12 100:20 100:25 102:2 explained 96:25 97:17 98:3 112:19 126:10 explicit 59:13 88:15 explicitly 48:14 49:10,19 50:8 51:15 59:23
--	---	---	--	--

61:14 106:6 109:17 exploit 96:20 103:1 explosions 42:5 extension 101:11 extent 85:22 external 129:7	86:23 87:3,17 87:19 88:1,4 88:11,18,25 91:8,9,13 92:7 92:18,25 93:16 93:16,17,22 94:6,14,24 95:18 96:24 98:20 99:17 103:21 104:4,6 104:10,15,18 104:25 105:1,4 105:6,15,20 106:3,7,7,15 106:19 109:15 109:16,23 111:15 118:15 119:7 120:19 120:19 123:25 124:15 125:18 125:22 126:14 126:22,25 127:1,2,7,12 127:21 128:7 129:21 134:25 136:3,6 145:14 145:18,21 figures 94:2 125:20 126:9 file 8:6,15 9:3 10:1,4,9,12 11:16 81:20 filter 141:15 142:21 144:1,7 144:23 145:10 final 15:5 146:15 find 17:6 58:23 67:20 74:6 88:14 finish 23:3 53:2 82:8 121:11 finished 107:23 122:20 FIR 141:15 142:20,25 143:16,25	144:6,22 145:10,16 firm 20:18,20 first 4:10 25:9 25:18,18 34:3 70:8 80:25 81:3 83:1,3,6,7 87:18 88:3,21 89:4,8 91:1 first' 80:23 81:1 Firstly 74:22 five 26:1 114:14 146:3 five-minute 146:3 floating 3:16 41:25 floating-point 3:13 47:22,23 47:25 48:15 49:21 50:10 51:16 53:1 60:24 61:6 67:6,8,9,11 144:15,20 145:4,7,17,19 folded 109:7 follow-on 53:3 following 73:20 111:20 follows 4:11 foregoing 148:21 forget 39:12 form 8:3,13,22 9:10,22 10:7 10:15,23 11:8 11:23 12:9,25 13:8,15 14:2 14:10,19 15:14 16:2,11,20 17:9,16 18:9 19:1,18 20:13 21:6 22:3,18 23:11 26:10 28:4,11 29:2 29:25 30:11	31:1,17 32:3 33:10,20 34:9 34:23 37:1,3 45:9 48:7,18 49:1,13,23 50:12,21 51:18 52:5 53:7 54:12,18 55:2 55:16 56:3,11 56:20 57:15 59:16 60:2 61:9,21 62:18 63:12 64:4,13 65:1,14,22 66:23 67:23 68:12,23 70:11 70:25 71:11 72:1,10,16,24 74:5,19 75:17 76:1,11 77:15 77:25 78:9 79:16,25 80:16 84:18 85:4,11 85:19 86:22 87:5,21 89:15 90:9 91:5 92:1 93:7,20 94:9 95:9,21 96:6 97:14,23 98:9 98:23 104:14 105:8,23 106:18 107:14 108:6 109:1,20 110:9 111:6 112:15 113:6 113:19 114:25 115:12,20 116:6,19,25 117:12,23 118:8,21 119:15 120:2 124:8 126:7,16 131:20 132:20 133:3 134:1,9 135:25 136:14 137:2 138:7 139:3,17	140:20 141:3 141:22 142:7 143:6 144:11 formal 26:11 format 144:16 144:21 formats 40:8 144:25 formed 11:24 19:25 28:13 29:4 forms 41:18 forth 8:19 11:5 12:7,22 27:1 28:23 30:17 forward 58:10 58:18 found 17:13 four 107:23 Fourier 142:19 143:24 FP 52:17 57:3 FPGA 3:17 frame 27:22 30:5 Franzon 1:14 3:3,6,6,8,8,10 3:10,11,14,15 4:9,17,22 5:22 14:21 16:12,22 19:3,20 33:24 46:21 51:20 69:17 85:21 86:7,18 114:8 148:6 149:5,21 Fremd 2:16 front 5:16 7:14 24:10 47:4 88:1 124:1 140:10 full 81:12 103:13 fully 76:22 77:1 148:4 function 73:15 81:19 126:1,4 126:14
--	--	--	--	---

fundamentals 37:10,15 further 96:14 102:20 144:18 furthermore 108:13 future 43:20	122:4,8,11 123:24 126:13 140:1 good 4:22,23 19:25 57:24 Google 1:4 2:3 4:6 20:17,21 20:23 149:4 graduate 32:7 37:16 graduate-level 41:4 green 83:11 95:12 Greenfield 2:4 4:8 Greg 122:13 Gregory 2:5 4:5 Gregory.Nieb... 2:10 grid 102:15,18 Ground 18:11 18:13 115:23 115:25 117:1 grounds 5:7 18:5,7 19:6 98:6 115:9,14 115:21,23 116:9,21	44:11 helpful 86:7 helping 15:17 helps 126:24 hereinafter 102:11 high 142:14 high-level 77:3 high-scale 42:1 high-speed 46:12,13 higher-precisi... 52:18 57:4 highlights 44:22 highly 41:12 66:14 hired 16:4 honors 25:9 horizontal 89:18 90:2 horizontally 87:19 host 71:22 72:6 72:21 73:11 75:6,11 129:2 hour 57:22,23 114:21 hours 45:7 114:15,16,20 114:23 115:5 HP 83:2 Hunt 2:6 4:7 146:16	138:9,10,14,15 138:19,24,24 139:5,13,13,20 139:23 IBM 46:9 idea 18:23 93:21 114:14 identification 5:19 6:2 24:3 54:7 69:22 140:6 identified 142:5 identifies 141:13 144:6 illustrate 95:19 99:16 104:17 illustrated 82:16 109:11 110:20 111:14 118:24 illustrates 128:19 illustration 79:22 127:13 image 59:2 102:7 142:12 immediate 146:14 impact 138:19 implementation 58:17 82:25 142:20 143:25 implemented 142:16 143:21 implication 52:21 implies 124:24 124:25 important 42:7 43:18 45:23 46:4,10,14 improve 43:21 103:9 inaccurate 122:16 include 11:20 12:13 28:14,20 29:4 66:4 68:4	84:16 97:16 105:4 106:5 108:14 109:4,8 109:16 110:13 111:19,21 112:11 117:19 118:1,2,5 120:7 124:13 142:18 143:8 143:23 included 8:11 9:7 12:11 34:7 34:11,12,13,14 34:16 37:9 84:22 107:19 140:21 includes 28:23 29:8,9,11,12 29:13,14 32:22 35:14,18 67:14 77:4 97:11 105:20 108:23 109:6,14 119:12,24 124:18 including 30:13 30:14 35:9,11 35:16 36:11 41:4 42:3,4,5 58:25 63:15,16 63:19 65:4,5,7 80:4 99:13 101:13 111:17 142:24 incorporate 104:11 incorporated 17:13 145:9 incorporates 98:20 incorrect 24:24 127:1 increases 101:19 indicates 131:16 indicating 127:2 indication 73:15 individual's
