

**In the Matter Of:**

**APPLE vs FINTIV**

---

**HENRY HOUH PH.D.**

*September 29, 2023*

*VOLUME I*

---



**ESQUIRE**  
DEPOSITION SOLUTIONS

800.211.DEPO (3376)  
*EsquireSolutions.com*

IPR2023-00399

VOLUME: I  
PAGES: 1 - 76  
EXHIBITS: None

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

-----X  
APPLE, INC.,

Petitioner

v.

FINTIV, INC.,

Patent Owner  
-----X

VIDEOCONFERENCE DEPOSITION OF HENRY  
HOUH, PH.D., taken on behalf of the Patent  
Owner, before Lauren M. Buzzerio, a Registered  
Professional Reporter, Certified Shorthand  
Reporter, and Notary Public in and for the  
Commonwealth of Massachusetts, via Zoom  
conferencing on Friday, September 29, 2023.  
  
-----

A P P E A R A N C E S

(Counsel, witness, and court reporter appeared remotely)

Jordan Maucotel, Esq.  
Eugene Goryunov, Esq.  
HAYNES AND BOONE, LLP  
2323 Victory Ave.  
Suite 700  
Dallas, Texas 75219  
(214) 651.5000  
jordan.maucotel.ipr@haynesboone.com  
eugene.goryunov.ipr@haynesboone.com  
Attorneys for the Petitioner

Daniel H. Golub, Esq.  
Brandon Theiss, Esq.  
VOLPE KOENIG  
30 South 17th Street  
18th Floor  
Philadelphia, Pennsylvania 19103  
(215) 255-9241  
dgolub@vklaw.com  
btheiss@vklaw.com  
Attorneys for the Patent Owner

ALSO PRESENT:

Alexandra Chen

I N D E X

|                          |      |
|--------------------------|------|
| Deposition of:           | Page |
| HENRY HOUH, PH.D.        |      |
| Examination by Mr. Golub | 4    |

E X H I B I T S

NONE

1 -----

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

3 9:55 a.m.

4 -----

5

6 HENRY HOUH, PH.D., duly sworn pursuant  
7 to Executive Order 144, was examined and  
8 testified as follows:

9

10 EXAMINATION BY MR. GOLUB:

11 Q. Please state your name.

12 A. My name is Henry Houh. That's spelled  
13 H-O-U-H.

14 Q. Good morning, Dr. Houh. Are you in  
15 Massachusetts today?

16 A. Yes, I am.

17 Q. Is anybody with you in the room?

18 A. No.

19 Q. Do you have documents with you?

20 A. I don't.

21 Q. Do you have access to your declaration  
22 and CV?

23 A. Electronically, I think I can get  
24 them.

25 Q. Okay. What did you do to prepare for

1 today's deposition?

2 A. I met with attorneys. And I reviewed  
3 some of the documents.

4 Q. Did you review any documents other  
5 than the ones identified in your declaration?

6 A. Can I just take a look at what I  
7 identified in my declaration?

8 Q. You sure can.

9 A. Well, I reviewed my declaration and  
10 that's not listed in my declaration. But aside  
11 from that, no.

12 Q. Can you pull up Exhibit 1004.

13 A. Sorry. Is that my CV?

14 Q. Yes.

15 A. Okay. I have it open now.

16 Q. What is Exhibit 1004?

17 A. This is my CV.

18 Q. Is this the most current version of  
19 your CV?

20 A. No, it's not.

21 Q. What is on the most current version of  
22 your CV that isn't on Exhibit 1004?

23 A. I may have added some items to the  
24 trials, testimony, and depositions section.  
25 And I -- on my current CV, as I've joined the

1 board of directors of the discovery museums.  
2 And I play in a number -- I joined a few more  
3 orchestras that are not listed in the version,  
4 Exhibit 1004.

5 Q. Is it otherwise accurate?

6 A. I mean, to the best of my knowledge,  
7 yes.

8 Q. Are you still with Einstein's  
9 Workshop? Your CV says 2009 to the present.

10 A. No. I sold that business last year.  
11 Well, I mean, I still own the company. There's  
12 a shell company. But I sold the assets at the  
13 end of last year that were used to operate the  
14 business.

15 Q. Looking at Exhibit 1004, is there  
16 anything else that you would change?

17 A. I did not complete my MicroMasters  
18 certificate from MITx. I didn't take the last  
19 course, which is a set of comprehensive exams.  
20 I haven't done that yet.

21 Q. Were there exams for the other  
22 courses?

23 A. Yeah. I mean, in each of the courses  
24 there were exams. So the four courses, there  
25 were exams. But the fifth course is a set of

1 proctored exams that cover all four of the  
2 courses that I took. So I did not complete  
3 that because I didn't have time to study. And  
4 I haven't found time to study yet. So I think  
5 I can complete it still if I complete the fifth  
6 class. But I haven't had enough time after I  
7 finished the four classes.

8 Q. Turning to your education, where did  
9 you get your undergraduate degree?

10 A. I got it at MIT, the Massachusetts  
11 Institute of Technology. I have actually two  
12 undergraduate degrees.

13 Q. What were your two undergraduate  
14 degrees?

15 A. One is electrical engineering and  
16 computer science. And the other is physics.

17 Q. Did you have any minors?

18 A. No.

19 Q. Did you concentrate in any particular  
20 area of physics?

21 A. No.

22 Q. Did you concentrate in any particular  
23 area of electrical engineering and computer  
24 science?

25 A. Not at the undergrad level. No.

1 Q. Did you have an undergraduate thesis?

2 A. I did.

3 Q. What was it about?

4 A. It was called Boundary Element  
5 Analysis of Arbitrarily Shaped Dialectic  
6 Structures. And it was about numerical  
7 analysis of waveguides basically.

8 Q. Give me an example of one of the  
9 waveguides you would have analyzed.

10 A. One of the waveguides was a waveguide  
11 on a chip made of materials that were  
12 different -- in different refractive indices  
13 laid out on a chip that would carry  
14 electromagnetic waves and transmit them.  
15 Another example that it could've been applied  
16 to -- I don't think I did this in my thesis --  
17 would be like an optical fiber.

18 Q. Does your thesis reach a conclusion?

19 A. I don't remember. Yeah.

20 Q. As an undergraduate, did you take any  
21 courses in business?

22 A. No, I don't think I did.

23 Q. As an undergraduate, did you take any  
24 courses on financial payment systems?

25 A. No.

1 Q. As an undergraduate, did you take any  
2 courses on the operation of mobile phones and  
3 cellular networks?

4 A. No. I think that was really before  
5 mobile phones were widely popular. So no. But  
6 I did take telecommunication courses.

7 Q. As an undergraduate, you took  
8 telecommunication courses?

9 A. Yes.

10 Q. Were those telecommunication courses  
11 directed to landline communications as opposed  
12 to cellular communications?

13 A. Mostly, yes.

14 Q. What part of it was not directed to  
15 landline communications?

16 A. I don't remember all the details. But  
17 at least one of the courses we did covered  
18 wireless networking protocols. There was a  
19 data networks course that I took. As well as a  
20 course specifically about the phone system.

21 Q. What wireless network protocols do you  
22 recall looking at?

23 A. ALOHA was one of them. I don't  
24 remember the others. I think there were a few  
25 others that we covered.

1 Q. Were any of them cellular telephony  
2 networks?

3 A. Not that I can recall from that class.  
4 No.

5 Q. What did you do after you graduated  
6 with your undergraduate physics degree in 1990?

7 A. I was at Bell Labs, I think, at that  
8 time doing some work as part of an internship.  
9 And I stayed there -- after February 1990, that  
10 spring term, I think I withdrew from MIT. And  
11 I worked for Bell Labs where I was doing my  
12 internship. They asked me to stay on for a  
13 little longer. So I stayed through, I think,  
14 the fall of 1990 when I went back to MIT.

15 Q. What was the subject of your work at  
16 AT&T Bell Labs?

17 A. I was working in the optical computing  
18 group. And one thing I did around that time is  
19 I helped come up with -- I mean, it's like an  
20 optical transistor. And I got -- one of my  
21 accounts I got from that time and that work I  
22 did there.

23 Q. Did all of your work at AT&T involve  
24 optical networks?

25 A. I mean, one of my internships, in a

1 previous summer, I wasn't working in optics. I  
2 was working in, I think, a switching systems  
3 group, my first summer.

4 Q. Besides optical networks and switching  
5 systems, what else did you work on at Bell  
6 Labs?

7 A. I mean, I did some work on lasers and  
8 whatnot that can be -- you might say are part  
9 of an optical network. But I really focused on  
10 kind of some of the laser stuff. I worked in a  
11 lab with an optical bench and did some work  
12 there in that lab. But I don't remember  
13 everything I did there.

14 Q. Other than optical networks, lasers,  
15 and switching systems, do you recall anything  
16 else that you did at AT&T Bell Labs?

17 A. I mean, nothing else comes to mind  
18 right now.

19 Q. At some point, do you transition from  
20 Bell Labs back to MIT?

21 A. Yes.

22 Q. Why do you do that?

23 A. I think I wanted to finish up and get  
24 my master's degree and stay for grad school. I  
25 wanted to continue my education.

1 Q. Did your master's program concentrate  
2 in any particular area of electrical  
3 engineering?

4 A. I mean, I did my -- research for my  
5 thesis was based on the work I did at Bell  
6 Labs.

7 Q. Was that your work on lasers?

8 A. Yes. My master's thesis was called  
9 Demonstration of a Laser Repetition Rate  
10 Multiplier. And that work I did do at Bell  
11 Labs.

12 Q. What is -- go ahead.

13 A. I mean, it was part of this integrated  
14 internship program. That's why I did my  
15 research at Bell Labs.

16 Q. What is a laser repetition rate  
17 multiplier?

18 A. It was a device that you could attach  
19 to the output of a laser system that was  
20 creating pulses at a regular interval. And it  
21 would -- it could multiply the frequency of  
22 those pulses. So, for example, you know, if  
23 you have -- if it was every, you know,  
24 microsecond, the pulses, for example, then you  
25 could have two pulses per microsecond or every

1 half microsecond, you'd have a pulse.

2 Q. So your master's thesis was the  
3 demonstration of such a device?

4 A. Yes. I actually built one and tested  
5 it in the lab.

6 Q. As part of your master's program, did  
7 you take any courses in business or accounting?

8 A. Not for my master's degree. No.

9 Q. As part of your master's program, did  
10 you take courses on financial payment systems?

11 A. No.

12 Q. As part of your master's program, did  
13 you take courses on the operation of mobile  
14 phones and cellular networks?

15 A. Not for my master's. But there may  
16 have been like some continuing ed classes I  
17 might have signed up for while I was an  
18 employee at Bell Labs that might have covered  
19 wireless. I vaguely recall that. I'm not  
20 totally sure. There was a number of different  
21 courses I took while I was employed at Bell  
22 Labs.

23 Q. Who gave those courses?

24 A. There was some internal education  
25 group at Bell Labs. They may have brought in

1 other people. But it was something Bell Labs  
2 offered its employees.

3 Q. You didn't take any courses on the  
4 operation of mobile phones and cellular  
5 networks as part of your master's program, did  
6 you?

7 A. No.

8 Q. After your master's, do you pursue a  
9 Ph.D. in electrical engineering and computer  
10 science?

11 A. Yes.

12 Q. Did your Ph.D. concentrate in any  
13 particular area of electrical engineering and  
14 computer science?

15 A. Yeah. I focused on networking.  
16 High-speed networks and distributed systems.

17 Q. What were some examples of high-speed  
18 networks that you studied?

19 A. Well, we built our own high-speed  
20 network. It was a gigabit network. I helped  
21 design the switches. The interface of the  
22 computers. The links between the switches. I  
23 wrote some of the software. And was part of  
24 the group -- that the whole research group did  
25 on certain types of applications that would be

1 enabled once you had a high-speed network and  
2 the ability to get the data into the computer.  
3 And one traffic type we had -- one of the other  
4 group members built it -- video capture port.  
5 So we could stream video across the network and  
6 into the computer for processing.

7 Q. Was the network that you built a local  
8 network or a wide area network?

9 A. Well, it was both. We actually had  
10 high-speed Sonnet links to, I think, several  
11 other locations. I think IBM somewhere in  
12 their research labs. And also I think to  
13 UPenn. And then there were -- some of our  
14 switches were deployed and our equipment were  
15 deployed at some -- at least one of these  
16 locations. So it was mostly local in our lab  
17 group. Like every office had a switch. But we  
18 also had switches -- I had one or more at these  
19 other locations.

20 Q. Did the networks that you worked on  
21 traverse any wireless communication links?

22 A. I don't think so. I don't know for  
23 sure, I mean, to the extent that the Sonnet  
24 link didn't include some wireless part. But I  
25 don't think it did. But I don't know for sure

1 one way or the other.

2 Q. As part of your Ph.D. program, did you  
3 take courses in business or accounting?

4 A. I did while I was a Ph.D. student.  
5 Yes.

6 Q. What business or accounting courses  
7 did you take as a Ph.D. student?

8 A. I took one class in the Sloan School  
9 on entrepreneurship. And I had started a  
10 company while I was a grad student. And I  
11 didn't take a course. But I had an accounting  
12 textbook. And I learned to keep all of the  
13 books for the business, which I still do today  
14 for all my businesses.

15 Q. Other than the course in  
16 entrepreneurship, did you take any other  
17 courses in business or accounting as part of  
18 your Ph.D. program?

19 A. No, I don't think so.

20 Q. The accounting book that you recall,  
21 when do you recall first looking at that book?

22 A. It was probably sometime around 1994.

23 Q. Do you recall the name of the book?

24 A. No. I don't remember.

25 Q. Do you recall what you learned from

1 the book?

2 A. I learned some accounting principles  
3 and how to keep my -- you know, set up a chart  
4 of accounts for the company I helped start.  
5 And I kept all the books for that company.

6 Q. What's the format of those books?

7 A. I don't remember exactly. I think it  
8 was chapters. They had chapters. I think they  
9 had questions at the end of every chapter.  
10 That kind of format.

11 Q. I didn't ask the question very well.  
12 What I meant to say was what was the format of  
13 the books that you kept after reading the book  
14 on accounting?

15 A. Oh. I think we used QuickBooks or  
16 something. Yeah. I think we used QuickBooks.  
17 Or no. No. I think at that time we used  
18 Peachtree actually.

19 Q. As part of your Ph.D. program, did you  
20 take any courses on the operation of mobile  
21 phones and cellular networks?

22 A. I mean, not directly. But we would  
23 review papers, you know, on a regular basis as  
24 part of our research group. And one of the  
25 other members of the group started to do

1 software radios. And he later started a  
2 company making wireless bay stations based on  
3 software radios. So, you know, we talked a lot  
4 about that and actually reviewed papers on --  
5 at various times about -- about mobile networks  
6 and things like that.

7 Q. About how many papers did you review  
8 with your colleague on the operation of mobile  
9 phones and cellular networks?

10 A. I wouldn't know an exact number here.

11 Q. What was this colleague's name?

12 A. His name Vanu Bose.

13 Q. Did you collaborate with him when he  
14 built bay stations?

15 A. No. I wasn't a direct collaborator.  
16 But I -- I mean, we did, you know, meet up  
17 regularly. And I visited his company. And I  
18 knew a number of people that he had hired  
19 because a few of them came out of our research  
20 group. But I kind of always stayed on top of  
21 what he was working on. And, you know, it was  
22 all based on his thesis. And there are a lot  
23 of discussions that we just sit around and talk  
24 about, you know, the various work we were all  
25 doing.

1 Q. Was his bay station compliant with any  
2 particular standard?

3 A. I think eventually yes. He had a  
4 company. And he kind of established -- he got  
5 the company established as a provider for kind  
6 of more rural areas and developing nations.  
7 And so I know that they did develop a number of  
8 wireless standards that their bay stations  
9 supported. I don't know which ones though.

10 Q. These papers that you recall reviewing  
11 with him, would those reviews have taken place  
12 during the period you were pursuing your Ph.D.?

13 A. Yes. I mean, we had regular meetings  
14 to review papers in all different areas of  
15 networking.

16 Q. What was the Agora Technology Group?

17 A. That was a company I helped start  
18 which started out as targeted advertising. But  
19 eventually we kind of switched over to  
20 providing web consulting services to help  
21 companies set up their websites.

22 Q. Why did you found the company?

23 A. I was pretty excited about the web  
24 when it first came out. And this was back  
25 really kind of at the very early stages for

1 web. I helped set up a website for our group.  
2 It was quite possibly one of the first 100  
3 websites ever set up, if not the first hundred  
4 or the first couple hundred. And I had  
5 maintained a list of businesses on the web.  
6 You know, people were very excited. And I'd  
7 get a lot of e-mails every day about companies  
8 getting on the web and wanting to register with  
9 my list.

10 So I thought that there was a lot of  
11 opportunity in the web. And so I started a  
12 business. And the idea we -- it might have  
13 come up -- I don't remember if this was part of  
14 the entrepreneurship course I took or not. But  
15 afterwards, you know, my old roommate and I, he  
16 also took the class. We started this business  
17 together. And initially it was kind of  
18 targeting advertising. Then we got companies  
19 who were just calling us asking us if we could  
20 help them set up their -- because we'd done a  
21 bunch of outreach to companies about the  
22 advertising. But instead they came back and  
23 said, well, would you help us set up our  
24 websites. And so we started doing that.

25 Q. Dr. Houh, you mentioned that one of

1 the things that motivated you to start Agora  
2 was that you had set up a website for your  
3 group. Which group were you referring to?

4 A. That was my research group at MIT. It  
5 was the telemedia networks and systems group.  
6 And so I helped set up the website right  
7 after -- I mean, literally like -- I saw a talk  
8 from Mark Andreson. He'd come to visit our  
9 lab. It was right down the hall. I went to  
10 the talk. And right after I heard his talk, I  
11 went back and downloaded the server. And I  
12 started -- you know, I installed it. And I  
13 started running web pages. I don't remember if  
14 I had a browser at that time either. But I  
15 probably -- if I didn't, I downloaded it then  
16 and started checking out the small number of  
17 websites that were up.

18 Q. Would this work have taken place  
19 before you started Agora in 1994?

20 A. Yes.

21 Q. Do you remember the URL of the  
22 website?

23 A. Yeah. It might have been  
24 www-tns.lcs.mit.edu.

25 Q. I'm sorry. Could you say that again

1 more slowly.

2 A. Sorry. It might have been www -- or  
3 it might have been tns-www or reverse  
4 www-tns.lcs.mit.edu. I think we listed it in  
5 some of the papers that I've written so you can  
6 verify it by looking at the papers. But that's  
7 what I recall sitting here right now.

8 Q. What was the purpose of the website?

9 A. It was to basically put our group on  
10 the web. And so, you know, kind of who's in  
11 the group. We put up -- I think I added some  
12 papers. Eventually we added all of our video  
13 demonstrations to the website so you could go  
14 to the website and start up one of our video  
15 demonstrations and stream recorded video or even  
16 live video. I had a camera in my office. You  
17 could sit and watch me working at my desk.

18 Q. Did the website have any payment  
19 functionality?

20 A. No, it didn't.

21 Q. At Agora how many websites did you  
22 personally create?

23 A. I don't remember the exact number. I  
24 mean, we had a number of different contracts.  
25 And I can recall maybe two or three at least.

1 Q. What were those two or three websites  
2 that you recall that you personally set up?

3 A. One was for a data communications  
4 magazine. One was for Bay Networks. One was  
5 for the MIT Industrial Liaison Program. And I  
6 know I set up one for the MIT Alumni  
7 Association. I don't remember if they paid us  
8 or I did it as a volunteer. Those are the ones  
9 I can remember right now. I mean, I also set  
10 up the one for our company. Oh. I also, as  
11 part of our company getting kind of a  
12 membership into the worldwide web consortium, I  
13 think I helped set up the world wide web  
14 consortium's website there too.

15 Q. When you're talking about "our  
16 company," are you referring to Agora?

17 A. Yes. That's what I mean here.

18 Q. And so the first website you mentioned  
19 was for a data communications magazine. What  
20 was the purpose of that website?

21 A. Well, I mean, we took some of the  
22 magazine issues and articles and we converted  
23 them to web pages and we posted them online. I  
24 mean, I don't remember if I know the purpose as  
25 intended by the data communications magazine.

1 But that's some of the things we did.

2 Q. Did the website have any payment  
3 functionality?

4 A. I mean, I don't think so when we first  
5 set it up. But, I mean, I think part of it was  
6 we probably set up some way to, you know,  
7 subscribe or sign up for the magazine. But I  
8 don't recall exactly what we did with that.

9 Q. What was the purpose of the website  
10 for Bay Networks?

11 A. That was so they could get their  
12 products -- I think this was the purpose  
13 anyway -- to get information about their  
14 products online so people could download the  
15 brochures and look at the different products  
16 that they had.

17 Q. Did the Bay Networks website have any  
18 payment functionality?

19 A. I don't think so.

20 Q. What was the purpose of the website  
21 that you did for the MIT Industrial Program?  
22 Do I have that right?

23 A. Industrial Liaison Program.

24 Q. Yes.

25 A. I think it was just to get their

1 office online and have potential companies who  
2 might be interested in signing up for the  
3 Industrial Liaison Program. Just get them the  
4 information they needed and have a presence on  
5 the web.

6 Q. Did the MIT Industrial Liaison Program  
7 website have any payment functionality?

8 A. No, I don't think so. I think we did  
9 list, you know, like, the expenses involved in  
10 joining ILP. But I don't think there was  
11 payment functionality.

12 Q. You mentioned that you set up a  
13 website for Agora. Did you do that personally?

14 A. I think I did. I think some other  
15 people helped me at that point too.

16 Q. Who else helped you?

17 A. I think there was -- one of the  
18 cofounders was Jonathan Soo. I think he may  
19 have helped with that as well.

20 Q. As part of setting up the Agora  
21 website, did you include any payment  
22 functionality in the website?

23 A. No, I don't think so.

24 Q. How many employees did Agora have?

25 A. You know, there were, at the time I

1 was there before I left, we had hired one  
2 engineer and had one other person, I think.  
3 And plus the three founders or cofounders.

4 Q. What was the background of the person  
5 you hired?

6 A. I mean, the engineer was a -- it was a  
7 recent graduate of MIT. I think he was  
8 computer science, I think. I don't really  
9 remember. And I think the other person we  
10 hired was more of a marketing person.

11 Q. Why did you stop working at Agora in  
12 1996?

13 A. I wanted to finish my Ph.D. And it  
14 was taking time away from my ability to  
15 graduate. So I wanted to go back -- well, I  
16 was still at MIT during that whole time. But  
17 it wasn't right that I was distracted by this  
18 business. And we were basically just getting  
19 into the consulting. And I think there was a  
20 good business in it, but I wanted to finish my  
21 Ph.D.

22 Q. Did you sell your interest in the  
23 company?

24 A. Yes.

25 Q. Who did you sell it to?

1 A. I think it was Jonathan Soo's father  
2 who bought my interest out.

3 Q. Did your other partners continue with  
4 the company?

5 A. Jonathan did. But my other partner  
6 also -- we got bought out at the same time.

7 Q. When you were an undergraduate at MIT,  
8 did you also work for the Department of  
9 Electrical Engineering and Computer Science?

10 A. Yes. Well, I mean, it was all part  
11 of -- mostly part of the research or being a  
12 teaching assistant. So in that sense, yes.

13 Q. Well, if we look at page 4 of your  
14 resume, do you see a section entitled MIT  
15 Department of Electrical Engineering and  
16 Computer Science?

17 A. Yes.

18 Q. Does that section set forth the  
19 positions that you held at the MIT Department  
20 of Electrical Engineering and Computer Science  
21 during your whole period at the university?

22 MR. MAUCOTEL: Objection. Form.

23 A. So I was -- there are five bullet  
24 points there. So I was being paid for the  
25 first four. And the last one is just a project

1 I did that really led up to getting hired as a  
2 teaching assistant.

3 Q. So --

4 A. Actually, I may have been -- that  
5 might have been part of a formal undergraduate  
6 research opportunities program, which I may  
7 have gotten paid for. For part of anyway. So  
8 yeah. I mean, it's possible I was paid for all  
9 these things. But certainly the first four.

10 Q. The bottom bullet, dated in 1987, says  
11 design construction and programming of a 16-bit  
12 computer. What was that project about?

13 A. That was taking those three components  
14 and putting them together to actually be an  
15 actual computer and then writing or rewriting a  
16 bunch of software for it. I think there was  
17 some base software. But I had improved the  
18 software to run, I don't remember, 20 times  
19 faster or something like that.

20 Q. And then in the same year, 1987, you  
21 become a laboratory teaching assistant for  
22 computational structures; is that correct?

23 A. Yes.

24 Q. What was computational structures?

25 A. That was the base level or

1 introductory computer architectures class.

2 Q. And what was the laboratory for that  
3 class focused on?

4 A. So in the lab, there would be --  
5 everyone would build these computers. And then  
6 the labs were various, you know, parts of  
7 putting together, running software, or,  
8 eventually, you know, going through a series of  
9 the labs. I think three or four would be  
10 building the whole computer. And then there  
11 would be a bunch of software lab assignments  
12 that had to be done.

13 Q. In 1988, you transition to being a  
14 head laboratory teaching assistant for  
15 computational structures; is that correct?

16 A. Yes.

17 Q. So can you explain to me how your  
18 position as the head laboratory teaching  
19 assistant differed from your position as  
20 laboratory teaching assistant?

21 A. Sure. As the head lab TA, I had to  
22 kind of make the schedule and have more  
23 responsibility for maintaining the lab. And I  
24 also helped update and revise some of the lab  
25 assignments. Or, actually, I may have created

1 one or two new lab assignments. So that's the  
2 difference.

3 Q. And then in the spring of '89, fall of  
4 1990, and spring of 1995, you become a teaching  
5 assistant for the same department; is that  
6 correct?

7 A. Yes. It was the same department. It  
8 was really the same class that I was the head  
9 lab TA for. In the spring of '89, I was a  
10 senior. And typically this role is reserved  
11 for grad students. But, actually, because I  
12 was a TA at that second term senior year, I not  
13 only got paid, but I also got my tuition paid  
14 for as well.

15 Q. And then from 1991 to 1998, you're a  
16 research assistant in the telemedia network  
17 systems group; is that correct?

18 A. Yes.

19 Q. And in that role, you design, develop,  
20 and implement a gigabit ATM network. Is that  
21 the same network we talked about earlier this  
22 morning?

23 A. Yes, that's the same network.

24 Q. Dr. Houh, you have a number of  
25 publications that are listed starting on page 9

1 of your CV and then they go through toward the  
2 end of page 10. Do you see that?

3 A. Yes.

4 Q. Did any of those papers focus on  
5 mobile phones and cellular networks?

6 A. The -- well, there is a paper there I  
7 did my area exam on. It was titled Wavelength  
8 Division Versus Code Division Access Methods  
9 For Optical Networks. But some of the papers  
10 that might -- this was for my area -- doctoral  
11 area exam. And I recall that, like, some of  
12 the papers that this was based on were coding  
13 over -- for the wireless channel for wireless  
14 networks. It was specifically CDMA. I may  
15 have applied that to optical networks. But I  
16 do recall that the paper was really a coding  
17 method that was used in wireless networks. So  
18 I think at least that paper touched on an area  
19 that was used for data transmission in wireless  
20 networks and wireless cellular networks.

21 Q. Anything else?

22 A. I mean, I don't see anything else  
23 directly. I mean, I did a lot of optics work.  
24 And certainly those were used in the backbone  
25 of mobile networks. But nothing directly

1 otherwise, other than that paper that I see on  
2 the list.

3 Q. The most recent paper I see on the  
4 list is dated November 1996. Do I have that  
5 right?

6 A. Yeah. That might be right for what's  
7 on this list.

8 Q. Well, that was about 25 years ago,  
9 right, 1996? So in the last 25 years, have you  
10 published any papers?

11 A. Not any referee papers. I think I  
12 wrote an internet draft or some early internet  
13 draft while I was at NBX Corporation. But  
14 other than that -- and that wasn't refereed.  
15 But no. I mean, my academic career kind of  
16 ended when I graduated.

17 Q. You consider your publications  
18 academic in that sense?

19 A. In that sense. I mean, they were when  
20 I was actually a researcher, you know, working  
21 on my Ph.D. or working on my, you know,  
22 master's thesis. So I do consider a lot of  
23 these papers to be kind of academic in the  
24 sense that it's what would be published by  
25 research groups at a university and what

1 professors may have as well. I mean, I  
2 submitted a number of patent applications which  
3 got published. But they're not refereed.

4 Q. Did your work in research stop after  
5 you left MIT?

6 MR. MAUCOTEL: Objection. Form.

7 A. Well, I mean, many of the companies, I  
8 was kind of maybe doing, you know, research or  
9 advanced development. I'm not sure what you  
10 would call it. But there were -- you know, I  
11 developed protocols. I developed systems. I  
12 architected systems. I don't know that I'd  
13 consider that not to be research or research  
14 or -- I mean, I had similar projects to what I  
15 did. We just weren't really keen on publishing  
16 about what our company was doing. You know,  
17 sometimes we'd file patent applications.

18 Q. When you're finishing up your Ph.D.,  
19 do you go to work for NBX?

20 A. I started working at NBX before I  
21 finished my Ph.D. But I overlapped maybe a  
22 semester. But then after I graduated, I did go  
23 to work at NBX full-time.

24 Q. And what was the business of NBX?

25 A. NBX made the first business telephone

1 system that shipped that you could buy, that  
2 companies could buy, that worked over the data  
3 network wires that a company used to share the  
4 data network as opposed to having separate  
5 wires for the phone systems which was typical  
6 back then. You know, companies would have two  
7 sets of wires running to each cubicle or  
8 office, one for data networks, one for  
9 telephone systems. And we made it so the  
10 business telephone system ran over the data  
11 network. And it was a packetized phone. Kind  
12 of like the early voice over IP phones.

13 Q. Did NBX make cellular equipment?

14 A. No.

15 Q. While you were at NBX, did you do any  
16 work on payment systems?

17 A. Not for NBX.

18 Q. Why did you leave NBX?

19 A. NBX had gotten acquired by 3Com. And,  
20 you know, the fun of the start-up, it wasn't  
21 quite the same after it got acquired. And I  
22 also had a friend I was talking to that was  
23 leaving his job. I think I went to Teradyne  
24 after that. He was leaving his job and he kind  
25 of recruited me to take over his role that he

1 was leaving because he was moving to  
2 California.

3 Q. What was his name?

4 A. His name was Steve Cheng. C-H-E-N-G.

5 Q. What was your first position at  
6 Teradyne?

7 A. I think at Teradyne I was the --  
8 initially, I was the director of business  
9 development.

10 Q. For what unit were you the director of  
11 business development?

12 A. There wasn't a specific unit. I mean,  
13 I was reporting directly to the chairman and  
14 founder of Teradyne at the time. And I kind of  
15 was working for the board. Because I had  
16 worked with two other board members directly.  
17 But they had me looking at and interacting with  
18 a group of companies they had purchased before  
19 I had gotten there that were all in the area of  
20 software testing. And so I would just go and  
21 meet with the general managers and various  
22 people within these five separate companies and  
23 try to put together a cohesive strategy for the  
24 whole -- for the whole group. And I kind of  
25 came up with product ideas. And it was a bunch

1 of things like that.