G G 4:1 general 73:8 106:8 generally 72:14 102:17 generation 60:17 generic 106:7 getting 6:7 25:25 85:13 122:3 give 23:17 34:24 50:6 59:19 112:18 117:25 127:14 146:3 given 44:21 104:22 105:12 123:1 giving 23:20 go 6:9 18:17 22:24 25:21 39:7 45:16 48:23 63:21 81:6 82:11 86:2 91:17 96:2 99:12 100:4,20,25 116:7 122:1,12 127:16 128:4 goes 115:23 128:11 131:6 going 5:11 9:16 16:21 19:19 21:8 25:13 37:25 39:10,19 40:13 57:22 82:20 84:7 91:1 121:7	H H 3:5 half 99:24 halfway 41:8 62:3 128:23 happening 121:22 happy 86:11 122:25 hardware 60:24 hear 7:7,10,11 45:6 55:6 64:18 hearing 78:25 heat 99:14 held 27:24 helped 43:3	I i.e 83:4,8 100:7 I/O 81:20 124:21 125:2,9 125:17 130:15 130:20,23 131:1,12,17 132:4,11,13 133:8,13,16,18 134:23 135:21 135:22 136:1,9 136:16,21 137:13,19,22	IBM 46:9 idea 18:23 93:21 114:14 identification 5:19 6:2 24:3 54:7 69:22 140:6 identified 142:5 identifies 141:13 144:6 illustrate 95:19 99:16 104:17 illustrated 82:16 109:11 110:20 111:14 118:24 illustrates 128:19 illustration 79:22 127:13 image 59:2 102:7 142:12 immediate 146:14 impact 138:19 implementation 58:17 82:25 142:20 143:25 implemented 142:16 143:21 implication 52:21 implies 124:24 124:25 important 42:7 43:18 45:23 46:4,10,14 improve 43:21 103:9 inaccurate 122:16 include 11:20 12:13 28:14,20 29:4 66:4 68:4	84:16 97:16 105:4 106:5 108:14 109:4,8 109:16 110:13 111:19,21 112:11 117:19 118:1,2,5 120:7 124:13 142:18 143:8 143:23 included 8:11 9:7 12:11 34:7 34:11,12,13,14 34:16 37:9 84:22 107:19 140:21 includes 28:23 29:8,9,11,12 29:13,14 32:22 35:14,18 67:14 77:4 97:11 105:20 108:23 109:6,14 119:12,24 124:18 including 30:13 30:14 35:9,11 35:16 36:11 41:4 42:3,4,5 58:25 63:15,16 63:19 65:4,5,7 80:4 99:13 101:13 111:17 142:24 incorporate 104:11 incorporated 17:13 145:9 incorporates 98:20 incorrect 24:24 127:1 increases 101:19 indicates 131:16 indicating 127:2 indication 73:15 individual's

32:11	interior 81:2,4	joining 4:7	15:21 16:7,16	110:23 111:1
industry 27:11	83:6,8,11,12	37:25 39:3,25	17:5,11 18:3	112:3,5 113:1
30:20 31:12,23	International		18:16 19:8	113:7 114:1,13
33:23	3:14	K	20:2,16 21:16	115:6,16 116:2
information	internships 31:4	keep 25:1 59:6	22:6,19 23:15	116:14,20
135:21 136:10	32:8	63:18 69:1	23:23 24:5,7	117:6,17 118:3
136:22	interpret 57:5	key 43:16	26:13 28:6,21	118:12 119:9
input 15:17	interpretation	Knight 41:16	29:19 30:6,16	119:20 120:18
126:4,14	91:7,8 112:24	know 5:15 6:5	31:8,20 32:13	121:15,23
input-output	interrupting	7:21 17:12	33:1,14 34:5	123:2,6,9,13
130:9	122:23	21:7 22:14	34:18 44:19	123:17,23
instruction	introduce 98:16	23:3 24:9	45:15 46:19	124:11 126:12
114:7	introduced.'	50:24 59:9,9	47:3 48:11,22	126:21 131:23
instructions	101:21	59:13 65:11,18	49:4,16 50:2	132:23 133:19
62:5 63:1 73:4	introduces	65:18 76:8	50:16,22 51:22	134:4,17 136:7
73:18 74:25	73:24	78:16,23 79:4	52:6,23 53:8	136:18 137:3
114:9 131:13	invalidity 5:8	86:3 88:12	53:23 54:1,9	138:11 139:9
133:8	18:5 112:10	96:23 104:18	54:15,22 55:5	139:25 140:8
integrated 46:13	invention 77:12	127:18 140:9	55:9,11,21	140:24 141:11
75:9 76:22	77:22 78:3	knowledge 8:24	56:6,14 57:8	142:1 143:2,9
77:1	124:20	8:24 9:6,12,17	57:25 58:4,11	145:1,25 146:6
Intel 62:5	inventors	59:19 61:11	59:12,22 60:19	language 43:6
intelligent' 73:7	101:10 108:18	101:17 116:13	61:13 62:11	77:4
intend 11:4,20	inverse 58:10,20	119:1	63:7,23 64:7	large 42:3
12:22 13:5	investigated	known 65:6	64:16 65:10,17	law 20:18,20
intended 95:19	144:8,21	96:18 100:17	66:17 67:1	lay 112:25
intensive 41:20	involve 18:5	102:24 103:9	68:6,18 69:10	layout 83:25
141:6	involved 21:11	104:23 106:23	69:16,24 70:14	92:12 95:12
intention 30:21	21:13 40:24	111:24 120:9	71:7,15 72:4	99:3,11 100:3
inter 4:25	66:6	knows 62:23	72:13,19 73:19	103:17 104:7
interconnect	involving 20:23		74:8,14 75:13	109:9 110:15
46:11 101:4,20	IPR 3:7,9 5:12	L	75:20,22 76:5	110:17 111:24
101:23	5:14,23 21:23	label 94:17	77:8,18 78:4	layouts 99:20
interconnection	IPR2023-00397	labeled 88:19	78:13 79:11,19	109:10 111:12
100:8,12	1:11	89:20 90:25	80:9 82:5	112:20
102:16	IPR2023-395	94:7,15 109:17	84:24 85:7,14	learned 42:12
interconnectio...	5:1	labeling 126:10	86:1,10,17	left 37:5 84:3,8
102:13	IPRs 5:3,7	Lambrianakos	87:1,16,24	95:1 96:2,9,16
interconnectio...	Irvine 42:22,24	2:15 3:4 4:2,3	89:21 90:23	102:23 103:22
102:10	issues 99:13	4:15 5:10,21	91:15 92:24	104:5 126:5
interconnects	IV 58:15	6:4,9,17,23 7:8	93:14 94:4,12	136:3
40:11		7:12 8:8,16 9:4	94:23 95:15	left-hand 62:3
interface 40:25	J	9:15 10:2,11	96:1 97:7,19	83:4 144:13
128:21	Jedi 41:15	10:18 11:1,3	98:4,18 104:8	legal 59:20,20
interfaces 40:10	Jennifer 1:23	11:18 12:5,20	105:2,18 106:1	115:22 117:2
128:9 129:22	148:13	13:4,11,23	107:1 108:1,22	length 99:23,25
130:9 136:3	job 1:25 56:4	14:6,15 15:9	109:12 110:4	let's 6:23 18:17

45:18 46:20 69:10 127:16 131:24 137:9 146:3 level 27:2 29:14 30:17 74:24 134:21 line 23:3 73:21 76:19 77:11,13 77:21,22 92:7 100:1 102:14 125:7 127:5,13 130:17,21,24 131:25 133:5,5 135:3,9 137:18 149:6 linear 95:11 101:8,19 linear-connect... 99:20 lines 72:11,14,25 76:14 89:11 90:3 92:17 95:12,13 125:3 125:5 135:1,8 135:11,12,17 list 36:23 37:1 65:23 listed 37:21 39:15 listening 122:5 literature 67:13 67:13 112:21 little 128:23 131:24 LLC 1:4,7 2:3 149:4,4 LLP 2:14 local 81:20 located 83:11 94:25 location 83:7,12 location[s] 81:4 logic 29:12 35:9 35:11,15 37:10 37:15 43:1 long 19:23 22:24	24:22 61:19 99:24 114:2,17 longer 83:9 look 20:19 24:15 39:20 63:21 65:16 83:19 134:14 137:9 looking 18:15,19 53:24 58:5 92:25 120:19 121:9 lot 14:24 17:20 76:15 low 74:23 low-energy 46:9 lower 92:21 lunch 123:16,20 M M 4:13 machines 3:17 140:18 141:9 main 75:5 major 41:11 manage 131:17 132:5,12,17,25 133:14,18 137:14,20 manages 135:22 manner 51:21 mantissa 52:14 56:25 manufacture 99:10 mark 23:25 marked 5:18 6:1 24:2 54:6 69:21 91:20 140:5 marking 69:18 Massachusetts 2:8 materials 110:3 math 47:22 mathematics 25:4 27:9 matter 99:4	mean 13:22 20:14 28:8 33:5 50:19 66:12 100:17 137:25 means 41:23 49:25 77:2 81:21 124:21 132:16,24 148:23 mechanism 125:8 media 44:2,2 medications 23:19 meet 31:14,24 113:17 117:9 meeting 114:2 member 15:23 memorize 55:3,8 56:5 memory 81:14 81:20 125:11 129:7,15 mentioned 45:22 mentions 132:1 Mentor 43:13 mesh 102:24 103:9 107:18 mesh' 96:19 methodology 43:4 microcode 74:24 microinstructi... 73:18 microprocess 39:12 microprocessi... 38:7 microprocessor 36:7 38:8,22 39:15,21 microprocesso... 29:9 34:12 37:18,19 39:17 mid-1980s 66:8	105:17 107:17 middle 88:20 89:3,8,25 91:1 91:22 93:3 144:13 Miller 1:23 148:13 mind 12:6,22 31:11 87:15 minimize 138:19 minimizing 52:13 56:24 minutes 114:15 missing 24:23 MMX 62:5,25 63:15 65:6 models 46:11,13 modes 81:13 90:16 modification 106:14,22 108:20 110:13 111:10 120:11 modifications 109:23 112:1 modified 106:3 modify 109:23 119:7 modules 45:25 moment 86:8 121:14 137:16 mono 131:14 133:10 month 20:9 months 14:24 19:7 54:21 morning 4:22,23 motivate 69:5 100:24 motivated 63:14 65:3 66:10,13 67:15,16 98:15 105:14 108:14 120:7 motivator 67:18 move 45:2 46:20 102:10 122:8	131:24 Moving 123:8 MPEG 44:11 MPEG-2 44:11 MTAP 90:11 98:17 101:13 101:25 112:2 127:3,15 129:8 multichip 45:25 46:12 multiple 59:10 59:11 61:1 62:7 80:3 94:16 109:2 110:18 112:20 114:16,22 115:4,14 117:25 118:23 130:18 multiplication 47:23 multiplier 145:17,19 multipliers 59:11 66:5 N N 2:1 3:1 4:1,13 4:13 name 4:16 39:13 narrow 62:7 NC 38:1 39:3,25 near 66:19 nearest 95:14,24 nearest-neigh... 96:17 102:23 necessary 3:12 31:14,24 42:1 141:18 142:4 need 6:8 12:1 23:2,8 50:14 64:17 67:16 68:2 69:2 86:2 87:6,13,14 89:5 120:4 needed 43:20 65:5 106:13
---	--	---	--	--

neighbor 95:14 95:24 neighbors 99:22 netlist 43:7 new 2:18 10:19 10:24 11:17 60:17 149:2,2 NEWS' 100:10 Nieberg 2:5 4:5 4:6 8:2,12,21 9:9,21 10:6,14 10:22 11:7,11 11:22 12:8,24 13:7,14 14:1,9 14:18 15:13 16:1,10,19 17:8,15 18:8 18:25 19:17 20:12 21:5 22:2,17 23:10 26:9 28:3,10 29:1,24 30:10 30:25 31:16 32:2 33:9,19 33:24 34:3,8 34:22 45:8 48:6,17,25 49:12,22 50:11 50:20 51:17 52:4 53:6,21 54:11,17 55:1 55:15 56:2,10 56:19 57:14,21 58:2 59:15 60:1 61:8,20 62:17 63:11 64:3,12,25 65:13,21 66:22 67:22 68:11,22 70:10,24 71:10 71:25 72:9,15 72:23 74:4,18 75:16,25 76:10 77:14,24 78:8 79:15,24 80:15 84:17 85:3,10 85:18 86:6,21	87:4,20 89:14 90:8 91:4,25 93:6,19 94:8 95:8,20 96:5 97:13,22 98:8 98:22 104:13 105:7,22 106:17 107:13 108:5,25 109:19 110:8 111:5 112:14 113:5,18 114:6 114:24 115:11 115:19 116:5 116:18,24 117:11,22 118:7,20 119:14 120:1 121:13,18 122:10,14 123:3,4,5,5,7 123:15 124:7 126:6,15 131:19 132:19 133:2,25 134:8 135:24 136:13 137:1 138:6 139:2,16 140:19 141:2 141:21 142:6 143:5 144:10 146:2,11 node 90:2,2 91:10,10 131:3 138:14,14,16 138:25 139:6 139:14,21 nodes 128:8 138:18 139:24 non-attorney 15:11,16 nonlinear 101:22 nonresponsive 11:2 55:10 74:11 75:21 110:24 111:9	112:4,8 122:1 122:5 normal' 77:6 north-east-we... 100:9 north-south 96:25 97:5,12 97:16 98:16,21 104:11,17,25 105:5,15,20 106:5,10,12,15 106:20,22 107:5,10,19 108:4,12,24 109:5 110:6,14 111:3,18 112:11 117:20 118:17 119:3,8 119:12,24 120:5,13 Notary 148:14 149:25 note 52:10 62:2 notes 147:1 148:5 notice 52:19 notwithstandi... 105:5 NTU 42:17 nuclear 42:5 number 3:14 29:16 39:18 42:3 46:6 52:13 56:24 60:13,23 62:20 63:19 65:24 67:24 88:19 89:23 90:25 94:7,15 95:3 101:18 125:22 127:6,9,10 142:23 143:3 143:12,15 numbered 7:17 71:17 numerous 19:23 21:11	O O 4:1,13 oath 22:7 107:12 object 8:2,12,21 9:9,21 10:6,14 10:22 11:1,7 11:22 12:8,24 13:7,14 14:1,9 14:18 15:13 16:1,10,19 17:8,15 18:8 18:25 19:17 20:12 21:5 22:2,17 23:10 26:9 28:3,10 29:1,24 30:10 30:25 31:16 32:2 33:9,19 34:8,22 45:8 48:6,17,25 49:12,22 50:11 50:20 51:17,24 51:24 52:4,6 53:6 54:11,17 55:1,9,15 56:2 56:10,19 57:14 59:15 60:1 61:8,20 62:17 63:11 64:3,12 64:25 65:13,21 66:22 67:22 68:11,22 70:10 70:24 71:10,25 72:9,15,23 74:4,10,18 75:16,20,25 76:10 77:14,24 78:8 79:15,24 80:15 84:17 85:3,10,18 86:21 87:4,20 89:14 90:8 91:4,25 93:6 93:19 94:8 95:8,20 96:5 97:13,22 98:8	98:22 104:13 105:7,22 106:17 108:5 108:25 109:19 110:8,23 111:5 112:3,14 113:5 113:19 114:24 115:11,19 116:5,18,24 117:11,22 118:7,20 119:14 120:1 124:7 126:6,15 131:19 132:19 133:2,25 134:8 135:24 136:13 137:1 138:6 139:2,16 140:19 141:2 141:21 142:6 143:5 144:10 objection 34:1 107:13 122:20 122:22 objections 114:10 148:3 obtained 25:5 25:11 26:4 obvious 80:14 82:25 116:10 Obviously 85:6 obviousness 5:8 7:24 18:6,14 97:21 98:6 111:3 115:9 117:8 Ocotber 1:15 October 148:7 149:4 off-chip 129:1 off-the-record 6:21 7:5 38:19 44:16 46:17 47:1 79:8 94:21 offering 43:21 OFFICE 1:1
--	--	--	--	---