2 I mean, I don't think it was the  
3 business development role in the sense that I'd  
4 go up and drum up business and meet with people  
5 who might, you know, buy products or, you know,  
6 developing businesses that way. It was more  
7 looking internally to see if we could, you  
8 know, evolve the businesses that were there.  
9 That's the job that the board and my boss  
10 wanted me to do.

11 Q. So your first position at Teradyne is  
12 director of business development, software test  
13 units. And if I understand your answer  
14 correctly, software test units is not a  
15 division of Teradyne; it was the general area  
16 in which you did business development?

17 MR. MAUCOTEL: Objection. Form.

18 A. Well, when Teradyne itself was -- got  
19 started, its primary business was hardware and  
20 chip testing. They built machines and software  
21 to test things like memory chips, processors,  
22 at various stages of the pipeline. I think  
23 there's some wafer tests. But there's  
24 certainly chip testing, like once the chips  
25 have been packaged. And they consider that all

1 hardware testing. And, you know, because you  
2 need to sort the chips that have defects from  
3 the chips that don't. So you can sell the ones  
4 that work. And that's the kind of equipment,  
5 like big multi-million dollar machines, that  
6 Teradyne sold. But the chairman had recognized  
7 that, you know, there was the whole new area  
8 around software that was growing up. And the  
9 testing available for the software was, you  
10 know, in a much more primitive state. But he  
11 thought that, you know, people would need to  
12 test software more.

13 So he went out before I got there and  
14 went to go -- and bought some companies. And I  
15 think there was a general manager. There was a  
16 division manager or something for all these  
17 groups. So I guess there was maybe some sort  
18 of formal internal structure. And all the  
19 software group general managers reported to  
20 this one division manager. And I think the  
21 division manager reported to my boss. And they  
22 were all within the realm of software testing.  
23 So there was a group called Hammer Technologies  
24 which was used to test telephone systems, both  
25 the functional and load testing. So that, you

1 know, if you built a -- like a voice mail  
2 system, a big voice mail system, could it  
3 handle like, you know, 50 simultaneous calls of  
4 people leaving voice mails, different voice  
5 mails to different voice mailboxes, and some  
6 picking up voice mails and, you know, some  
7 doing the menu stuff to delete the -- you know,  
8 and does that all work properly.

9 So Hammer was a start-up company that  
10 was -- that they -- well, I'm not sure if it  
11 was characterized as a start-up when they got  
12 acquired by Teradyne. But they had developed  
13 some software to test the software of these  
14 telecommunications systems. And Teradyne  
15 bought Hammer. They bought a number of other  
16 companies. I think five total. Actually, I  
17 remember going around with the division head to  
18 actually -- we made an offer on another company  
19 which we didn't successfully acquire. So that  
20 was part of one thing I did.

21 But all these were in software  
22 testing. You know, there was protocol testers.  
23 Modem bank testers. Middleware testing.  
24 Website testing. So these companies were all  
25 in the area of software testing. And they were

1 kind of acquired, you know, just here and there  
2 without -- you know, without Teradyne really  
3 having a comprehensive strategy for all the  
4 groups. So I was there trying to pull together  
5 a more comprehensive strategy across all the  
6 groups, as well as looking for companies to  
7 potentially add. And then looking for gaps in  
8 the product lines that we could enter for kind  
9 of a new adjacent area in that business.

10 Q. Just so I'm clear, your focus was on  
11 software testing as opposed to hardware test  
12 units?

13 A. Well, I mean, it was a focus on the  
14 software used in the various systems, not the  
15 chips or packaged chips that was traditionally  
16 Teradyne's business or the wafer testing or  
17 memory testing or CPU testing. So that was  
18 considered the hardware side of Teradyne's  
19 business. But these new software divisions, I  
20 mean, it was a small fraction of the overall  
21 income of Teradyne. I think Teradyne might  
22 have hit a billion dollars a quarter when I was  
23 there. But the software test divisions were  
24 much smaller. But the chairman thought they  
25 could grow. You know, kind of eventually

1 become, you know, maybe bigger than the  
2 hardware side of the business. So that's why  
3 he was exploring and purchased a number of  
4 businesses. That's why Teradyne purchased  
5 those businesses.

6 Q. So within a year or so after you  
7 joined Teradyne, you transitioned to a spin-out  
8 called Empirix; is that right?

9 A. Yes. So what Teradyne actually did  
10 was they spun out the divisions that I was --  
11 you know, all these software test units into a  
12 separate standalone company. And there was  
13 outside investors, venture capitalists. I  
14 think Matrix Partners led the spin-out. So  
15 they invested in the spin-out. Matrix is the  
16 company -- one of the companies that founded  
17 Apple in the very early days. So, you know, we  
18 actually had on our board Tim Barrows, who, I  
19 think, did the Apple deal for Matrix way back.  
20 And Paul Ferri was on our board too. And he'd  
21 done a number of, you know, very successful --  
22 as a venture capitalist, made some really good  
23 investments. So they joined our board. And  
24 they invested in the spin-out. Teradyne owned  
25 some Matrix -- there might have been a handful

1 of other smaller venture capitalists. But  
2 those software test units I was working with  
3 spun out as this separate company called  
4 Empirix. So, I mean, I transitioned out of  
5 Teradyne with the spin-out.

6 Q. And then for the rest of your time at  
7 Empirix/Teradyne, are you working for Empirix?

8 A. Yes. I was no longer a Teradyne  
9 employee. I was an Empirix employee.

10 Q. Okay. So you're with Teledyne (sic)  
11 in 1999. And then from 2000 to 2004, you're  
12 with Empirix?

13 A. Yeah. I mean, the company was  
14 Teradyne. Teledyne is a different company.  
15 But it's Teradyne.

16 Q. Oh. I misspoke. Okay. So from 2000  
17 to 2001, you were an engineering manager at the  
18 communications infrastructure test group; is  
19 that right?

20 A. Yes. So I came up with a new product  
21 idea that would fill a gap in the business that  
22 was formally Hammer Technologies. I think the  
23 brand of products still went by the Hammer  
24 name. But I came up with a new product. I ran  
25 it by the board. Well, I presented it to the

1 board. And they invested, you know, a decent  
2 sum of money into this new idea. And they  
3 asked -- I was asked to run the project as the  
4 engineering manager.

5 Q. And what was that project?

6 A. That was a data test platform that was  
7 programmable so that you could load different  
8 programs and do high-speed data network testing  
9 with it. It was a packet sphere.

10 Q. Was it used to test data networks or  
11 software?

12 A. It was -- well, it was used to test  
13 data networks. But, really, the software that  
14 was -- that supported the underlying protocols  
15 for the data networks or test the response --  
16 that first product was -- I forget what it was  
17 called. But it was a cloud emulator. And it  
18 would allow you to test like voice over IP  
19 performance over a real network in the lab.  
20 That is because, you know, in the lab you don't  
21 have a real network. You're not plugged into  
22 the internet. You can't test the voice over IP  
23 performance, you know, across the country or,  
24 you know, an international call. But the  
25 packet sphere went in and emulated the

1 characteristics of such a network so that you  
2 could test in the lab how your voice protocols  
3 and your -- you know, would respond to various  
4 real world network conditions without having to  
5 go out and build distributed test, you know,  
6 sites all over the world. You could do that by  
7 emulating the network using our packet sphere  
8 product.

9 And that was the first product that we  
10 shipped. And that also was used in the storage  
11 area network business to kind of test the  
12 performance of distributed storage systems to  
13 real world networking things that happened,  
14 such as, you know, delays, packet loss, data  
15 loss, a jitter in the network. And potentially  
16 reordering for certain networks.

17 Q. For the rest of your time at Empirix,  
18 do you stay focused on that same project?

19 A. No.

20 Q. What's the next project you focus on?

21 A. Well, I mean, I stayed in that group  
22 after we launched the project to kind of take a  
23 broader view. But then I moved over to a  
24 different subgroup of Empirix or a different  
25 division of Empirix to work on testing for

1 websites. So that was the web application test  
2 group. And there I helped re-architect the  
3 current product and lead the technical  
4 development of the next generation product.

5 Q. Did any of your work at Empirix focus  
6 on payment systems?

7 A. I mean, not directly. I think the web  
8 testing software probably was used by people  
9 who were developing web payment systems to  
10 ensure that they worked correctly under -- both  
11 functionality and under load. But, I mean, I  
12 wasn't developing those systems. I was just  
13 developing the software to run -- to run -- to  
14 test those kinds of -- that our customers used  
15 to test those kinds of systems.

16 Q. Do you recall any specific customers  
17 that used products of Empirix to test payment  
18 systems?

19 A. Well, I know that some of our  
20 customers offered products and services online.  
21 And I would -- I would -- I mean, I don't know  
22 directly if they actually tested the purchase  
23 of these products and the payment verification  
24 for those products. But many of our customers  
25 had things like online stores and online

1 transaction systems for financial transactions  
2 like buying products and whatnot. And now I  
3 don't know of anything directly or anything --  
4 but, you know, we had press releases that we  
5 issued that -- like, for example, H&R Block was  
6 a customer to test the actual -- you know,  
7 filing the taxes. I don't know for sure. But,  
8 you know, you would have to pay H&R Block to  
9 access the tax filing service, I think. Or at  
10 least some customers would. And, you know, to  
11 the extent they used our software to use those  
12 transaction systems, I mean -- we were -- we  
13 were more concerned about making sure our  
14 products were compatible with a large number of  
15 websites. And some of them -- I mean, we had  
16 thousands of customers, I think, at the time.  
17 So I think some of them I would -- I would  
18 venture to -- I mean, I don't know directly.  
19 But I wouldn't be surprised if some of or many  
20 of them tested kind of transaction -- you know,  
21 financial transaction functionality that they  
22 had on their website.

23 Q. While you were at Empirix, did you do  
24 any work on cellular networks?

25 A. I mean, I did -- at the time, we did

1 go out and speak with a number of people in the  
2 cellular network industry just to get informed.  
3 And this was while I was, you know, at Teradyne  
4 and Empirix. To kind of understand what the  
5 test needs of various people in the industry  
6 were. So I do recall going out to a number of  
7 different companies and talking to them  
8 about -- there were some specific ones about  
9 their test needs. But I think there were some  
10 more general ones where I think some of the  
11 venture capitalists just had asked me to go out  
12 and talk to these people at these companies  
13 and, you know, tell them what I thought.

14 So there were a number of different  
15 companies like that. I don't remember how  
16 many. But part of my role at some point at  
17 Teradyne and Empirix was to kind of go out and  
18 study these adjacent areas. So that was part  
19 of me trying to determine what gaps in our  
20 product lines we had to fill.

21 Q. Did Empirix sell mobile phones?

22 A. No.

23 Q. Did Empirix design mobile phones?

24 A. No.

25 Q. Did Empirix sell bay stations?

1 A. No.

2 Q. Did Empirix design cellular bay  
3 stations?

4 A. No. I mean, what we would have --  
5 what Empirix might have done, and I think I did  
6 a little bit of work in this area, was figure  
7 out what kind of testing needs all those  
8 product manufacturers had. Like how do you  
9 test a mobile bay station. What were the  
10 protocols. And Empirix had products that  
11 tested things at the protocol level. And so  
12 that was part of what I spent a little time on  
13 was investigating kind of what other kind of  
14 protocols could we test and whatnot. But we  
15 didn't actually manufacture all those things.  
16 Like we didn't make websites for our customers.  
17 We built the software which our customers could  
18 use to test their websites.

19 Q. Do you recall any specific customers  
20 that used this software to test cellular  
21 networks?

22 A. I mean, I didn't say we actually had a  
23 product that -- but I did some investigation.  
24 And there was a division of Empirix that tested  
25 kind of modem banks. And at the time Empirix

1 was around, there were still tens of millions  
2 of people, you know, dialling in with modems to  
3 get to the internet. So there was a product to  
4 test the modem banks. And then all the  
5 different protocols that the modem banks used.

6 Q. Were these cellular modems?

7 A. No. They were landline modems.

8 MR. GOLUB: Can we take a short break,  
9 Dr. Houh. Would that work for you?

10 THE WITNESS: Sure.

11 MR. GOLUB: How long would you like?

12 THE WITNESS: Maybe ten minutes,  
13 please.

14 MR. GOLUB: Does that work for  
15 everybody else?

16 MR. MAUCOTEL: That works for us.

17 MR. GOLUB: All right. Let's go off  
18 the record.

19 (Recess taken.)

20 MR. GOLUB: Back on the record.

21 Q. Dr. Houh, why did you leave Empirix?

22 A. I think the CEO was pushed out for  
23 some reason. And then the CFO took over and he  
24 let me go.

25 Q. What did you do after you were let go

1 from Empirix?

2 A. I went to -- so I called up a number  
3 of friends, including the founder of NBX. And  
4 he was then at a venture capital firm called  
5 Commonwealth Capital. And he asked me to kind  
6 of join him and come to Commonwealth Capital as  
7 kind of like an entrepreneur-in-residence. And  
8 we would try to figure out a new start-up to  
9 work on together.

10 Q. How long were you an  
11 entrepreneur-in-residence at Commonwealth  
12 Capital?

13 A. I don't remember. It was probably  
14 three to six months. What happened was that  
15 Alex found a deal. It wasn't our own company.  
16 We explored a bunch of our own company ideas.  
17 But there was a deal that came through  
18 Commonwealth. And Alex left to join -- it was  
19 to purchase BBN, to spin it out from Verizon.  
20 And so Commonwealth invested in that spin-out.  
21 Alex joined us as the head of the delta  
22 division. And I joined him as -- it might have  
23 been director of technology when I joined.

24 Q. In 2004, do you go to work for BBN?

25 A. Yes.

1 Q. In what division?

2 A. It was in a new division called the  
3 delta division, which was headed up by the  
4 former founder and president of NBX Corporation  
5 where I worked before.

6 Q. And what was the focus of the delta  
7 division?

8 A. The delta division's focus was to look  
9 at existing projects and research projects and  
10 technologies within BBN and figure out how to  
11 create companies around them to kind of spin  
12 out the technology and create companies based  
13 on it. BBN had -- was around since the mid  
14 '90s. Sorry. Mid-1900s. Mid-1960ish, maybe.  
15 And they had the first contract to build the  
16 ARPANET. And they built the first router. And  
17 they also invented and sent the first computer  
18 to computer e-mail. And they'd never figured  
19 out how to commercialize those things. And  
20 then BBN got into the many other areas of  
21 research, including speech and natural language  
22 processing. And there was a lot of technology  
23 within BBN that could form the basis for some  
24 interesting companies. And that's what the  
25 venture capitalists felt when they purchased it

1 from -- helped spin it out of Verizon.

2 Q. Did you write business plans while you  
3 were director of technology at the delta  
4 division to try and commercialize any of these  
5 technologies?

6 A. I did.

7 Q. How many business plans did you write?

8 A. I don't remember the exact number.  
9 Several. Maybe three or four. It could've  
10 been more.

11 Q. Was one of them for a call center?

12 A. Not exactly. It was related to call  
13 centers. There was already an existing  
14 business where BBN consulted on some call  
15 center customers. They had consulting  
16 contracts. And they'd help analyze the  
17 performance of the call center. But what I  
18 wrote a business plan around that was to turn  
19 that into a software as a service. So lighter  
20 on the consulting, but heavier on the automated  
21 analysis. And so I helped kind of set up this  
22 new business that was more an online web portal  
23 business as opposed to pure consulting. And I  
24 wrote the business plan for that. I hired the  
25 developer. I hired a general manager and

1 helped get that business running. And  
2 eventually it went on to sell that  
3 software-to-service website, along with  
4 consulting services, to customers like I think  
5 Dell, Apple, the Center for Medicare and  
6 Medicaid Services. So during the rollout of  
7 Obamacare, every call that went into a CMMS  
8 call center went through our system so they  
9 could analyze the quality and responsiveness of  
10 the system and make sure it was working  
11 properly.