Oh 39:16 82:9	orange 83:2	66:18 70:16	138:3 144:19	14:25 16:9
okay 4:16 18:22	order 106:15	71:16,21 72:5	paragraphs	21:2
23:5,6 35:6	114:20 121:4	73:21 76:18,19	70:22 71:4	path 94:18
51:1 69:16	ordered 46:8	77:11,13,21,23	parallel 29:10	95:13,23,23
104:1 126:13	ordinary 8:25	78:14,20 79:3	34:13 42:1	96:9 97:12
130:24 135:10	9:6,13,18	79:10,20 80:10	52:24 59:5,10	99:21 100:7
136:19	11:14 26:23	82:6,12,20	59:24 60:14	111:20
one-dimensio...	27:20 29:22	83:18 84:7	62:10,15,24	paths 95:19
109:9	30:4,18,23	85:9,17 86:19	63:9,14,25	Paul 1:14 3:3,6
online 42:21	31:15,25 58:24	88:24 90:10	64:9,22 65:3,8	3:8,10 4:9
open 5:16 6:15	59:8,18 61:12	92:6,12,25	65:12,20 66:5	148:6 149:5,21
6:16 7:15,20	62:23 63:16	95:18 98:20	66:8,10,14	pe 81:14 83:1,4
24:9,10 69:25	69:1 98:14	99:7 100:3	67:14,21 68:4	83:6,8,11,13
140:10,11	101:16 104:21	104:11 109:8	68:10,20 69:2	88:20 89:3,7
opened 24:11	105:11 106:4	115:24,24	69:8 77:6 82:2	89:11,13,24
operate 82:2,3	106:10 108:11	118:16 121:9	103:10	90:16,20 91:1
operation	110:12,16	123:10,25	parallelism	91:18,22 92:9
124:23	111:25 112:23	124:13,20	67:19	92:21 93:3,5
operations	116:12 119:6	125:3,5,7,20	parallelization	93:11 98:25
41:25 53:1	134:21 135:15	126:23 127:4	65:5,6	99:11 101:18
62:6 76:25	organization	127:17,24	part 19:13 20:5	102:9,11,13
143:4	37:17,18 39:17	128:1 130:6,16	42:10 81:25	124:15,18
operators 48:16	39:20	130:21 137:11	82:3 88:6,9	125:22 127:5,6
49:21 50:9,10	original 112:2	138:12,13	95:1 98:5	127:9,10
51:16 61:6	originally 15:4	141:12,13	100:18 117:15	129:25 130:10
141:17 142:2,9	17:18,25 18:1	142:10 144:5	124:22 127:12	138:15
142:15,23	22:23	145:5,6 149:6	144:8	PEi 91:20 93:8
143:1,11,20	outer 83:9	pages 38:15 50:4	Part-time 40:22	pending 4:25
144:9 145:4	Outside 107:14	51:2,5 58:13	partes 4:25	23:3 58:1,3
opine 19:10	overall 99:23	80:5 115:15	partial 104:19	76:6 121:5,14
66:15 67:17	overlapped	117:4,5	participate	perform 28:16
opinion 8:5	25:17	paper 3:11	125:2	28:17 47:21
19:25 27:1,5	owner 1:8 2:13	145:3	particular 66:21	108:21 141:18
28:13 47:19	146:17	paperwork	96:24 136:24	142:3
48:5 50:6	owners 4:4	20:19	141:1	performance
101:3 111:21		paragraph	particularly	138:20
122:15	P	26:22 27:1,4	66:16 104:22	performed
opinions 7:24	P 2:1,1 4:1	27:19 47:17	105:12	73:16
8:10,18 10:19	P.C 2:4	52:11 56:15,22	parts 51:6 77:5	performing
10:25 11:4,14	p.m 146:20	80:5 83:19	131:2	33:17 42:10
11:17,19,25	packaging 37:13	84:5 92:3	Pass 145:25	period 19:7,24
13:17,18,21	page 3:2 26:19	95:10 96:10	passing 75:11	person 8:24 9:6
14:12,14,25	26:21,25 35:12	97:5,17 98:3	patent 1:1,2,8,9	9:12,18 11:14
15:7,8,20 48:5	35:13 40:6,14	99:1,15 100:4	1:10 2:13 4:3	26:22 27:20
Optimizing 3:12	41:6,8 45:19	100:23 108:8	73:1 87:9,14	29:22 30:3,23
option 101:25	47:7,15,18	128:12,19,23	146:17	31:15,25 58:24
optional 118:4	58:13 62:2	129:19 130:6	patents 5:4 7:25	59:8,18 61:11

62:22 63:16 68:25 98:13 101:15 104:21 105:11 106:4,9 107:2 108:10 108:20 110:11 110:16 111:24 112:23 116:12 119:6 134:21 135:15 personally 14:16 16:6 PEs 47:11,20 59:11 61:1 81:8 83:6,8,25 87:18 88:3,10 91:16 92:14 93:17 94:2,6 94:14,25 95:7 95:14,17,24 100:12 103:11 103:14,18 105:21 106:16 107:5,10 108:4 108:24 110:15 110:17 117:21 124:22,24,25 125:1,12,13,17 129:1 138:20 PEs.' 129:9,16 Peter 2:15 4:2 petition 8:15 24:14,18 petitioner 1:5 4:6 5:7 Petitioners 146:11 PH.D 3:3 PhD 1:14 3:6,8 4:9 27:24 30:13 32:15,20 32:23 100:18 107:18,21 148:6 philosophy 26:2 physical 99:3,10 101:6	physically 100:13 physics 25:4 PI 127:10,10 PIO 90:1,13 91:3,10,13 92:9,22 93:9 124:5,14,18 128:25 129:6 131:9,16 132:16,17,24 132:25 133:7 133:23,24 134:5,6,18,19 135:2,2,11,12 137:25 138:9,9 PIO/SIO 129:24 130:8 pixel 59:7 pixels 58:9,21 place 30:23 places 80:4 130:18,22 plambrianako... 2:20 play 9:1 please 5:15 6:4 6:18 7:20 12:19 24:9 26:19 31:19 46:21 47:7 49:15 53:3 54:14 63:6 64:6,20 69:25 70:17 71:16 72:3,18 74:7 74:13 75:19 76:4 77:17 78:14,17,19,20 79:1,3 82:7,8 83:18 88:23 89:2,6 94:11 119:19 121:12 123:12 124:10 132:22 134:3 137:16 140:9 141:24	plural 15:12 125:14 point 3:16 34:20 37:1 40:13 41:25 61:17 120:6 122:17 137:7 point-to-point 128:16 pointer 73:16 pointers 81:16 pointing 135:1 poly 47:11,21 81:15,16 83:25 88:6 89:4,8 91:23 93:4 103:18 poly-execution 129:25 port 90:13,18 portion 49:17 93:3 POSA 8:23 26:23 27:2,6 28:7 47:19 99:2 100:6,20 110:1 120:7 POSA's 101:15 116:11 POSAs 82:16 99:9 position 49:8 101:15 136:9 positioned 80:25 81:3 83:3 positions 14:5 possibly 74:25 potentially 142:24 power 3:11 46:9 52:14 56:25 66:13 127:3 practice 10:9 preceding 106:25 precision 52:13 52:16 56:24	57:2 Precision/Ran... 3:12 preclude 145:23 predates 100:19 preferable 76:21 96:20 103:1 preparation 114:3 prepare 13:5,10 13:12,24 14:8 16:5 85:8,16 86:18 113:2,17 prepared 14:4 preparing 15:11 15:24 present 10:24 13:20 14:12 40:16 48:10 71:12 80:8 109:2,13 110:6 111:2 112:19 125:17 presented 17:22 17:24 80:18 112:10 142:15 143:21 presenting 117:14 presents 11:17 15:7,20 48:4 142:8 pretty 39:25 prevent 23:20 previous 53:10 111:8 121:11 127:4 138:3 primary 78:10 98:10 principles 83:23 103:16 prior 16:8,17 17:6,12 18:6 37:2 101:2 116:11 privilege 19:12 probably 63:19	67:13 problem 71:8,13 75:15,24 76:7 76:13 problems 42:3 73:22,25 74:2 74:16 76:16 78:24 proceed 80:5 proceeding 5:24 6:25 7:2,17 26:17 46:23 proceedings 7:22 10:5 19:16 20:4,23 21:3,23 24:6 24:21 26:16 59:21 148:3 process 14:4 22:1,5 28:15 43:5 52:20 59:1,4 76:24 100:18 115:7 processed 73:14 processes 68:4 100:24 112:25 processing 29:10 34:13 44:3 48:14 49:10,11,20 50:8 51:15 52:15,20,25 55:14,25 56:9 56:18 57:1,6 57:11 58:9 59:2,2,6,24 61:15,16 62:10 62:15,16 63:9 63:10 64:1,1 64:10,10,23 65:4,20 66:1,2 67:6,21 68:1 68:10,20,21 69:3,8 73:3 77:7 80:22,24 81:1,2,5,7,17 82:1 102:8,8