12 Q. What year was Obamacare rolled out?

13 A. I don't remember.

14 Q. Do you recall what year President  
15 Obama was elected?

16 A. Oh, yeah. So I could've left before  
17 this all happened. But that was the business  
18 that I helped set up. I don't -- let's see.  
19 What year was Obama elected? 2008, first,  
20 maybe.

21 Q. Yes. I think his first term was in  
22 2008. And do you recall when Obamacare was  
23 passed?

24 A. Probably within the first two years of  
25 around that time.

1 Q. When Obamacare was passed, you weren't  
2 still with BBN, right?

3 A. No. I think I said I'd left. But the  
4 business that I helped set up and write the  
5 business plan for was still ongoing. And it  
6 did get the contract for the Center for  
7 Medicare and Medicaid Services. And it did --  
8 every call during the launch of Obamacare, did  
9 go through the system of -- that was the  
10 business that I helped write the business plan  
11 for and got help set up.

12 Q. What was the name of that business?

13 A. I think it was called Evoke.

14 Q. What other business plans did you  
15 write?

16 A. I wrote the business plan around using  
17 natural language processing and the semantic  
18 databases for a resume search to help find, you  
19 know, better matches for people. And that was  
20 an idea I had. But that didn't get funded.

21 Q. What other business plans did you  
22 write while you were at the delta division?

23 A. Oh, there was one for a business that  
24 started out being called PodZinger. And it was  
25 for a video and audio search business. And we

1 did get that funded. And then that got spun  
2 out as a separate company.

3 Q. Did you go to work for PodZinger?

4 A. I did for a while before the spin-out.  
5 Or maybe during. I don't remember exactly the  
6 timeline. But, yes, I did work with PodZinger.  
7 And that -- as the VP of operations and  
8 technology.

9 Q. What was the business of PodZinger?

10 A. So we provided video and audio search  
11 to -- so we had first set up a demonstration  
12 website to demonstrate the technology where we  
13 scraped podcasts and other video and audio off  
14 the web and added them to our search index. So  
15 you could search these video and audio files on  
16 the web by the spoken word within them. So,  
17 you know, a lot of times videos or audio might  
18 just have a brief description. Like, you know,  
19 this is our news broadcast on whatever. And it  
20 might have a headline. But we unlocked all the  
21 words that were spoken within these video and  
22 audio for search capability. BBN, at the time,  
23 had the best large language speaker independent  
24 speech recognition system that was available.  
25 And that's evaluated in these separate, you

1 know, evaluations. And so we took that speech  
2 reco system and applied it to video and audio  
3 search.

4 And then the business -- then we were  
5 able to sell services for processing video and  
6 audio and building internal search systems  
7 for -- I think we sold eventually -- I mean,  
8 this was after I stepped down as VP of  
9 technology. But we sold to, you know, ESPN,  
10 Disney, all the major broadcast networks and  
11 other media companies that had lots of, you  
12 know, video and audio.

13 Q. Why did you step down from PodZinger?

14 A. I probably was looking at something  
15 else. I was -- had another project. And kind  
16 of my roles were kind of to get things started  
17 and move onto the next thing. And that was  
18 kind of the delta division's role, was to  
19 figure out -- you know, it wasn't just to set  
20 up one thing and have everyone go do to the one  
21 thing and spend -- it was to do a number of  
22 different things. You know, try to set up a  
23 number of different companies. And, you know,  
24 like the real world, you know, they wouldn't  
25 all make it. And but maybe some would. And

1 you need more irons in fire, so to speak. And  
2 so that was kind of my role, which was to help  
3 get these businesses set up, bring in some new  
4 people to help keep the business running and  
5 grow the business, and then move onto the next  
6 project. Because there was so much technology  
7 within BBN that we could leverage to kind of  
8 create new start-up companies.

9 Q. At BBN did you participate in the  
10 design of online payment systems?

11 A. I mean, not directly. There were some  
12 projects where there were money-related  
13 products within BBN that I would take a look at  
14 to see if they were applicable for something we  
15 could leverage into a business. But, no, I  
16 didn't end up, you know, taking any of that  
17 technology and further developing it or build  
18 anything like that into the existing systems.

19 Q. Why do you leave the delta division in  
20 2008?

21 A. So another -- did I talk about this?  
22 Another start-up that I created internally was  
23 a social network basically. And it was  
24 eventually to figure out how to leverage some  
25 of the natural language processing to figure

1 out -- to better understand what people were  
2 posting so you could better target them for  
3 ads. And that was the idea. And I helped  
4 build and set up a whole system. We got into  
5 alpha testing, maybe beta testing. And then we  
6 sold that whole project to another start-up  
7 company called Eons. And I left with that  
8 project to become the CTO of Eons. And that's  
9 why I left the delta division.

10 Q. What was the name of that website?

11 A. That was called Eons. Yeah. The  
12 company and the website were the same name  
13 really.

14 Q. Did the Eons website have online  
15 payment functionality?

16 A. I'm not sure it did when I got there.  
17 But one of the things I was evaluating were how  
18 to integrate online payment systems with, you  
19 know, maybe micro payments or small payments  
20 for games or -- there's a subscription to some  
21 part of the website. And I did investigate  
22 that while I was CTO at Eons.

23 Q. Did you implement any online payment  
24 functionality while you were at Eons?

25 A. No. I mean, it couldn't really agree

1 on the right direction. That's part of why I  
2 left.

3 Q. After you left Eons, what did you do?

4 A. I help start a new robotic league in  
5 town which grew into another business that I  
6 started. The STEM education business for kids,  
7 that we did business as Einstein's Workshop.  
8 And then I was doing -- I got a few, or maybe  
9 one to start with, expert witness cases while I  
10 was starting this other business. And then  
11 both those businesses grew from there.

12 Q. Did you set up a website for  
13 Einstein's Workshop?

14 A. Yes, I did.

15 Q. You did that work personally?

16 A. A large part of it. Yes. And then I  
17 eventually hired another web person who I  
18 worked with previously at, I think, BBN and  
19 Eons.

20 Q. About how many hours did you spend  
21 setting up that website?

22 A. Oh, it was a lot. I mean, maybe  
23 hundreds. A hundred or 200. I can't give you  
24 a specific number better than that. I spent a  
25 lot of time on getting that website up.

1 Because we did integrate -- well, at some  
2 point -- and certainly over time, I spent a lot  
3 more time on it. Although, I had -- you know,  
4 we hired people to help, you know, update the  
5 content. But if there were things like  
6 integrating a payment system, I would be the  
7 one to do that. And I don't remember if we had  
8 that on day one. I think we might have because  
9 -- I think we probably did actually. Because I  
10 think people could pay for their classes,  
11 register for them online. And I wanted to have  
12 a website that had that capability. So I  
13 spent a -- I think, thinking back now, I think  
14 we did. And I spent a lot of time, you know,  
15 not only setting the website up, but  
16 integrating with -- I think we might have  
17 integrated with PayPal initially.

18 Q. What year did you integrate with  
19 PayPal?

20 A. I think that would've been before we  
21 opened the shop. So maybe sometime in 2012.  
22 But I'd done previous PayPal integrations for  
23 other -- at least one other website that I'd  
24 done years earlier.

25 Q. I'm confused. So you said 2012, but

1 when I look at your CV, your time at Einstein's  
2 Workshop starts in 2009. So was there no  
3 website between 2009 and 2012?

4 A. So I started this informal home  
5 robotics league. And the first year was in my  
6 house, like 12 kids. I just collected checks  
7 from parents. We didn't have a website. I  
8 just sent out some e-mails. And then the next  
9 two years, it was also not that formal either.  
10 And I think we just collected checks from  
11 parents without a website. So it was not until  
12 I actually leased a facility in 2012, and it  
13 was launching as a more expansive business than  
14 just robotics. But, you know, effectively, I  
15 started that with, you know, this home kid's  
16 league that was 12 kids. And that grew -- you  
17 know, it took a couple years to finally like  
18 decide that I wanted to do that full-time and  
19 lease a facility. And that was in 2012. So  
20 that's why that line there says formerly  
21 Lexington Robotics. Because we started out as  
22 Lexington Robotics. And, you know, it was  
23 Lexington Robotics for a couple years, two or  
24 three years. And then I incorporated the  
25 business when I decided to actually lease a

1 facility. And that's the timeline there. And  
2 we incorporated in 2012.

3 Q. So it's not until 2012, or later, that  
4 you integrate payment functionality into the  
5 Einstein's Workshop website; is that correct?

6 A. Well, I think it was 2012. Now that I  
7 think back, I'm pretty sure we had the  
8 capability right off the bat to register and  
9 pay for classes online.

10 Q. Can you describe for me what was  
11 entailed in setting up that payment  
12 functionality?

13 A. Well, I had to have a whole website  
14 with classes. I had to create a back-end  
15 database to keep track of all the classes and  
16 all the different customers we had, the users.  
17 And integrate with the payment system -- I  
18 think it was PayPal initially -- so that we  
19 could actually, you know, have people purchase  
20 a class. And we'd get some confirmation that  
21 they were, so we could update the database,  
22 that people had both registered and paid for  
23 the class. And so it was finding some modules  
24 that helped with that and then, you know,  
25 customizing and doing the whole system

1 integration to get the workflow to what we  
2 wanted it to be.

3 Q. Did PayPal provide information on how  
4 to integrate websites with its payment  
5 platform?

6 A. Yeah. I mean, that's -- they had  
7 documentation about how to do a number of  
8 things. And so I kind of, you know, figured  
9 out what it was we needed to do. Used the  
10 PayPal API. They might have had some  
11 customized codes snippets to include --  
12 sorry -- generic code snippets to include,  
13 which I, you know, edited to make sure we had  
14 our account attached to the payments. You  
15 know, I did all the testing. I set up a whole  
16 testing infrastructure to make sure we could  
17 take, you know, payments. To test the system  
18 before it launched. And then there was a whole  
19 management system that we also added, either,  
20 you know, finding some modules and then  
21 customizing the rest to be able to have our --  
22 the people at the company kind of, you know,  
23 generate the class rosters and figure out who's  
24 in what class. You know, so it was really --  
25 you know, we built the whole website. That was

1 the public-facing part of it for information.  
2 We had the look and feel. And that was what  
3 the person I hired kind of worked on, getting  
4 all the information on classes into the  
5 website. And then we had to have a full  
6 back-end system, too, that we got payments. We  
7 had to reconcile -- you know, I was doing that  
8 initially, is reconciling all the payments and  
9 all the books. And eventually we hired a  
10 bookkeeper to do that and then later a CPA.  
11 But initially I was doing all that. But we had  
12 basically set up all the systems and the  
13 workflow for our whole business. And I worked  
14 on all of that. And the person I hired, I  
15 mentioned earlier worked on a lot of the design  
16 and content for that website.

17 Q. Did PayPal provide model code for  
18 integrating with PayPal's APIs?

19 A. I think they did. But I think we had  
20 to customize the code so it was, you know, tied  
21 to our PayPal account.

22 Q. So your work figured out how your  
23 website could talk to PayPal, but PayPal would  
24 then take that information and process the  
25 transaction? Is that a fair way of thinking

1 about it?

2 MR. MAUCOTEL: Objection. Form.

3 A. So PayPal would actually process the  
4 credit card part of the transaction. They'd  
5 report it to us. And we had to integrate that  
6 data into our system so we knew who paid and  
7 who didn't pay. Because we would just get a  
8 note of information from PayPal about a  
9 particular transaction. But we had to  
10 reconcile that to our database automatically so  
11 that the database would update and reflect the  
12 confirmation of payment processing by PayPal.

13 Q. What was BlocksCAD?

14 A. BlocksCAD is a company that makes  
15 kids' 3D computer-aided design software that's  
16 educational. And that is an effort we started  
17 at Einstein's Workshop to help teach kids how  
18 to design and use 3D printers. And we had a  
19 class for that that we created this software  
20 for. And then we received the DARPA grant to  
21 develop it. And then we spun it out as a  
22 separate company. And it got into a number of  
23 different ed tech accelerators and different  
24 accelerator programs like -- yeah. I think  
25 they're listed in the CV. But we got into two

1 or three accelerator programs. And it now has  
2 a product that it sells to school systems. And  
3 it has a freeware version of the software too  
4 that anyone can use online.

5 Q. Dr. Houh, I want to ask you a question  
6 from your declaration, which is Exhibit 1003.  
7 Can you pull that up.

8 A. Okay. I have it up.

9 Q. Can you turn to paragraphs 23 and 24.

10 A. Okay.

11 Q. In those paragraphs, do you identify  
12 November 21, 2011, as the priority date for the  
13 patent that's the subject of these proceedings?

14 A. Yes.

15 Q. So this is what I have in my notes for  
16 websites that you worked on prior to  
17 November 2011. I'm going to go through the  
18 list and then ask you whether it's complete.  
19 Prior to November 2011, you worked on a website  
20 for the telemedia and systems group at MIT, a  
21 data communications magazine, Bay Networks, the  
22 MIT Industrial Liaison Program, the MIT Alumni  
23 Association, and Agora. Is that a complete  
24 list?

25 A. No, it's not.

1 Q. What other websites did you work on  
2 prior to November 2011?

3 A. I set up the website for the MIT Club  
4 of Boston. And at some point during that --  
5 and I was really -- that was as a volunteer.  
6 So I wasn't getting paid for that. And I redid  
7 it a number of times, like two or three times,  
8 during my tenure with the MIT Club of Boston.  
9 And during that time, I did integrate online  
10 payments. Because MIT Club of Boston would  
11 host events, like a dinner or a talk or a trip  
12 to see a show or apple picking or something  
13 like that. And we -- you know, when I first  
14 joined the club and starting helping, you know,  
15 run the club, all the registration was done  
16 using mail-in registration, handwritten  
17 registration forms that people would fill out  
18 when they'd mail a check. And I actually  
19 converted or added an online payment and  
20 registration system at some point during my  
21 work with the MIT Club of Boston. And that was  
22 certainly before 2011.

23 Q. Any other websites that you worked on  
24 before 2011 that had a payment system that you  
25 integrated into the website?

1 A. I mean, I can't think of anything else  
2 right now. But there could've been.

3 Q. Do you have a copy of the 488 patent?

4 A. I have an electronic copy I can pull  
5 up.

6 Q. Okay. Does the electronic copy have  
7 columns and line numbers?

8 A. Yes. It's a PDF formatted version of  
9 the patent.

10 Q. And can you look at column 9, line 35.

11 A. Okay.

12 Q. Do you see a reference there to a GSM  
13 SIM card?

14 A. Yes.

15 Q. What was the purpose of a GSM SIM card  
16 in the context of the 488 patent?

17 A. Well, what it's talking about right  
18 there is that there is a mobile wallet  
19 application installed on a mobile device in the  
20 devices memory on a SIM card, whereas otherwise  
21 accessible to the mobile device. So one of the  
22 uses here is that it's saying that the  
23 application can be installed on, for example, a  
24 SIM card.

25 Q. And one of the SIM cards it talks

1 about is a GSM SIM card; is that correct?

2 A. Yeah. It gives that example in line  
3 35.

4 Q. As of the priority date, when GSM  
5 phones were sold, did they include a SIM card?

6 A. I mean, I don't recall exactly. I  
7 think some -- I mean, my early phones didn't  
8 have removable SIM cards. But I don't remember  
9 what platform they were on.

10 Q. I didn't say removable. I just said  
11 as of the priority date, did GSM phones come  
12 with a SIM card?

13 A. I mean, I'd have to do a little bit of  
14 research into that. Unless I've already said  
15 something about that in my declaration.

16 Q. Are you familiar with the acronym  
17 MSISDN?

18 A. I mean, I may have heard of that. I  
19 mean, I certainly heard of ISDN before. Is  
20 this like MS-ISDN or MSISDN all together?

21 Q. Either one.

22 MR. MAUCOTEL: Objection. Foundation.

23 A. I may have. I don't know one way or  
24 the other. But I've certainly heard of ISDN.

25 Q. Do you know what the acronym HLR

1 stands for in the context of a cellular  
2 network?

3 A. I mean, that might refer to home  
4 location register. I think I've seen that  
5 before.

6 Q. What's the function of the home  
7 location register?

8 A. Well, I mean, is this something I said  
9 in my declaration, or are you just asking me a  
10 general question here?

11 Q. I'm just asking you a question.

12 A. If my recollection is correct about  
13 this, it's an -- it's a location that can be  
14 looked up for a particular mobile subscriber to  
15 find out where in the network they are. I  
16 believe -- that's just vaguely from memory  
17 here. So that's what I think it could be used  
18 for.

19 Q. As of the priority date, November 11,  
20 2011 -- actually, strike that. Let me make  
21 sure I have the right date. As of the priority  
22 date, November 21, 2011, could a GSM phone gain  
23 access to a cellular network without a SIM  
24 card?

25 A. Well, I believe there was a legal

1 requirement at the time that all 911 calls must  
2 be completed regardless of whether a phone was  
3 registered properly to any network or not. So  
4 I think any phone that dialed 911 could access  
5 the network, a cellular network to make an  
6 emergency call. I believe that was the legal  
7 requirement.

8 Q. Separate and apart from 911 calls,  
9 could a GSM phone access the cellular network  
10 without a SIM card?

11 A. I mean, I would want to take a look at  
12 any GSM standards documents to answer that.  
13 But I'm -- I'd have to do a little bit of  
14 research into that.

15 Q. Can you turn to paragraph 27 of your  
16 declaration.

17 A. Okay.

18 Q. I think I have the paragraph wrong.  
19 Please give me one second. Could you look at  
20 paragraph 47 of your declaration.

21 A. Okay.

22 Q. In paragraph 47, you identify three  
23 references that you're relying on, Dill,  
24 Vadhri, and Akashika. Do you see that?

25 A. Yes.

1 Q. Are those the only references that  
2 you're relying on for your opinion?

3 A. Well, I believe that's what I'm  
4 relying on for the obviousness combinations.  
5 But I think there are other references I cite  
6 to just show the background support for some of  
7 the -- some of what's in my declaration.

8 Q. So there are other references that  
9 you're relying on for background that you  
10 didn't include in paragraph 47?

11 A. Well, they're included at the top, I  
12 believe, in that chart of listing all the  
13 materials. I saw it up at the top. But the  
14 combinations themselves are really only those  
15 three. The others weren't for a combination,  
16 combining to render obvious, it's just for  
17 background support.

18 MR. GOLUB: Okay. I don't have any  
19 further questions.

20 MR. MAUCOTEL: Okay. Let's go off the  
21 record for minute. We'll confer and see if we  
22 have redirect. We'll be back on in, say, ten  
23 minutes.

24 MR. GOLUB: See you in ten minutes.

25 MR. MAUCOTEL: Thank you.

1 (Recess taken.)

2 MR. MAUCOTEL: Back on the record. We  
3 have no further questions.

4 Thank you for you time, Dr. Houh. We  
5 appreciate it.

6 (Whereupon the deposition was  
7 concluded at 11:59 a.m.)

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

ESQUIRE ERRATA SHEET

Esquire Job ID: J10243541

Case Caption: Apple v. Fintiv, Inc.

DECLARATION UNDER PENALTY OF PERJURY

I declare under penalty of perjury that I have read the entire transcript of my Deposition taken in the above-captioned matter or the same has been read to me and the same is true and accurate, save and except for changes and/or corrections, if any, as indicated by me on the DEPOSITION ESQUIRE ERRATA SHEET hereof, with the understanding that I offer these changes as if still under oath.

Signed on the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
HENRY HOUH, PH.D.,

DEPOSITION ERRATA SHEET

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_ DATE: \_\_\_\_\_

HENRY HOUH, PH.D.,

DEPOSITION ERRATA SHEET

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_ DATE: \_\_\_\_\_

HENRY HOUH, PH.D.,

CERTIFICATE

Commonwealth of Massachusetts  
Middlesex, ss.

I, Lauren M. Buzzerio, a Registered Professional Reporter, Certified Shorthand Reporter, and Notary Public in and for the Commonwealth of Massachusetts, do hereby certify: that HENRY HOUH, PH.D.,, the witness whose deposition is hereinbefore set forth, was satisfactorily identified, then duly sworn by me, and that such deposition is a true record of the testimony given by the said witness.

I further certify that I am not a relative or employee or counsel or attorney for any of the parties, or a relative or employee of such counsel or attorney, nor am I financially or otherwise interested in the outcome of the action.

IN WITNESS WHEREOF, I have hereunto set my hand and notarial seal this 4th day of October, 2023.



---

LAUREN M. BUZZERIO  
My commission expires  
on January 18, 2024

|               |             |             |                    |                    |
|---------------|-------------|-------------|--------------------|--------------------|
|               | <b>1998</b> | 65:9        | 67:10              | 10:21              |
| <b>1</b>      | 30:15       | <b>25</b>   | <b>90s</b>         | 17:4               |
|               | <b>1999</b> | 32:8, 9     | 50:14              | <b>accurate</b>    |
| <b>10</b>     | 41:11       | <b>27</b>   | <b>911</b>         | 6:5                |
| 31:2          |             | 70:15       | 70:1, 4, 8         | <b>acquire</b>     |
| <b>100</b>    | <b>2</b>    |             | <b>9:55</b>        | 38:19              |
| 20:2          |             | <b>3</b>    | 4:3                | <b>acquired</b>    |
| <b>1003</b>   | <b>20</b>   |             | <b>A</b>           | 34:19, 21          |
| 65:6          | 28:18       | <b>35</b>   |                    | 38:12              |
| <b>1004</b>   | <b>200</b>  | 67:10       |                    | 39:1               |
| 5:12, 16,     | 58:23       | 68:3        | <b>a.m.</b>        | <b>acronym</b>     |
| 22 6:4, 15    | <b>2000</b> | <b>3com</b> | 4:3 72:7           | 68:16, 25          |
| <b>11</b>     | 41:11, 16   | 34:19       | <b>ability</b>     | <b>actual</b>      |
| 69:19         | <b>2001</b> | <b>3D</b>   | 15:2               | 28:15              |
| <b>11:59</b>  | 41:17       | 64:15, 18   | 26:14              | 45:6               |
| 72:7          | <b>2004</b> |             | <b>academic</b>    | <b>add</b>         |
| <b>12</b>     | 41:11       | <b>4</b>    | 32:15, 18,         | 39:7               |
| 60:6, 16      | 49:24       |             | 23                 | <b>added</b>       |
| <b>144</b>    | <b>2008</b> | <b>4</b>    | <b>accelerator</b> | 5:23               |
| 4:7           | 52:19, 22   | 27:13       | 64:24              | 22:11, 12          |
| <b>16-bit</b> | 56:20       | <b>47</b>   | 65:1               | 54:14              |
| 28:11         | <b>2009</b> | 70:20, 22   | <b>accelerator</b> | 62:19              |
| <b>1987</b>   | 6:9 60:2,   | 71:10       | <b>s</b>           | 66:19              |
| 28:10, 20     | 3           | <b>488</b>  | 64:23              | <b>adjacent</b>    |
| <b>1988</b>   | <b>2011</b> | 67:3, 16    | <b>access</b>      | 39:9               |
| 29:13         | 65:12, 17,  |             | 4:21 31:8          | 46:18              |
| <b>1990</b>   | 19 66:2,    | <b>5</b>    | 45:9               | <b>ads</b>         |
| 10:6, 9, 14   | 22, 24      |             | 69:23              | 57:3               |
| 30:4          | 69:20, 22   | <b>50</b>   | 70:4, 9            | <b>advanced</b>    |
| <b>1991</b>   | <b>2012</b> | 38:3        | <b>accessible</b>  | 33:9               |
| 30:15         | 59:21, 25   |             | 67:21              | <b>advertising</b> |
| <b>1994</b>   | 60:3, 12,   | <b>8</b>    | <b>account</b>     | 19:18              |
| 16:22         | 19 61:2,    |             | 62:14              | 20:18, 22          |
| 21:19         | 3, 6        | <b>89</b>   | 63:21              | <b>Agora</b>       |
| <b>1995</b>   | <b>21</b>   | 30:3, 9     | <b>accounting</b>  | 19:16              |
| 30:4          | 65:12       |             | 13:7               | 21:1, 19           |
| <b>1996</b>   | 69:22       | <b>9</b>    | 16:3, 6,           | 22:21              |
| 26:12         | <b>23</b>   |             | 11, 17, 20         | 23:16              |
| 32:4, 9       | 65:9        | <b>9</b>    | 17:2, 14           | 25:13, 20,         |
|               | <b>24</b>   | 30:25       | <b>accounts</b>    | 24 26:11           |
|               |             |             |                    | 65:23              |

|                                            |                                                                                                                                     |                                                                                    |                                                         |                                                                                            |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------------------------------------------------|--------------------------------------------------------------------------------------------|
| <b>agree</b><br>57:25                      | <b>application</b><br>s<br>14:25<br>33:2, 17                                                                                        | <b>assistant</b><br>27:12<br>28:2, 21<br>29:14, 19,<br>20 30:5,<br>16              | 48:20<br>59:13<br>61:7<br>71:22<br>72:2                 | 24:10, 17<br>46:25<br>47:2, 9<br>65:21                                                     |
| <b>ahead</b><br>12:12                      | <b>applied</b><br>8:15<br>31:15<br>55:2                                                                                             | <b>Association</b><br>23:7<br>65:23                                                | <b>back-end</b><br>61:14<br>63:6                        | <b>BBN</b><br>49:19, 24<br>50:10, 13,<br>20, 23<br>51:14<br>53:2<br>54:22                  |
| <b>Akashika</b><br>70:24                   | <b>Arbitrarily</b><br>8:5                                                                                                           | <b>AT&amp;T</b><br>10:16, 23<br>11:16                                              | <b>backbone</b><br>31:24                                | 56:7, 9, 13<br>58:18                                                                       |
| <b>Alex</b><br>49:15, 18,<br>21            | <b>architected</b><br>33:12                                                                                                         | <b>ATM</b><br>30:20                                                                | <b>background</b><br>26:4<br>71:6, 9, 17                | <b>Bell</b><br>10:7, 11,<br>16 11:5,<br>16, 20<br>12:5, 10,<br>15 13:18,<br>21, 25<br>14:1 |
| <b>ALOHA</b><br>9:23                       | <b>architectur<br/>es</b><br>29:1                                                                                                   | <b>attach</b><br>12:18                                                             | <b>bank</b><br>38:23                                    | <b>bench</b><br>11:11                                                                      |
| <b>alpha</b><br>57:5                       | <b>area</b><br>7:20, 23<br>12:2<br>14:13<br>15:8<br>31:7, 10,<br>11, 18<br>35:19<br>36:15<br>37:7<br>38:25<br>39:9<br>43:11<br>47:6 | <b>attached</b><br>62:14                                                           | <b>banks</b><br>47:25<br>48:4, 5                        | <b>beta</b><br>57:5                                                                        |
| <b>Alumni</b><br>23:6<br>65:22             |                                                                                                                                     | <b>attorneys</b><br>5:2                                                            | <b>Barrows</b><br>40:18                                 | <b>big</b><br>37:5 38:2                                                                    |
| <b>analysis</b><br>8:5, 7<br>51:21         |                                                                                                                                     | <b>audio</b><br>53:25<br>54:10, 13,<br>15, 17, 22<br>55:2, 6, 12                   | <b>base</b><br>28:17, 25                                | <b>bigger</b><br>40:1                                                                      |
| <b>analyze</b><br>51:16<br>52:9            |                                                                                                                                     | <b>automated</b><br>51:20                                                          | <b>based</b><br>12:5<br>18:2, 22<br>31:12<br>50:12      | <b>billion</b><br>39:22                                                                    |
| <b>analyzed</b><br>8:9                     |                                                                                                                                     | <b>automatical<br/>ly</b><br>64:10                                                 | <b>basically</b><br>8:7 22:9<br>26:18<br>56:23<br>63:12 | <b>bit</b><br>47:6<br>68:13<br>70:13                                                       |
| <b>Andreson</b><br>21:8                    | <b>areas</b><br>19:6, 14<br>46:18<br>50:20                                                                                          | <b>automat</b>                                                                     | <b>basis</b><br>17:23<br>50:23                          | <b>Block</b><br>45:5, 8                                                                    |
| <b>API</b><br>62:10                        | <b>ARPANET</b><br>50:16                                                                                                             | <b>back</b><br>10:14<br>11:20<br>19:24<br>20:22<br>21:11<br>26:15<br>34:6<br>40:19 | <b>bat</b><br>61:8                                      | <b>Blockscad</b><br>64:13, 14                                                              |
| <b>APIS</b><br>63:18                       | <b>articles</b><br>23:22                                                                                                            | <b>B</b>                                                                           | <b>bay</b><br>18:2, 14<br>19:1, 8<br>23:4               | <b>board</b><br>6:1<br>35:15, 16                                                           |
| <b>apple</b><br>40:17, 19<br>52:5<br>66:12 | <b>assets</b><br>6:12                                                                                                               |                                                                                    |                                                         |                                                                                            |
| <b>applicable</b><br>56:14                 | <b>assignments</b><br>29:11, 25<br>30:1                                                                                             |                                                                                    |                                                         |                                                                                            |
| <b>application</b><br>44:1<br>67:19, 23    |                                                                                                                                     |                                                                                    |                                                         |                                                                                            |