--	--	--	---	--

112:12 142:13 142:17 143:22 processor 28:25 34:7,11,21 38:10 39:4 62:13 63:15,25 64:9,22,23 66:7,21 73:9 73:11 75:7,12 76:24 81:22 82:19 90:12 98:17 102:7 103:10 105:16 107:18 111:13 127:15 128:10 130:10 131:14 133:10 processors 53:13,14 54:25 63:15 66:4 67:14 professional 40:14 professor 33:11 33:13,15 40:15 program 39:21 77:2 programmed 74:23 127:15 programming 29:13,14 34:15 73:22,25 74:2 74:16 75:4 76:16 programs 67:6,9 project 38:7,21 38:22,23 41:15 46:8 projects 31:4 32:6,8 33:17 33:22 45:20 pronounced 4:16 proper 122:22 propose 75:14 75:23 76:7 proposed 79:13	proposing 97:8 97:10 provide 31:11 31:22 76:22 138:18 provided 86:24 provides 128:16 providing 75:8 Public 148:14 149:25 publication 3:14 41:13 published 42:14 purpose 73:9 pursuing 31:10 31:22 put 5:13,22 10:20 13:18 37:3 107:9 140:1 putting 23:24 54:2 Q Quantitative 3:16 question 12:18 22:13,21,23 23:7,14 29:6 31:19 45:11,12 45:14 48:24 49:15 51:20,25 52:1,2,10 53:3 53:5,11 54:14 55:19,20 58:1 58:3,6 60:4,10 61:25 63:6 64:6,18,19 72:3,17 74:9 74:13 76:6,9 77:17 79:18 85:15,21 86:4 86:8 87:23 89:1,6,17 94:11 95:17 105:25 113:21 116:16 117:25	120:21 121:3,4 121:5,14,19,20 121:25 122:18 122:25 123:8 124:10 126:17 131:22 132:22 134:3 136:19 137:6 138:12 141:24 questions 9:12 9:17 11:13 12:4 22:10 23:4 51:8,10 53:4 84:12 120:22 122:9 122:16 quote 127:13 quoting 102:18 102:20 R R 2:1 4:1 R&D 41:16 Rambus 40:18 40:23 range 81:12 133:16 rate 59:7 62:25 rates 59:5 ratios 100:22 read 27:5,14 30:2 47:18 52:11 54:10,16 54:20 55:20,22 56:22 58:16 61:24 62:4 68:3 70:5 73:2 73:23 74:21 76:20 80:21 81:6,11,23 82:13,23 83:21 84:4 90:12 92:6 96:13 99:1,8,18 100:5 101:1,12 102:2,20 103:5 113:8,10,13	115:17 116:3 116:15,21,22 116:22 117:5 124:20 125:7 127:13 128:6 128:12,24 129:5,12,20 130:7,25 132:3 132:9 133:6 137:12,12,18 138:13 139:4 139:10,19,19 141:5 142:11 142:11 143:19 144:14,19 145:6,15 146:8 reading 38:14 53:25 60:5 61:23 84:5 114:17 115:7 120:17 121:7 ready 4:20 real-time 63:18 69:2 142:16 143:22 really 10:12 43:17 reask 12:18 reason 22:20 23:16 82:17 reasonable 92:22 110:11 110:16 reasons 47:20 99:9,12 recall 5:5 16:24 19:9 39:8 55:12 70:12 96:12 106:13 114:5,11,19 120:12 134:12 137:5 receive 6:5 133:23 134:6 136:2 received 135:21 receives 136:9	136:22 recess 6:12 69:13 86:14 123:20 recognize 70:2 recollection 115:8 record 6:10 54:2 57:23 86:2 122:7 146:8 records 21:9,15 22:10 red 83:2 92:7,20 92:21 redirect 146:5 146:12 reduce 66:13 100:22 reduced 52:16 57:2 reduced-bitwi... 47:11,24 48:15 49:11,21 50:9 51:16 52:25 53:13 54:24 55:13,25 56:8 56:17 61:6 63:25 64:9,22 reduces 52:14 56:25 75:10 reducing 3:11 67:10 reduction 66:16 67:17 REF 149:5 refer 51:1 52:20 65:25 67:25 81:22 82:15 87:7,14 88:17 95:11 96:11 108:15 121:1 125:25 134:15 reference 50:15 54:4 56:16 61:1,2 67:20 68:9,16 70:3,9 70:15 71:17
--	---	--	---	---

78:11 81:10	register 43:6	96:11 97:18	rest 122:4	132:7,14,18
83:15 88:14	81:19	110:22 116:1	131:13 133:9	133:1 135:4,14
94:18 97:25	regular 146:15	126:11 127:24	result 16:17	135:23 136:12
98:1,11,12	regularly 40:1	137:6,7	103:17	139:1 140:18
120:9 130:15	related 3:6,8	REPORTED	resulted 17:2,3	141:15 142:5
140:14	11:14 45:24	1:22	83:24	143:18 144:9
references 16:25	99:13	reporter 60:21	results 17:21	145:22
17:1,6 48:13	relevant 9:14	148:25	66:20 67:7	right-hand
48:21 49:3,6,9	27:21 30:5	reports 13:21	86:24	66:19 79:12
49:18,25 50:1	45:1,4 66:14	15:12	retained 16:4	142:11
50:7,14 51:14	rely 9:7 140:15	represent 88:13	20:3,11,17,18	ring 102:14
56:5 60:13,23	remainder 48:4	90:7 93:9 95:6	20:22	RMR 1:23
60:25 61:3	131:17	95:13,22	return 60:11	148:13
62:21 63:20,22	remember 17:23	representation	returning 60:3	role 40:23 41:16
65:8,11,16,19	20:9 54:23	21:1 80:12	60:10	rough 146:14
65:24,24 67:25	55:23 56:7,12	92:4 104:20	reveal 14:21	round 109:7
68:3,8,17 69:5	107:22	144:22	16:13,22 19:3	routine 106:21
113:11,13	renders 80:13	represents 13:21	19:20 113:22	108:19 109:22
117:9 119:3	repeat 54:13	92:8	revealing 85:22	110:13 111:10
referencing	55:7 60:20	reproduction	review 48:20,20	112:1 119:5
97:20	64:17,19 72:2	148:23	48:23 49:3	120:10
referred 71:5	78:18 79:1	request 23:13	50:1,14 51:4,6	row 87:18 88:3
111:16 120:23	82:22 89:6	requested 146:9	60:14 61:2	88:21 89:4,8
referring 7:16	94:10 124:9	require 106:14	reviewed 137:10	91:2,16,23
62:9 67:7	132:21 134:2	110:6 111:3	reviewing 52:9	92:14 93:4,11