|                   |                  |                   |                    |                    |
|-------------------|------------------|-------------------|--------------------|--------------------|
| 36:9              | 43:23            | 35:8, 11          | 52:7, 8            | <b>cards</b>       |
| 40:18, 20,        | <b>brochures</b> | 36:3, 4,          | 53:8 70:6          | 67:25              |
| 23 41:25          | 24:15            | 12, 16, 19        | <b>called</b>      | 68:8               |
| 42:1              | <b>brought</b>   | 39:9, 16,         | 8:4 12:8           | <b>career</b>      |
| <b>book</b>       | 13:25            | 19 40:2           | 37:23              | 32:15              |
| 16:20, 21,        | <b>browser</b>   | 41:21             | 40:8 41:3          | <b>carry</b>       |
| 23 17:1,          | 21:14            | 43:11             | 42:17              | 8:13               |
| 13                | <b>build</b>     | 51:2, 7,          | 49:2, 4            | <b>cases</b>       |
| <b>bookkeeper</b> | 29:5 43:5        | 14, 18, 22,       | 50:2               | 58:9               |
| 63:10             | 50:15            | 23, 24            | 53:13, 24          | <b>CDMA</b>        |
| <b>books</b>      | 56:17            | 52:1, 17          | 57:7, 11           | 31:14              |
| 16:13             | 57:4             | 53:4, 5,          | <b>calling</b>     | <b>cellular</b>    |
| 17:5, 6, 13       | <b>building</b>  | 10, 12, 14,       | 20:19              | 9:3, 12            |
| 63:9              | 29:10            | 16, 21, 23,       | <b>calls</b>       | 10:1               |
| <b>Bose</b>       | 55:6             | 25 54:9           | 38:3               | 13:14              |
| 18:12             | <b>built</b>     | 55:4              | 70:1, 8            | 14:4               |
| <b>boss</b>       | 13:4             | 56:4, 5, 15       | <b>camera</b>      | 17:21              |
| 36:9              | 14:19            | 58:5, 6, 7,       | 22:16              | 18:9               |
| 37:21             | 15:4, 7          | 10 60:13,         | <b>capability</b>  | 31:5, 20           |
| <b>Boston</b>     | 18:14            | 25 63:13          | 54:22              | 34:13              |
| 66:4, 8,          | 36:20            | <b>businesses</b> | 59:12              | 45:24              |
| 10, 21            | 38:1             | 16:14             | 61:8               | 46:2               |
| <b>bottom</b>     | 47:17            | 20:5              | <b>capital</b>     | 47:2, 20           |
| 28:10             | 50:16            | 36:6, 8           | 49:4, 5, 12        | 48:6               |
| <b>bought</b>     | 62:25            | 40:4, 5           | <b>capitalist</b>  | 69:1, 23           |
| 27:2, 6           | <b>bullet</b>    | 56:3              | 40:22              | 70:5, 9            |
| 37:14             | 27:23            | 58:11             | <b>capitalists</b> | <b>center</b>      |
| 38:15             | 28:10            | <b>buy</b>        | 40:13              | 51:11, 15,         |
| <b>Boundary</b>   | <b>bunch</b>     | 34:1, 2           | 41:1               | 17 52:5, 8         |
| 8:4               | 20:21            | 36:5              | 46:11              | 53:6               |
| <b>brand</b>      | 28:16            | <b>buying</b>     | 50:25              | <b>centers</b>     |
| 41:23             | 29:11            | 45:2              | <b>Captial</b>     | 51:13              |
| <b>break</b>      | 35:25            | <b>C</b>          | 49:6               | <b>CEO</b>         |
| 48:8              | 49:16            | <b>C-H-E-N-G</b>  | <b>capture</b>     | 48:22              |
| <b>bring</b>      | <b>business</b>  | 35:4              | 15:4               | <b>certificate</b> |
| 56:3              | 6:10, 14         | <b>California</b> | <b>card</b>        | 6:18               |
| <b>broadcast</b>  | 8:21 13:7        | 35:2              | 64:4               | <b>CFO</b>         |
| 54:19             | 16:3, 6,         | <b>call</b>       | 67:13, 15,         | 48:23              |
| 55:10             | 13, 17           | 33:10             | 20, 24             | <b>chairman</b>    |
| <b>broader</b>    | 20:12, 16        | 42:24             | 68:1, 5, 12        | 35:13              |
|                   | 26:18, 20        | 51:11, 12,        | 69:24              | 37:6               |
|                   | 33:24, 25        | 14, 17            | 70:10              | 39:24              |
|                   | 34:10            |                   |                    |                    |

|                                                              |                                              |                                                                                                                          |                                                                                                                                                                                                                                     |                                                                                                                     |
|--------------------------------------------------------------|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>change</b><br>6:16                                        | 61:20, 23<br>62:23, 24<br>64:19              | <b>collected</b><br>60:6, 10                                                                                             | 46:7, 12,<br>15 50:11,<br>12, 24                                                                                                                                                                                                    | 28:22, 24<br>29:15                                                                                                  |
| <b>channel</b><br>31:13                                      | <b>classes</b><br>7:7 13:16                  | <b>column</b><br>67:10                                                                                                   | 55:11, 23<br>56:8                                                                                                                                                                                                                   | <b>computer</b><br>7:16, 23<br>14:9, 14<br>15:2, 6<br>26:8<br>27:9, 16,<br>20 28:12,<br>15 29:1,<br>10 50:17,<br>18 |
| <b>chapter</b><br>17:9                                       | 59:10<br>61:9, 14,<br>15 63:4                | <b>columns</b><br>67:7                                                                                                   | <b>company</b><br>6:11, 12<br>16:10<br>17:4, 5<br>18:2, 17<br>19:4, 5,<br>17, 22<br>23:10, 11,<br>16 26:23<br>27:4<br>33:16<br>34:3<br>38:9, 18<br>40:12, 16<br>41:3, 13,<br>14 49:15,<br>16 54:2<br>57:7, 12<br>62:22<br>64:14, 22 |                                                                                                                     |
| <b>chapters</b><br>17:8                                      | <b>clear</b><br>39:10                        | <b>combination</b><br>71:15                                                                                              |                                                                                                                                                                                                                                     |                                                                                                                     |
| <b>characteris<br/>tics</b><br>43:1                          | <b>cloud</b><br>42:17                        | <b>combination<br/>s</b><br>71:4, 14                                                                                     |                                                                                                                                                                                                                                     |                                                                                                                     |
| <b>characteriz<br/>ed</b><br>38:11                           | <b>club</b><br>66:3, 8,<br>10, 14, 15,<br>21 | <b>combining</b><br>71:16                                                                                                |                                                                                                                                                                                                                                     | <b>computer-<br/>aided</b><br>64:15                                                                                 |
| <b>chart</b><br>17:3<br>71:12                                | <b>CMMS</b><br>52:7                          | <b>commerciali<br/>ze</b><br>50:19<br>51:4                                                                               |                                                                                                                                                                                                                                     | <b>computers</b><br>14:22<br>29:5                                                                                   |
| <b>check</b><br>66:18                                        | <b>code</b><br>31:8<br>62:12<br>63:17, 20    | <b>Commonwealt<br/>h</b><br>49:5, 6,<br>11, 18, 20                                                                       |                                                                                                                                                                                                                                     | <b>computing</b><br>10:17                                                                                           |
| <b>checking</b><br>21:16                                     | <b>codes</b><br>62:11                        | <b>communicati<br/>on</b><br>15:21                                                                                       | <b>compatible</b><br>45:14                                                                                                                                                                                                          | <b>concentrate</b><br>7:19, 22<br>12:1<br>14:12                                                                     |
| <b>checks</b><br>60:6, 10                                    | <b>coding</b><br>31:12, 16                   | <b>communicati<br/>ons</b><br>9:11, 12,<br>15 23:3,<br>19, 25<br>41:18<br>65:21                                          | <b>complete</b><br>6:17 7:2,<br>5 65:18,<br>23                                                                                                                                                                                      | <b>concerned</b><br>45:13                                                                                           |
| <b>Cheng</b><br>35:4                                         | <b>cofounders</b><br>25:18<br>26:3           | <b>companies</b><br>19:21<br>20:7, 18,<br>21 25:1<br>33:7<br>34:2, 6<br>35:18, 22<br>37:14<br>38:16, 24<br>39:6<br>40:16 | <b>completed</b><br>70:2                                                                                                                                                                                                            | <b>concluded</b><br>72:7                                                                                            |
| <b>chip</b><br>8:11, 13<br>36:20, 24                         | <b>cohesive</b><br>35:23                     |                                                                                                                          | <b>compliant</b><br>19:1                                                                                                                                                                                                            | <b>conclusion</b><br>8:18                                                                                           |
| <b>chips</b><br>36:21, 24<br>37:2, 3<br>39:15                | <b>collaborate</b><br>18:13                  |                                                                                                                          | <b>components</b><br>28:13                                                                                                                                                                                                          | <b>conditions</b><br>43:4                                                                                           |
| <b>cite</b><br>71:5                                          | <b>collaborato<br/>r</b><br>18:15            |                                                                                                                          | <b>comprehensi<br/>ve</b><br>6:19<br>39:3, 5                                                                                                                                                                                        | <b>confer</b><br>71:21                                                                                              |
| <b>class</b><br>7:6 10:3<br>16:8<br>20:16<br>29:1, 3<br>30:8 | <b>colleague</b><br>18:8                     |                                                                                                                          | <b>computation<br/>al</b>                                                                                                                                                                                                           | <b>confirmatio<br/>n</b><br>61:20<br>64:12                                                                          |
|                                                              | <b>colleague's</b><br>18:11                  |                                                                                                                          |                                                                                                                                                                                                                                     | <b>confused</b><br>59:25                                                                                            |
|                                                              |                                              |                                                                                                                          |                                                                                                                                                                                                                                     | <b>considered</b>                                                                                                   |

|                    |                  |                    |                  |                    |
|--------------------|------------------|--------------------|------------------|--------------------|
| 39:18              | 50:4             | 56:8               |                  | <b>declaration</b> |
| <b>consortium</b>  | <b>correct</b>   | 61:14              | <b>D</b>         | 4:21 5:5,          |
| 23:12              | 28:22            | <b>created</b>     |                  | 7,9,10             |
| <b>consortium'</b> | 29:15            | 29:25              | <b>DARPA</b>     | 65:6               |
| <b>s</b>           | 30:6,17          | 56:22              | 64:20            | 68:15              |
| 23:14              | 61:5 68:1        | 64:19              | <b>data</b>      | 69:9               |
| <b>constructio</b> | 69:12            | <b>creating</b>    | 9:19 15:2        | 70:16,20           |
| <b>n</b>           | <b>correctly</b> | 12:20              | 23:3,19,         | 71:7               |
| 28:11              | 36:14            | <b>credit</b>      | 25 31:19         | <b>defects</b>     |
| <b>consulted</b>   | 44:10            | 64:4               | 34:2,4,8,        | 37:2               |
| 51:14              | <b>could've</b>  | <b>CTO</b>         | 10 42:6,         | <b>degree</b>      |
| <b>consulting</b>  | 8:15 51:9        | 57:8,22            | 8,10,13,         | 7:9 10:6           |
| 19:20              | 52:16            | <b>cubicle</b>     | 15 43:14         | 11:24              |
| 26:19              | 67:2             | 34:7               | 64:6             | 13:8               |
| 51:15,20,          | <b>country</b>   | <b>current</b>     | 65:21            | <b>degrees</b>     |
| 23 52:4            | 42:23            | 5:18,21,           | <b>database</b>  | 7:12,14            |
| <b>content</b>     | <b>couple</b>    | 25 44:3            | 61:15,21         | <b>delays</b>      |
| 59:5               | 20:4             | <b>customer</b>    | 64:10,11         | 43:14              |
| 63:16              | 60:17,23         | 45:6               | <b>databases</b> | <b>delete</b>      |
| <b>context</b>     | <b>courses</b>   | <b>customers</b>   | 53:18            | 38:7               |
| 67:16              | 6:22,23,         | 44:14,16,          | <b>date</b>      | <b>Dell</b>        |
| 69:1               | 24 7:2           | 20,24              | 65:12            | 52:5               |
| <b>continue</b>    | 8:21,24          | 45:10,16           | 68:4,11          | <b>delta</b>       |
| 11:25              | 9:2,6,8,         | 47:16,17,          | 69:19,21,        | 49:21              |
| 27:3               | 10,17            | 19 51:15           | 22               | 50:3,6,8           |
| <b>continuing</b>  | 13:7,10,         | 52:4               | <b>dated</b>     | 51:3               |
| 13:16              | 13,21,23         | 61:16              | 28:10            | 53:22              |
| <b>contract</b>    | 14:3             | <b>customize</b>   | 32:4             | 55:18              |
| 50:15              | 16:3,6,17        | 63:20              | <b>day</b>       | 56:19              |
| 53:6               | 17:20            | <b>customized</b>  | 20:7 59:8        | 57:9               |
| <b>contracts</b>   | <b>cover</b>     | 62:11              | <b>days</b>      | <b>demonstrate</b> |
| 22:24              | 7:1              | <b>customizing</b> | 40:17            | 54:12              |
| 51:16              | <b>covered</b>   | 61:25              | <b>deal</b>      | <b>demonstrati</b> |
| <b>converted</b>   | 9:17,25          | 62:21              | 40:19            | <b>on</b>          |
| 23:22              | 13:18            | <b>CV</b>          | 49:15,17         | 12:9 13:3          |
| 66:19              | <b>CPA</b>       | 4:22               | <b>decent</b>    | 54:11              |
| <b>copy</b>        | 63:10            | 5:13,17,           | 42:1             | <b>demonstrati</b> |
| 67:3,4,6           | <b>CPU</b>       | 19,22,25           | <b>decide</b>    | <b>ons</b>         |
| <b>Corporation</b> | 39:17            | 6:9 31:1           | 60:18            | 22:13,15           |
| 32:13              | <b>create</b>    | 60:1               | <b>decided</b>   | <b>department</b>  |
|                    | 22:22            | 64:25              | 60:25            | 27:8,15,           |
|                    | 50:11,12         |                    |                  | 19 30:5,7          |

|                                                                                         |                                                                                 |                                                                                                                                       |                                                          |                                                                                                                                       |
|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>deployed</b><br>15:14,15                                                             | 36:3,12,<br>16 44:4                                                             | <b>directors</b><br>6:1                                                                                                               | 37:5                                                     | 64:16                                                                                                                                 |
| <b>deposition</b><br>5:1 72:6                                                           | <b>device</b><br>12:18                                                          | <b>discovery</b><br>6:1                                                                                                               | <b>dollars</b><br>39:22                                  | <b>effectively</b><br>60:14                                                                                                           |
| <b>depositions</b><br>5:24                                                              | 13:3<br>67:19,21                                                                | <b>discussions</b><br>18:23                                                                                                           | <b>download</b><br>24:14                                 | <b>effort</b><br>64:16                                                                                                                |
| <b>describe</b><br>61:10                                                                | <b>devices</b><br>67:20                                                         | <b>Disney</b><br>55:10                                                                                                                | <b>downloaded</b><br>21:11,15                            | <b>Einstein's</b><br>6:8 58:7,<br>13 60:1                                                                                             |
| <b>description</b><br>54:18                                                             | <b>Dialectic</b><br>8:5                                                         | <b>distracted</b><br>26:17                                                                                                            | <b>draft</b><br>32:12,13                                 | 61:5<br>64:17                                                                                                                         |
| <b>design</b><br>14:21<br>28:11<br>30:19<br>46:23<br>47:2<br>56:10<br>63:15<br>64:15,18 | <b>dialed</b><br>70:4                                                           | <b>distributed</b><br>14:16<br>43:5,12                                                                                                | <b>drum</b><br>36:4                                      | <b>elected</b><br>52:15,19                                                                                                            |
|                                                                                         | <b>dialling</b><br>48:2                                                         | <b>division</b><br>31:8<br>36:15<br>37:16,20,<br>21 38:17<br>43:25<br>47:24<br>49:22<br>50:1,2,3,<br>7 51:4<br>53:22<br>56:19<br>57:9 | <b>duly</b><br>4:6                                       | <b>electrical</b><br>7:15,23<br>12:2<br>14:9,13<br>27:9,15,<br>20                                                                     |
|                                                                                         | <b>differed</b><br>29:19                                                        |                                                                                                                                       | <b>E</b>                                                 |                                                                                                                                       |
|                                                                                         | <b>difference</b><br>30:2                                                       |                                                                                                                                       | <b>e-mail</b><br>50:18                                   | <b>electromagn<br/>etic</b><br>8:14                                                                                                   |
| <b>desk</b><br>22:17                                                                    | <b>Dill</b><br>70:23                                                            |                                                                                                                                       | <b>e-mails</b><br>20:7 60:8                              | <b>electronic</b><br>67:4,6                                                                                                           |
| <b>details</b><br>9:16                                                                  | <b>dinner</b><br>66:11                                                          |                                                                                                                                       | <b>earlier</b><br>30:21<br>59:24<br>63:15                | <b>Electronica<br/>lly</b><br>4:23                                                                                                    |
| <b>determine</b><br>46:19                                                               | <b>direct</b><br>18:15                                                          | <b>division's</b><br>50:8<br>55:18                                                                                                    | <b>early</b><br>19:25<br>32:12<br>34:12<br>40:17<br>68:7 | <b>Element</b><br>8:4                                                                                                                 |
| <b>develop</b><br>19:7<br>30:19<br>64:21                                                | <b>directed</b><br>9:11,14                                                      | <b>divisions</b><br>39:19,23<br>40:10                                                                                                 |                                                          | <b>emergency</b><br>70:6                                                                                                              |
| <b>developed</b><br>33:11<br>38:12                                                      | <b>direction</b><br>58:1                                                        |                                                                                                                                       | <b>ed</b><br>13:16<br>64:23                              | <b>Empirix</b><br>40:8<br>41:4,7,9,<br>12 43:17,<br>24,25<br>44:5,17<br>45:23<br>46:4,17,<br>21,23,25<br>47:2,5,<br>10,24,25<br>48:21 |
| <b>developer</b><br>51:25                                                               | <b>directly</b><br>17:22<br>31:23,25<br>35:13,16<br>44:7,22<br>45:3,18<br>56:11 | <b>doctoral</b><br>31:10                                                                                                              | <b>edited</b><br>62:13                                   |                                                                                                                                       |
| <b>developing</b><br>19:6 36:6<br>44:9,12,<br>13 56:17                                  | <b>director</b><br>35:8,10<br>36:12<br>49:23<br>51:3                            | <b>documentati<br/>on</b><br>62:7                                                                                                     | <b>education</b><br>7:8 11:25<br>13:24<br>58:6           |                                                                                                                                       |
| <b>development</b><br>33:9<br>35:9,11                                                   |                                                                                 | <b>documents</b><br>4:19 5:3,<br>4 70:12                                                                                              | <b>educational</b>                                       |                                                                                                                                       |
|                                                                                         |                                                                                 | <b>dollar</b>                                                                                                                         |                                                          |                                                                                                                                       |

|                    |                    |                    |                  |                  |
|--------------------|--------------------|--------------------|------------------|------------------|
| 49:1               | 39:8               | <b>Evoke</b>       | <b>explored</b>  | <b>figured</b>   |
| <b>Empirix/</b>    | <b>entitled</b>    | 53:13              | 49:16            | 50:18            |
| <b>teradyne</b>    | 27:14              | <b>evolve</b>      | <b>exploring</b> | 62:8             |
| 41:7               | <b>entrepreneu</b> | 36:8               | 40:3             | 63:22            |
| <b>employed</b>    | <b>r-in-</b>       | <b>exact</b>       | <b>extent</b>    | <b>file</b>      |
| 13:21              | <b>residence</b>   | 18:10              | 15:23            | 33:17            |
| <b>employee</b>    | 49:7, 11           | 22:23              | 45:11            | <b>files</b>     |
| 13:18              | <b>entrepreneu</b> | 51:8               |                  | 54:15            |
| 41:9               | <b>rship</b>       | <b>exam</b>        | <b>F</b>         | <b>filing</b>    |
| <b>employees</b>   | 16:9, 16           | 31:7, 11           |                  | 45:7, 9          |
| 14:2               | 20:14              | <b>EXAMINATION</b> | <b>facility</b>  | <b>fill</b>      |
| 25:24              | <b>Eons</b>        | 4:10               | 60:12, 19        | 41:21            |
| <b>emulated</b>    | 57:7, 8,           | <b>examined</b>    | 61:1             | 46:20            |
| 42:25              | 11, 14, 22,        | 4:7                | <b>fair</b>      | 66:17            |
| <b>emulating</b>   | 24 58:3,           | <b>examples</b>    | 63:25            | <b>finally</b>   |
| 43:7               | 19                 | 14:17              | <b>fall</b>      | 60:17            |
| <b>emulator</b>    | <b>equipment</b>   | <b>exams</b>       | 10:14            | <b>financial</b> |
| 42:17              | 15:14              | 6:19, 21,          | 30:3             | 8:24             |
| <b>enabled</b>     | 34:13              | 24, 25 7:1         | <b>familiar</b>  | 13:10            |
| 15:1               | 37:4               | <b>excited</b>     | 68:16            | 45:1, 21         |
| <b>end</b>         | <b>ESPN</b>        | 19:23              | <b>faster</b>    | <b>find</b>      |
| 6:13 17:9          | 55:9               | 20:6               | 28:19            | 53:18            |
| 31:2               | <b>established</b> | <b>Executive</b>   | <b>father</b>    | 69:15            |
| 56:16              | 19:4, 5            | 4:7                | 27:1             | <b>finding</b>   |
| <b>ended</b>       | <b>evaluated</b>   | <b>Exhibit</b>     | <b>February</b>  | 61:23            |
| 32:16              | 54:25              | 5:12, 16,          | 10:9             | 62:20            |
| <b>engineer</b>    | <b>evaluating</b>  | 22 6:4, 15         | <b>feel</b>      | <b>finish</b>    |
| 26:2, 6            | 57:17              | 65:6               | 63:2             | 11:23            |
| <b>engineering</b> | <b>evaluations</b> | <b>existing</b>    | <b>felt</b>      | 26:13, 20        |
| 7:15, 23           | 55:1               | 50:9               | 50:25            | <b>finished</b>  |
| 12:3               | <b>events</b>      | 51:13              | <b>Ferri</b>     | 7:7 33:21        |
| 14:9, 13           | 66:11              | 56:18              | 40:20            | <b>finishing</b> |
| 27:9, 15,          | <b>eventually</b>  | <b>expansive</b>   | <b>fiber</b>     | 33:18            |
| 20 41:17           | 19:3, 19           | 60:13              | 8:17             | <b>fire</b>      |
| 42:4               | 22:12              | <b>expenses</b>    | <b>figure</b>    | 56:1             |
| <b>ensure</b>      | 29:8               | 25:9               | 47:6 49:8        | <b>firm</b>      |
| 44:10              | 39:25              | <b>expert</b>      | 50:10            | 49:4             |
| <b>entailed</b>    | 52:2 55:7          | 58:9               | 55:19            | <b>focus</b>     |
| 61:11              | 56:24              | <b>explain</b>     | 56:24, 25        | 31:4             |
| <b>enter</b>       | 58:17              | 29:17              | 62:23            | 39:10, 13        |
|                    | 63:9               |                    |                  |                  |

|                   |                      |                   |                  |                      |
|-------------------|----------------------|-------------------|------------------|----------------------|
| 43:20             | <b>fraction</b>      | <b>gap</b>        | <b>graduated</b> | 37:17                |
| 44:5              | 39:20                | 41:21             | 10:5             |                      |
| 50:6, 8           | <b>freeware</b>      | <b>gaps</b>       | 32:16            | <hr/> <b>H</b> <hr/> |
| <b>focused</b>    | 65:3                 | 39:7              | 33:22            |                      |
| 11:9              | <b>frequency</b>     | 46:19             | <b>grant</b>     | <b>H&amp;r</b>       |
| 14:15             | 12:21                | <b>gave</b>       | 64:20            | 45:5, 8              |
| 29:3              | <b>friend</b>        | 13:23             | <b>grew</b>      | <b>H-O-U-H</b>       |
| 43:18             | 34:22                | <b>general</b>    | 58:5, 11         | 4:13                 |
| <b>forget</b>     | <b>friends</b>       | 35:21             | 60:16            | <b>half</b>          |
| 42:16             | 49:3                 | 36:15             | <b>group</b>     | 13:1                 |
| <b>form</b>       | <b>full</b>          | 37:15, 19         | 10:18            | <b>hall</b>          |
| 27:22             | 63:5                 | 46:10             | 11:3             | 21:9                 |
| 33:6              | <b>full-time</b>     | 51:25             | 13:25            | <b>Hammer</b>        |
| 36:17             | 33:23                | 69:10             | 14:24            | 37:23                |
| 50:23             | 60:18                | <b>generate</b>   | 15:4, 17         | 38:9, 15             |
| 64:2              | <b>fun</b>           | 62:23             | 17:24, 25        | 41:22, 23            |
| <b>formal</b>     | 34:20                | <b>generation</b> | 18:20            | <b>handful</b>       |
| 28:5              | <b>function</b>      | 44:4              | 19:16            | 40:25                |
| 37:18             | 69:6                 | <b>generic</b>    | 20:1             | <b>handle</b>        |
| 60:9              | <b>functional</b>    | 62:12             | 21:3, 4, 5       | 38:3                 |
| <b>formally</b>   | 37:25                | <b>gigabit</b>    | 22:9, 11         | <b>handwritten</b>   |
| 41:22             | <b>functionalit</b>  | 14:20             | 30:17            | 66:16                |
| <b>format</b>     | 22:19                | 30:20             | 35:18, 24        | <b>happened</b>      |
| 17:6, 10, 12      | 24:3, 18             | <b>give</b>       | 37:19, 23        | 43:13                |
| <b>formatted</b>  | 25:7, 11,            | 8:8 58:23         | 41:18            | 49:14                |
| 67:8              | 22 44:11             | 70:19             | 43:21            | 52:17                |
| <b>forms</b>      | 45:21                | <b>GOLUB</b>      | 44:2             | <b>hardware</b>      |
| 66:17             | 57:15, 24            | 4:10              | 65:20            | 36:19                |
| <b>found</b>      | 61:4, 12             | 48:8, 11,         | <b>groups</b>    | 37:1                 |
| 7:4 19:22         | <b>funded</b>        | 14, 17, 20        | 32:25            | 39:11, 18            |
| 49:15             | 53:20                | 71:18, 24         | 37:17            | 40:2                 |
| <b>Foundation</b> | 54:1                 | <b>good</b>       | 39:4, 6          | <b>head</b>          |
| 68:22             |                      | 4:14              | <b>grow</b>      | 29:14, 18,           |
| <b>founded</b>    | <hr/> <b>G</b> <hr/> | 26:20             | 39:25            | 21 30:8              |
| 40:16             | <b>gain</b>          | 40:22             | 56:5             | 38:17                |
| <b>founder</b>    | 69:22                | <b>grad</b>       | <b>growing</b>   | 49:21                |
| 35:14             | <b>games</b>         | 11:24             | 37:8             | <b>headed</b>        |
| 49:3 50:4         | 57:20                | 16:10             | <b>GSM</b>       | 50:3                 |
| <b>founders</b>   |                      | 30:11             | 67:12, 15        | <b>headline</b>      |
| 26:3              |                      | <b>graduate</b>   | 68:1, 4, 11      | 54:20                |
|                   |                      | 26:7, 15          | 69:22            |                      |
|                   |                      |                   | 70:9, 12         |                      |
|                   |                      |                   | <b>guess</b>     |                      |

|                                                                                                                                                               |                                                                       |                                                                |                                                                        |                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------------------------------------|------------------------------------------------------------------------|-----------------------------------------------|
| <b>heard</b><br>21:10<br>68:18, 19,<br>24                                                                                                                     | <b>home</b><br>60:4, 15<br>69:3, 6                                    | <b>implement</b><br>30:20<br>57:23                             | 64:8                                                                   | 26:22                                         |
| <b>heavier</b><br>51:20                                                                                                                                       | <b>host</b><br>66:11                                                  | <b>improved</b><br>28:17                                       | <b>informed</b><br>46:2                                                | 27:2                                          |
| <b>held</b><br>27:19                                                                                                                                          | <b>Houh</b><br>4:6, 12, 14<br>20:25<br>30:24<br>48:9, 21<br>65:5 72:4 | <b>include</b><br>15:24<br>25:21<br>62:11, 12<br>68:5<br>71:10 | <b>infrastructure</b><br>41:18<br>62:16                                | <b>interested</b><br>25:2                     |
| <b>helped</b><br>10:19<br>14:20<br>17:4<br>19:17<br>20:1 21:6<br>23:13<br>25:15, 16,<br>19 29:24<br>44:2<br>51:1, 21<br>52:1, 18<br>53:4, 10<br>57:3<br>61:24 | <b>hours</b><br>58:20                                                 | <b>included</b><br>71:11                                       | <b>initially</b><br>20:17<br>35:8<br>59:17<br>61:18<br>63:8, 11        | <b>interesting</b><br>50:24                   |
| <b>helping</b><br>66:14                                                                                                                                       | <b>house</b><br>60:6                                                  | <b>including</b><br>49:3<br>50:21                              | <b>installed</b><br>21:12<br>67:19, 23                                 | <b>interface</b><br>14:21                     |
| <b>Henry</b><br>4:6, 12                                                                                                                                       | <b>hundred</b><br>20:3, 4<br>58:23                                    | <b>income</b><br>39:21                                         | <b>Institute</b><br>7:11                                               | <b>internal</b><br>13:24<br>37:18<br>55:6     |
| <b>high-speed</b><br>14:16, 17,<br>19 15:1,<br>10 42:8                                                                                                        | <b>hundreds</b><br>58:23                                              | <b>incorporate</b><br>d<br>60:24<br>61:2                       | <b>integrate</b><br>57:18<br>59:1, 18<br>61:4, 17<br>62:4 64:5<br>66:9 | <b>internally</b><br>36:7<br>56:22            |
| <b>hired</b><br>18:18<br>26:1, 5, 10<br>28:1<br>51:24, 25<br>58:17<br>59:4<br>63:3, 9, 14                                                                     | <b>I</b>                                                              | <b>independent</b><br>54:23                                    | <b>Institute</b><br>7:11                                               | <b>international</b><br>42:24                 |
| <b>hit</b><br>39:22                                                                                                                                           | <b>IBM</b><br>15:11                                                   | <b>index</b><br>54:14                                          | <b>integrated</b><br>12:13<br>59:17<br>66:25                           | <b>internet</b><br>32:12<br>42:22<br>48:3     |
| <b>HLR</b><br>68:25                                                                                                                                           | <b>idea</b><br>20:12<br>41:21<br>42:2<br>53:20<br>57:3                | <b>indices</b><br>8:12                                         | <b>integrating</b><br>59:6, 16<br>63:18                                | <b>internship</b><br>10:8, 12<br>12:14        |
|                                                                                                                                                               | <b>ideas</b><br>35:25<br>49:16                                        | <b>Industrial</b><br>23:5<br>24:21, 23<br>25:3, 6<br>65:22     | <b>integration</b><br>62:1                                             | <b>internships</b><br>10:25                   |
|                                                                                                                                                               | <b>identified</b><br>5:5, 7                                           | <b>industry</b><br>46:2, 5                                     | <b>integration</b><br>s<br>59:22                                       | <b>interval</b><br>12:20                      |
|                                                                                                                                                               | <b>identify</b><br>65:11<br>70:22                                     | <b>informal</b><br>60:4                                        | <b>intended</b><br>23:25                                               | <b>introducer</b><br>y<br>29:1                |
|                                                                                                                                                               | <b>ILP</b><br>25:10                                                   | <b>information</b><br>24:13<br>25:4 62:3<br>63:1, 4, 24        | <b>interacting</b><br>35:17                                            | <b>invented</b><br>50:17                      |
|                                                                                                                                                               |                                                                       |                                                                | <b>interest</b>                                                        | <b>invested</b><br>40:15, 24<br>42:1<br>49:20 |
|                                                                                                                                                               |                                                                       |                                                                |                                                                        | <b>investigate</b><br>57:21                   |