72:12 74:2,16	141:23	120:13 142:14	65:23	93:12
90:21 92:11,15	repeating	required 67:11	reviews 5:1	rule 122:21
92:19 95:17	111:21	requires 59:5	right 8:6,15 9:25	run 87:19
97:17 100:2	repetitions	reread 120:16	10:4,21 18:21	running 75:6
111:16 117:2	109:8	rereading	20:7 21:4 22:8	runs 47:14 73:9
118:11,13	rephrase 135:7	126:19	23:1,9 26:4	Rye 2:18
119:17,19,21	report 10:1,4,10	research 33:18	27:22 34:7	
125:4,13 127:4	10:13,20,25	33:21 41:15	48:1 50:24	S
134:13,25	11:5,16,21	44:23 45:1	51:3 56:1,9,18	S 2:1,5 3:5 4:1
refers 52:19	12:1,7,12,23	reserve 8:6,14	78:7 79:21	SACKS 2:4
58:8 62:22,25	13:3,6,19 15:1	9:2,25 10:21	80:11 82:16,24	saw 70:8
63:20 68:20	15:6,6,11,18	resistance 99:14	84:2,9,25 88:7	saying 9:5,16
90:12 126:1	15:19,24 16:5	respect 4:25	88:24 95:1	32:4 57:19
127:6	17:1,2 18:15	21:2,2	96:3,9,17	60:22 63:24
reflects 15:7	18:18 30:2	respective	102:23 103:20	64:8,21 65:2
refresh 87:15	42:14 48:9	129:23 132:17	104:3 108:4,24	90:24 107:11
115:8	66:15 67:18	132:25 136:10	119:13 120:24	110:10
refusing 51:19	70:4 71:6,14	136:23	124:6 127:16	says 25:3 42:17
regard 45:21	74:7 75:19	respond 122:11	128:5,22	47:11 61:18
regarding 37:13	76:4 78:21	response 11:9	129:17,19	79:21 126:20
52:9 65:19	80:4 84:23	11:12 12:3,3	130:12,17	128:3 130:24
117:8	88:15,22 95:11	111:8 116:17	131:7,14,18	132:3,9 133:5

137:18 138:13 139:4,19 141:5 143:7 145:6,14 145:23 scalar 76:25 77:6 82:3,4 school 25:13 107:9 science 25:4,16 25:17,21 scientist 97:3 98:1 scope 10:7,15 12:9,25 13:8 17:9 74:5,19 75:17 76:1,11 107:14 133:3 137:2 139:3,17 search 17:3 searches 16:9,18 17:4,7,21,22 second 41:25 81:4 83:2,10 83:12 91:16,22 92:14 93:4,11 93:12 125:8 141:12 144:20 second' 80:23 81:2 secondary 98:12 Secondly 75:4 section 47:9,14 48:4,13,20,24 49:10 50:8 51:1,12,12,15 58:8 67:5 70:18 71:13 73:21 82:14 90:11 98:24 115:22 120:15 120:16 130:2 144:4 sections 48:9 secure 42:25 43:2 see 25:6 26:21 42:16,22 47:9	47:12,14 60:14 61:23 66:18,20 70:21 71:21 72:5,20 73:20 73:23 83:21 84:8 87:17 88:3,10,11,18 89:3,7,10,22 90:1 91:16,19 94:5,13,24 118:19 125:22 126:19,22 127:20 129:3 129:10 130:3 131:4,25 135:19 137:23 138:21,22 145:11,12 146:5 seeing 98:15 seen 84:14 85:1 140:12 semaphores 133:12 semester 40:1,2 send 73:13 sentence 57:9 62:16 63:10 sentences 145:13 separate 81:14 separated 75:5 sequence 73:17 serialization 139:7 serialize 138:17 139:22 series 74:24 serve 43:17 served 43:11 set 8:19 11:5 12:7,22 27:1 28:22 30:17 135:8,10,12 seven 45:7 Shirazi 18:12,14 18:24 78:6,12	79:14,23 98:7 98:11 104:9 110:20 112:10 113:10 140:14 140:17,22 141:17 142:2,8 144:2 Shirazi's 47:24 short 6:12 69:13 86:14 show 89:12,24 96:24 106:15 106:20 109:14 118:17 showing 86:19 106:8 shown 88:3,10 94:5,14 106:6 109:7 124:13 124:16 126:3,4 136:5 145:18 145:21 shows 91:13,22 124:4,15 125:22 129:21 side 41:2 66:19 79:12 signal 66:1,2,7 67:6 92:15 142:12,17 143:22 SIMD 71:24 72:8,22 73:3 73:14 75:12 76:25 81:8,17 81:18,25 101:12 102:6,7 similar 102:6 103:10 similarly 36:20 36:24 43:1 102:3 129:13 simple 81:15 101:11 simulation 29:14 simultaneously	62:8 sine 125:23,25 126:1,4,14 127:8,11,11 single 67:20,25 77:2 132:12 133:17 Singular 1:7 20:24 21:2,13 149:4 SIO 65:25 90:2 91:2,10,13 92:23 93:9 124:5,14,18 125:9 128:25 129:13 131:10 131:17 132:16 132:17,25 133:1,7,23,24 134:6,7 135:3 135:4,13,13 138:4,10 sir 4:20 7:14 8:17 10:3 21:18 24:12 44:20 45:16 47:5 49:5 50:3 50:17,19 51:8 53:5,24 54:10 64:18 65:19 70:2,6 71:19 74:9 76:9 84:4 84:13 85:15 88:13 94:24 106:2 113:2 118:14 sitting 11:19 55:23 size 90:15,19 size' 52:17 57:3 skill 8:25 9:6,13 9:18 11:15 26:23 27:2,21 29:22 30:4,18 30:23 31:15,25 58:25 59:8,18 61:12 62:23	63:16 69:1 98:14 101:16 104:21 105:12 106:4,10 108:11,20 110:12,16 111:25 112:23 116:12 119:6 134:21 135:15 slightly 92:4 slow 38:16 small 52:17 57:3 so-called 100:9 software 73:11 133:12 SOI 90:17 solely 80:18 solid 92:19 134:20 solution 76:18 76:21 solutions 76:16 solve 71:9 75:14 75:23 76:7 sorry 11:10 22:21 34:2 55:6 58:2 64:15 71:19 78:18 114:8 118:9 122:12 143:10,13 sort 62:9 South 2:17 span 41:19 speak 113:16 specific 22:10 76:13 137:6 141:14,19 142:4 specifically 39:9 108:16 109:10 speeches 122:5 spend 25:25 114:2,17 122:4 Splash-2 142:17 143:23 staff 15:23
---	---	--	---	---

stage 107:8	97:9 104:9	87:7,25 88:25	supports 48:10	123:11 124:22
stand 14:13	structures 81:16	93:1,16 95:18	supposed 80:12	146:3,16
standard 77:3	student 15:23	97:9,11 98:20	sure 86:10	taken 6:13 30:22
stands 128:20	30:15 32:5	103:8,16	123:14,18	69:14 86:15
start 35:1,6	student's 31:9	104:10 105:20	146:6	123:21 148:5,6
45:18,18 73:17	31:21	109:15,17	swazzle 95:13	talk 51:23
120:17 121:7	study 41:10,21	117:16,18	95:19,23 96:9	121:16
started 17:18	42:9,10 69:7	119:10,23	97:12 99:21	talked 46:3
18:14 52:8	studying 30:24	123:25 124:12	105:5,21	talking 82:10
107:21	31:3	140:15	106:16 107:10	talks 67:10
starting 125:7	Stuttard 18:11	sub-array 93:12	110:6,14 111:3	Talon 43:1
133:5	18:24 70:3,9	subfields 62:7	111:20 112:11	tap 145:16
state 27:19	70:15,22 71:5	submitted 7:22	117:20 118:17	tasks 28:16,18
31:18 38:1	71:5,8,17,21	9:19 24:20	119:12,25	taught 35:20,22
39:3,25 77:16	72:5,20 73:1	Subscribed	120:5	36:4,8,9,12,17
122:20	73:22,23 74:2	149:22	swazzle' 100:7	36:19,21,25
statement 71:13	74:16,20 75:14	substance	swazzled')	37:19,20,24
states 1:1 42:7	75:23 76:7,13	113:22	102:12	38:2,9,21,25
73:23 143:19	76:15,15,17	substitute 27:16	sworn 4:10	39:2,4,11,18
Stenographer	77:9,19 78:1,6	31:6	149:22	39:23 42:16
12:15 32:18	78:12 79:13,23	success 42:19	synchronize	52:12 56:23
35:4,25 36:15	81:10 84:3	suggest 57:20	133:11	96:14
37:7 38:4,12	87:8,14 88:15	suggested 120:8	synthesis 43:4,4	teach 37:22
40:4,20 43:9	90:11 97:2	suggests 57:10	system 28:24,25	42:20
43:23 44:8	98:7,11 108:17	Suite 2:17 149:2	42:21 44:11	teaches 37:18
53:17 57:17	110:2 112:9	summary 44:21	62:16 63:10	102:5 128:15
60:7 63:3 71:2	113:10 119:2	77:12,21	64:1,10,23	teaching 35:1,7
84:20 87:11	121:10 124:20	superscalar 38:9	71:22 72:6,21	37:2 39:9
93:24 103:24	125:19 126:10	38:24 39:4	131:18	40:16 41:2,3
115:2 146:13	126:19,23	supervision	systemic 29:13	42:19 46:2
stenographic	127:21 128:13	148:25	systems 28:17	teachings 36:23
148:5	130:14,24	supplemental	29:10 34:13,17	team 42:10
STENOGRA...	133:4 134:12	11:5,21 12:7	36:5 37:11	technical 40:17
1:22	134:15,20	12:23 13:6	39:13 42:22,24	43:12
stop 122:23	137:9	supplementary	43:13 44:2	technique 103:9
stopped 82:10	Stuttard's 47:21	8:6,15 9:3 10:1	65:4 131:1	techniques
straightforward	81:7 84:8 92:9	10:10,13,20,25	systolic 142:19	102:16
104:24 106:9	100:15 101:10	11:16,25 12:12	143:25	technologies
streamed 125:11	101:14 102:1,4	13:2		101:20,23
129:15	102:6 103:21	supplied 24:13	T	technology
streaming	104:4 129:21	24:17	T 3:5 4:13	37:23 39:1,10
124:21,23	Stuttard-Shir...	support 8:10,18	T-O-N-G 53:22	42:7 97:4 98:2
125:2,9	19:14 47:10	48:5 62:24	Table 58:15	101:4,6,8
Street 149:2	79:21 80:3,11	81:15 98:13	tabular 37:3	Technology'
stresses 100:23	80:19 82:19	109:24 125:15	tailored 141:9	102:5
strided 90:17	83:1,23 84:10	supporting	take 23:4 49:7	tell 44:25 45:16
strike 62:13	85:8,17 86:19	97:24 98:1	69:11 86:8	125:3 126:13

ten 114:15	time 8:4 13:17	100:3	25:18 27:10	understanding
tenure 32:24	14:12 19:24	total 25:24	30:20,22 31:12	5:6 18:4 24:19
33:3	22:25 23:1	track 25:1	31:22 32:10	67:2 74:1,15
term 115:22	27:21 30:5	TRADEMARK	33:4 44:25	88:16 90:6
117:2	42:21 57:24	1:1	45:3 73:22,24	91:21 93:2,15
terms 59:21	66:3 68:5 69:9	transcript 33:25	83:6 88:10,11	124:17 125:16
117:15	70:8 100:17	148:8,22	89:11,13,22,25	133:22 134:5
Tessera 42:22	106:25,25	transfer 43:6	90:2,7,24 91:2	understood
test 36:10	111:25 112:22	59:4,4 63:18	91:19 99:22	22:15 99:2
testability 46:5	120:10	90:15,19 132:6	100:13 101:10	100:6 105:4
46:7	times 21:20	133:15 136:12	107:3,9,22	unit 47:21 52:20
tested 64:1,10	37:25 71:6	136:24 137:15	108:17 128:17	59:10,10 63:18
64:23	117:25 118:23	137:21 138:23	141:13 144:7	81:24 88:6
testified 4:11	127:10	139:1,12,14	145:9 146:15	89:4,20 91:23
testify 115:18	titled 115:25	transfers 135:22	two-dimensio...	93:4 129:23,25
116:4	titles 24:23	138:17 139:8	58:18 82:18	131:14 133:10
testimony 23:17	today 4:24 9:17	139:22,24	83:24 92:12	145:18
23:21 57:13	11:20 12:4	transform 58:19	96:15 98:25	unit' 52:17 57:3
98:19 105:3	21:3 23:17	59:1 142:19	99:11 100:3	United 1:1 42:7
107:6,7 108:10	55:23 85:5	143:24	101:3,5 102:22	units 52:18 57:4
testing 46:7	115:18	transmit 136:2	103:17 104:7	60:24 65:8
66:20 67:3,5,8	today's 5:11	transparently	109:10	66:9,11,15
tests 36:10	113:3 114:3	76:24	two-issue 38:8	68:1,5 81:19
text 109:6	Tong 3:11 52:12	TRIAL 1:2	38:23	145:8
111:17 118:25	52:24 53:9,12	trigonometry	two-year 41:19	units.' 128:17
Thank 4:19	53:15,20,21,25	126:2	typically 73:16	unlabeled 93:9
11:11 34:2,4	54:3,10,16,24	true 138:4 148:8	142:13	up' 75:7
86:12 123:2,6	55:4,8,12,18	truthful 23:17		use 9:19 16:25
Theodore 2:16	55:20,22,24	23:20	U	18:17 60:24
things 24:23	56:8,13,16,23	try 38:16	ultimately 17:13	68:16 102:7
30:14 41:1	57:10,11 58:5	trying 42:25	19:14	110:17 141:18
140:23	58:8,13 60:12	45:11 55:19	undergraduate	142:3
think 17:17	60:23 61:4,10	88:14	30:14 32:5,24	uses 69:5
44:21 45:3	61:14,19,24	Tuesday 1:15	33:3 36:6	
57:9,22 58:4	62:12,14,20,20	turn 26:14,19	undergraduates	V
90:3 107:20	63:8,14,24	43:6 46:22	36:22	v 1:6
121:18,19	64:8,21 65:3	47:7 70:17	understand 4:24	validates 119:11
135:8	66:10,12,18,21	71:16 73:8	5:3 21:25 22:7	119:24
thinking 137:17	67:5,10,14,16	78:14,20 79:3	22:12,13,23	values 47:25
thinks 51:21	67:21 68:7,8,9	82:6 83:18	23:8 50:19	variable-sized
thought 82:9	68:19,20 69:5	125:18 130:14	51:3 60:21	129:9
threads 133:12	Tong's 67:3	138:16 139:6	79:17 85:24	variant 105:1
three 25:19 45:1	tools 45:21,23	139:21	87:22 89:16	various 19:6,6
45:4,20 107:20	45:23,25 46:2	turned 70:19	105:19 111:7	145:3
128:19 131:2	top 39:5 47:17	71:18,20	112:7 117:7,19	varying 40:8
throughput	79:12 88:24	turning 35:12	131:21 134:22	VCI 128:3,15
142:14	91:17 93:3	two 4:25 25:16	135:16 136:8	VCIs 128:9,13

128:19 verify 24:15 120:16 versa 27:17 31:7 vertical 89:19 90:25 vertical-labeled 89:23 vice 27:16 31:7 video 44:3 59:2 59:5,7 62:24 63:19 65:25 69:2 view 107:2 119:10 virtual 128:8,20 visited 42:11 VLSI 38:6,22 volumes 134:23 vs 149:4 VSI 128:14,15	weather 42:4 weeks 146:15 well-known 101:24 went 105:13 When's 70:8 width 94:18 window 5:13 wish 12:7 withdraw 122:24 withdrawn 121:20 witness 3:2 6:7 6:15 7:7,10 8:4 8:14,23 9:11 9:23 10:8,16 10:24 11:9,12 11:24 12:10,17 13:1,9,16 14:3 14:11,23 15:15 16:3,15,24 17:10,17 18:10 19:5,22 20:14 21:7 22:4 23:12 26:11 28:5,12 29:3 30:1,12 31:2 31:18 32:4,20 33:11,21 34:2 34:10,24 35:6 36:2,17 37:9 38:6,14,21 40:6,22 43:11 43:25 44:10,18 45:10 48:8,19 49:2,14,24 50:13 52:3,8 53:19 54:13,19 55:3,17 56:4 56:12,21 57:19 58:5,7 59:17 60:3,9 61:10 61:22 62:19 63:5,13 64:5 64:14 65:2,15 65:23 66:24	67:24 68:13,24 70:12 71:4,12 72:2,11,17,25 74:6,12,20 75:18 76:2,12 77:16 78:1,10 79:10,17 80:1 80:17 84:22 85:5,12,24 86:23 87:6,13 87:22 89:16 90:10 91:6 92:2 93:8,21 94:1,10 95:10 95:22 96:7 97:15,24 98:10 98:24 104:1,15 105:9,24 106:19 107:15 108:7 109:2,21 110:10 111:7 112:16 113:24 114:11,22 115:4,13,21 116:7 117:1,13 117:24 118:9 118:22 119:16 120:3 122:6,12 123:11 124:9 126:8,17 131:21 132:21 133:4 134:2,10 136:1,15 138:8 139:4,18 140:21 141:4 141:23 142:8 143:7 144:12 146:1 149:5 WO 3:14 Wolf 2:4 4:7 word 62:8 words 14:16 15:2,3 50:19 51:13 work 25:1 31:10 31:21 33:7,15 69:6 75:3	worked 40:17 41:17 wrapped 75:7 write 14:16 128:24 129:5 writing 8:5 14:13 written 77:3 94:17 95:3 97:25 wrote 42:13	02210 2:8
W			X	1
wait 122:19 want 6:16 7:15 10:20 21:14 45:6 51:24 112:17 113:18 116:7 120:20 122:19 wanted 42:20 wants 52:3 121:16 122:1 way 37:4 41:21 56:13 57:5 76:12 103:12 108:2 126:8 127:14 ways 110:18 we'll 23:3,24 146:16 we're 4:24 7:16 21:3 69:18 88:24 92:15,19 111:15 122:3,8 We've 57:21 weapons 42:5			X 3:1,5 4:13 x-axis 125:23 127:7	1 3:6 5:18 6:24 7:18 13:13,25 18:13,17 26:14 40:14 46:22 50:23 71:17,21 72:5 73:21 81:23 100:22 1:55 146:20 10 41:24 125:7 10,754,616 1:10 5:4 100 99:15 10017 149:2 1003 5:14,24 6:25 7:1,17,18 26:16 1004 24:6 1006 69:19 124:19 125:4 130:15 101 92:3 95:10 99:16 102 100:23 103 115:24 1034 54:3 1036 140:1 104 96:10 97:5 97:17 98:3 105 83:19 10580 2:18 107 108:8 1081 96:11,22 97:1,20 98:5 102:3,19,20 103:6 108:16 1088 128:18 11,169,775 1:9 5:4 1108 98:15 101:9,22 103:6 108:17 118 128:12 119 128:19,23 12 126:23
			Y	
			y-axis 125:23 126:5 Yeah 68:13 123:13 128:2 139:10 year 17:19 20:6 25:20 33:5 37:21 40:1,1 70:13 years 21:12 25:16,18,19,24 26:1 27:10 28:1 30:20,22 31:12,23 32:10 32:15,21 33:4 39:10,19 41:3 41:18 107:3,9 107:21,23 years' 30:7,13 yes-or-no 85:15 86:4 112:17,18 yielded 19:14 York 2:18 149:2 149:2	
			Z	
			zoom 1:12 89:5	
			0	

120 129:19 130:6 128 90:20 140 3:15 155 142:10 156 141:12 144:14 16 72:14 90:15 16-bit 144:21 162 145:6 17 127:13 18 41:24 18-bit 144:15 19 26:19 130:16 130:21 137:11 1983 25:5 1984 25:11 1989 26:4 39:3,8 39:10,19,25 40:16 41:5 1991 46:8 1992 43:13 1994 37:22 39:1 39:6 1995 37:16,20 38:2 43:25 1996 43:13,25 1997 36:20,24 43:3 1998 36:20 1999 37:14 38:1 1A 18:13 115:23 115:25 1B 18:11 1C 80:20,21 83:17 1D 99:25 102:14 102:17 111:21 1st 45:19 2 2 3:8 6:1 7:1,19 13:13,25 76:19 77:11,21 2-D 142:18 2.0 144:4 20 21:21 26:25	28:1 30:7,13 41:3 138:13 149:23 20-plus 32:15,21 2000 36:8,9,12 2002 36:4 2003 36:3 2004 36:3 2005 36:3 43:1 2005/03726 3:14 2006 35:21,22 36:3 2007 35:20 41:10 2008 35:20 2009 27:2,20 29:20 30:8 32:14 33:6 34:6,11 35:2 41:5 100:19 2010 27:2 2022 20:7 2023 1:15 148:7 149:4 206 2:17 21 96:22 212 2:9 149:3 212)257-5797 2:19 216 149:2 218 37:17 39:14 39:16 22 130:17,21 23 90:10 125:7 130:24 24 3:10 72:14 125:5 25 73:21 125:5 133:5,5 26 60:16 61:1 278 66:18 279 58:13 28 77:11,21 127:5 131:25 280 58:14 283 62:2 29 137:18	2D 83:5 96:14 96:21 100:7,16 100:18,24 101:23 102:15 102:18,21 103:2,7,9,13 105:16 106:8 107:18 110:14 110:17 111:12 111:24 112:20 141:14 143:23 144:6 145:10 145:20 3 3 1:15 3:10 23:25 24:2 41:6 77:13,23 81:23 148:7 149:4 318 39:14 32 90:16 94:7,15 94:16,17 95:3 32-bit 90:14,18 33 26:22 342 36:19,21 37:10 40:7 36 27:1,4 37 27:19 395 3:7 5:12 6:25 7:17 18:18 24:6 26:16 46:23 397 3:9 5:1,23 7:2,18 18:15 3D 41:1 42:23 4 4 3:4,11 54:2,6 61:2 76:19 90:15 125:20 400-8845 149:3 411 2:16 42 70:16 115:24 45th 149:2 464 35:10,23 36:4	48 47:7,18 50:4 51:2 80:5 492B 36:18 5 5 3:6,14 18:14 69:18,21 81:23 520 35:2,8,14,22 36:18 37:15 40:8 54 3:11 544 37:13 40:9 56 47:15 50:4 51:2 59 92:6 6 6 3:8,15 38:15 77:13,22 124:20 125:18 125:20,22 126:14,22 127:1 140:2,5 60 100:3 109:8 60-odd 117:3,5 600 2:7 616 6:15 16:9 62 80:5 82:6 83:18 63 84:7 85:9,17 86:19 88:24 92:25 95:18 98:20 104:11 118:16 121:9 123:25 124:13 64 45:19 88:19 89:23 90:1,25 64-bit 90:14,19 67 82:12 68 78:14,20 79:3 79:10,20 80:10 125:3 69 3:14 691P 38:9 7 7 35:13 84:3,8	103:21 104:4 127:21 128:7 129:21 134:25 145:14,18 733 35:17 36:2 76 70:22 127:24 77 127:17 128:1 775 6:16 16:9 78 130:6 783 117:15 8 8 38:15 90:15 91:13 145:14 145:21 8-by-8 58:9,20 8042 1:25 149:5 81 70:22 84 47:17 849-3338 2:9 86 52:11 56:15 56:22 89 46:6 9 9 40:6 41:10 9:00 1:13 903 149:2 99 99:1
---	--	---	--	--