|                             |                          |                                                |                             |                                      |
|-----------------------------|--------------------------|------------------------------------------------|-----------------------------|--------------------------------------|
| <b>investigati<br/>ng</b>   | 49:21, 22,<br>23 66:14   | 55:15, 16,<br>18 56:2, 7                       | <b>language</b>             | 35:1 38:4                            |
| 47:13                       |                          | 62:8, 22                                       | 50:21                       | <b>led</b>                           |
| <b>investigati<br/>on</b>   | <b>joining</b><br>25:10  | 63:3                                           | 53:17                       | 28:1                                 |
| 47:23                       | <b>Jonathan</b><br>25:18 | <b>kinds</b><br>44:14, 15                      | 54:23                       | 40:14                                |
| <b>investments</b><br>40:23 | 27:1, 5                  | <b>knew</b><br>18:18                           | 56:25                       | <b>left</b><br>26:1 33:5             |
| <b>investors</b><br>40:13   | <b>K</b>                 | 64:6                                           | <b>large</b><br>45:14       | 49:18                                |
| <b>involve</b><br>10:23     | <b>keen</b><br>33:15     | <b>knowledge</b><br>6:6                        | 54:23                       | 52:16                                |
| <b>involved</b><br>25:9     | <b>kid's</b><br>60:15    | <b>L</b>                                       | 58:16                       | 53:3                                 |
| <b>IP</b>                   | <b>kids</b><br>58:6      | <b>lab</b><br>11:11, 12                        | <b>laser</b><br>11:10       | 57:7, 9                              |
| 34:12                       | 60:6, 16                 | 13:5                                           | 12:9, 16,<br>19             | 58:2, 3                              |
| 42:18, 22                   | 64:17                    | 15:16                                          | <b>lasers</b><br>11:7, 14   | <b>legal</b><br>69:25                |
| <b>irons</b><br>56:1        | <b>kids'</b><br>64:15    | 21:9                                           | 12:7                        | 70:6                                 |
| <b>ISDN</b><br>68:19, 24    | <b>kind</b><br>11:10     | 29:4, 11,<br>21, 23, 24                        | <b>launch</b><br>53:8       | <b>level</b><br>7:25                 |
| <b>issued</b><br>45:5       | 17:10                    | 30:1, 9                                        | <b>launched</b><br>43:22    | 28:25                                |
| <b>issues</b><br>23:22      | 18:20                    | 42:19, 20                                      | 62:18                       | 47:11                                |
| <b>items</b><br>5:23        | 19:4, 5,<br>19, 25       | 43:2                                           | <b>launching</b><br>60:13   | <b>leverage</b><br>56:7, 15,<br>24   |
|                             | 20:17                    | <b>laboratory</b><br>28:21                     | <b>lead</b><br>44:3         | <b>Lexington</b><br>60:21, 22,<br>23 |
|                             | 22:10                    | 29:2, 14,<br>18, 20                            | <b>league</b><br>58:4       | <b>Liaison</b><br>23:5               |
|                             | 23:11                    | <b>labs</b><br>10:7, 11,<br>16 11:6,<br>16, 20 | 60:5, 16                    | 24:23                                |
|                             | 29:22                    | 12:6, 11,<br>15 13:18,<br>22, 25               | <b>learned</b><br>16:12, 25 | 25:3, 6                              |
| <b>J</b>                    | 32:15, 23                | 14:1                                           | 17:2                        | 65:22                                |
|                             | 33:8                     | 15:12                                          | <b>lease</b><br>60:19, 25   | <b>lighter</b><br>51:19              |
| <b>jitter</b><br>43:15      | 34:11, 24                | 29:6, 9                                        | <b>leased</b><br>60:12      | <b>lines</b><br>39:8                 |
| <b>job</b><br>34:23, 24     | 35:14, 24                | <b>laid</b><br>8:13                            | <b>leave</b><br>34:18       | 46:20                                |
| 36:9                        | 37:4                     | <b>landline</b><br>9:11, 15                    | 48:21                       | <b>link</b><br>15:24                 |
| <b>join</b><br>49:6, 18     | 39:1, 8, 25              | 48:7                                           | 56:19                       | <b>links</b><br>14:22                |
| <b>joined</b><br>5:25 6:2   | 43:11, 22                |                                                | <b>leaving</b><br>34:23, 24 | 15:10, 21                            |
| 40:7, 23                    | 45:20                    |                                                |                             | <b>list</b><br>20:5, 9               |
|                             | 46:4, 17                 |                                                |                             |                                      |
|                             | 47:7, 13,<br>25 49:5, 7  |                                                |                             |                                      |
|                             | 50:11                    |                                                |                             |                                      |
|                             | 51:21                    |                                                |                             |                                      |

|                  |                    |                    |                   |                    |
|------------------|--------------------|--------------------|-------------------|--------------------|
| 25:9             | 54:17              | 47:16              | <b>matches</b>    | 69:16              |
| 32:2, 4, 7       | 58:22, 25          | 52:10              | 53:19             | <b>mentioned</b>   |
| 65:18, 24        | 59:2, 14           | 55:25              | <b>materials</b>  | 20:25              |
| <b>listed</b>    | 63:15              | 62:13, 16          | 8:11              | 23:18              |
| 5:10 6:3         | <b>lots</b>        | 69:20              | 71:13             | 25:12              |
| 22:4             | 55:11              | 70:5               | <b>Matrix</b>     | 63:15              |
| 30:25            |                    | <b>makes</b>       | 40:14, 15,        | <b>menu</b>        |
| 64:25            | <b>M</b>           | 64:14              | 19, 25            | 38:7               |
| <b>listing</b>   |                    | <b>making</b>      | <b>MAUCOTEL</b>   | <b>met</b>         |
| 71:12            | <b>machines</b>    | 18:2               | 27:22             | 5:2                |
| <b>literally</b> | 36:20              | 45:13              | 33:6              | <b>method</b>      |
| 21:7             | 37:5               | <b>management</b>  | 36:17             | 31:17              |
| <b>live</b>      | <b>made</b>        | 62:19              | 48:16             | <b>Methods</b>     |
| 22:16            | 8:11               | <b>manager</b>     | 64:2              | 31:8               |
| <b>load</b>      | 33:25              | 37:15, 16,         | 68:22             | <b>micro</b>       |
| 37:25            | 34:9               | 20, 21             | 71:20, 25         | 57:19              |
| 42:7             | 38:18              | 41:17              | 72:2              | <b>Micromaster</b> |
| 44:11            | 40:22              | 42:4               | <b>meant</b>      | <b>s</b>           |
| <b>local</b>     | <b>magazine</b>    | 51:25              | 17:12             | 6:17               |
| 15:7, 16         | 23:4, 19,          | <b>managers</b>    | <b>media</b>      | <b>microsecond</b> |
| <b>location</b>  | 22, 25             | 35:21              | 55:11             | 12:24, 25          |
| 69:4, 7, 13      | 24:7               | 37:19              | <b>Medicaid</b>   | 13:1               |
| <b>locations</b> | 65:21              | <b>manufacture</b> | 52:6 53:7         | <b>mid</b>         |
| 15:11, 16,       | <b>mail</b>        | 47:15              | <b>Medicare</b>   | 50:13              |
| 19               | 38:1, 2            | <b>manufacture</b> | 52:5 53:7         | <b>Mid-1900s</b>   |
| <b>long</b>      | 66:18              | <b>rs</b>          | <b>meet</b>       | 50:14              |
| 48:11            | <b>mail-in</b>     | 47:8               | 18:16             | <b>Mid-1960ish</b> |
| 49:10            | 66:16              | <b>Mark</b>        | 35:21             | 50:14              |
| <b>longer</b>    | <b>mailboxes</b>   | 21:8               | 36:4              | <b>Middleware</b>  |
| 10:13            | 38:5               | <b>marketing</b>   | <b>meetings</b>   | 38:23              |
| 41:8             | <b>mails</b>       | 26:10              | 19:13             | <b>millions</b>    |
| <b>looked</b>    | 38:4, 5, 6         | <b>Massachuset</b> | <b>members</b>    | 48:1               |
| 69:14            | <b>maintained</b>  | <b>ts</b>          | 15:4              | <b>mind</b>        |
| <b>loss</b>      | 20:5               | 4:15 7:10          | 17:25             | 11:17              |
| 43:14, 15        | <b>maintaining</b> | <b>master's</b>    | 35:16             | <b>minors</b>      |
| <b>lot</b>       | 29:23              | 11:24              | <b>membership</b> | 7:17               |
| 18:3, 22         | <b>major</b>       | 12:1, 8            | 23:12             | <b>minute</b>      |
| 20:7, 10         | 55:10              | 13:2, 6, 8,        | <b>memory</b>     | 71:21              |
| 31:23            | <b>make</b>        | 9, 12, 15          | 36:21             | <b>minutes</b>     |
| 32:22            | 29:22              | 14:5, 8            | 39:17             |                    |
| 50:22            | 34:13              | 32:22              | 67:20             |                    |

|                 |                   |                   |                  |                    |
|-----------------|-------------------|-------------------|------------------|--------------------|
| 48:12           | <b>money</b>      | 56:25             | 34:8             |                    |
| 71:23, 24       | 42:2              | <b>NBX</b>        | 42:10, 13,       | <b>0</b>           |
| <b>misspoke</b> | <b>money-</b>     | 32:13             | 15 43:16         |                    |
| 41:16           | <b>related</b>    | 33:19, 20,        | 45:24            | <b>Obama</b>       |
| <b>MIT</b>      | 56:12             | 23, 24, 25        | 47:21            | 52:15, 19          |
| 7:10            | <b>months</b>     | 34:13, 15,        | 55:10            | <b>Obamacare</b>   |
| 10:10, 14       | 49:14             | 17, 18, 19        | 65:21            | 52:7, 12,          |
| 11:20           | <b>morning</b>    | 49:3 50:4         | <b>news</b>      | 22 53:1, 8         |
| 21:4            | 4:14              | <b>needed</b>     | 54:19            |                    |
| 23:5, 6         | 30:22             | 25:4 62:9         | <b>note</b>      | <b>Objection</b>   |
| 24:21           | <b>motivated</b>  | <b>network</b>    | 64:8             | 27:22              |
| 25:6            | 21:1              | 9:21 11:9         | <b>notes</b>     | 33:6               |
| 26:7, 16        | <b>move</b>       | 14:20             | 65:15            | 36:17              |
| 27:7, 14,       | 55:17             | 15:1, 5, 7,       | <b>November</b>  | 64:2               |
| 19 33:5         | 56:5              | 8 30:16,          | 32:4             | 68:22              |
| 65:20, 22       | <b>moved</b>      | 20, 21, 23        | 65:12, 17,       | <b>obvious</b>     |
| 66:3, 8,        | 43:23             | 34:3, 4, 11       | 19 66:2          | 71:16              |
| 10, 21          | <b>moving</b>     | 42:8, 19,         | 69:19, 22        | <b>obviousness</b> |
| <b>MITX</b>     | 35:1              | 21 43:1,          | <b>number</b>    | 71:4               |
| 6:18            | <b>MS-ISDN</b>    | 4, 7, 11, 15      | 6:2 13:20        | <b>offer</b>       |
| <b>mobile</b>   | 68:20             | 46:2              | 18:10, 18        | 38:18              |
| 9:2, 5          | <b>MSISDN</b>     | 56:23             | 19:7             | <b>offered</b>     |
| 13:13           | 68:17, 20         | 69:2, 15,         | 21:16            | 14:2               |
| 14:4            | <b>multi-</b>     | 23 70:3,          | 22:23, 24        | 44:20              |
| 17:20           | <b>million</b>    | 5, 9              | 30:24            | <b>office</b>      |
| 18:5, 8         | 37:5              | <b>networking</b> | 33:2             | 15:17              |
| 31:5, 25        | <b>multiplier</b> | 9:18              | 38:15            | 22:16              |
| 46:21, 23       | 12:10, 17         | 14:15             | 40:3, 21         | 25:1 34:8          |
| 47:9            | <b>multiply</b>   | 19:15             | 45:14            | <b>ongoing</b>     |
| 67:18, 19,      | 12:21             | 43:13             | 46:1, 6, 14      | 53:5               |
| 21 69:14        | <b>museums</b>    | <b>networks</b>   | 49:2 51:8        | <b>online</b>      |
| <b>model</b>    | 6:1               | 9:3, 19           | 55:21, 23        | 23:23              |
| 63:17           | <b>N</b>          | 10:2, 24          | 58:24            | 24:14              |
| <b>modem</b>    |                   | 11:4, 14          | 62:7             | 25:1               |
| 38:23           |                   | 13:14             | 64:22            | 44:20, 25          |
| 47:25           |                   | 14:5, 16,         | 66:7             | 51:22              |
| 48:4, 5         |                   | 18 15:20          | <b>numbers</b>   | 56:10              |
| <b>modems</b>   |                   | 17:21             | 67:7             | 57:14, 18,         |
| 48:2, 6, 7      | <b>nations</b>    | 18:5, 9           | <b>numerical</b> | 23 59:11           |
| <b>modules</b>  | 19:6              | 21:5 23:4         | 8:6              | 61:9 65:4          |
| 61:23           | <b>natural</b>    | 24:10, 17         |                  | 66:9, 19           |
| 62:20           | 50:21             | 31:5, 9,          |                  | <b>open</b>        |
|                 | 53:17             | 14, 15, 17,       |                  | 5:15               |
|                 |                   | 20, 25            |                  |                    |

|                    |                   |                    |                  |                    |
|--------------------|-------------------|--------------------|------------------|--------------------|
| <b>opened</b>      | 33:21             | <b>parents</b>     | 59:10            | 37:11              |
| 59:21              | <b>owned</b>      | 60:7, 11           | 61:9 64:7        | 38:4 44:8          |
| <b>operate</b>     | 40:24             | <b>part</b>        | <b>payment</b>   | 46:1, 5, 12        |
| 6:13               |                   | 9:14 10:8          | 8:24             | 48:2               |
| <b>operation</b>   | <b>P</b>          | 11:8               | 13:10            | 53:19              |
| 9:2 13:13          |                   | 12:13              | 22:18            | 56:4 57:1          |
| 14:4               | <b>packaged</b>   | 13:6, 9, 12        | 24:2, 18         | 59:4, 10           |
| 17:20              | 36:25             | 14:5, 23           | 25:7, 11,        | 61:19, 22          |
| 18:8               | 39:15             | 15:24              | 21 34:16         | 62:22              |
| <b>operations</b>  | <b>packet</b>     | 16:2, 17           | 44:6, 9,         | 66:17              |
| 54:7               | 42:9, 25          | 17:19, 24          | 17, 23           | <b>performance</b> |
| <b>opinion</b>     | 43:7, 14          | 20:13              | 56:10            | 42:19, 23          |
| 71:2               | <b>packetized</b> | 23:11              | 57:15, 18,       | 43:12              |
| <b>opportuniti</b> | 34:11             | 24:5               | 23 59:6          | 51:17              |
| <b>es</b>          | <b>pages</b>      | 25:20              | 61:4, 11,        | <b>period</b>      |
| 28:6               | 21:13             | 27:10, 11          | 17 62:4          | 19:12              |
| <b>opportunity</b> | 23:23             | 28:5, 7            | 64:12            | 27:21              |
| 20:11              | <b>paid</b>       | 38:20              | 66:19, 24        | <b>person</b>      |
| <b>opposed</b>     | 23:7              | 46:16, 18          | <b>payments</b>  | 26:2, 4, 9,        |
| 9:11 34:4          | 27:24             | 47:12              | 57:19            | 10 58:17           |
| 39:11              | 28:7, 8           | 57:21              | 62:14, 17        | 63:3, 14           |
| 51:23              | 30:13             | 58:1, 16           | 63:6, 8          | <b>personally</b>  |
| <b>optical</b>     | 61:22             | 63:1 64:4          | 66:10            | 22:22              |
| 8:17               | 64:6 66:6         | <b>participate</b> | <b>Paypal</b>    | 23:2               |
| 10:17, 20,         | <b>paper</b>      | 56:9               | 59:17, 19,       | 25:13              |
| 24 11:4,           | 31:6, 16,         | <b>partner</b>     | 22 61:18         | 58:15              |
| 9, 11, 14          | 18 32:1, 3        | 27:5               | 62:3, 10         | <b>Ph.d.</b>       |
| 31:9, 15           | <b>papers</b>     | <b>partners</b>    | 63:17, 21,       | 4:6 14:9,          |
| <b>optics</b>      | 17:23             | 27:3               | 23 64:3,         | 12 16:2,           |
| 11:1               | 18:4, 7           | 40:14              | 8, 12            | 4, 7, 18           |
| 31:23              | 19:10, 14         | <b>parts</b>       | <b>Paypal's</b>  | 17:19              |
| <b>orchestras</b>  | 22:5, 6, 12       | 29:6               | 63:18            | 19:12              |
| 6:3                | 31:4, 9, 12       | <b>passed</b>      | <b>PDF</b>       | 26:13, 21          |
| <b>Order</b>       | 32:10, 11,        | 53:1               | 67:8             | 32:21              |
| 4:7                | 23                | <b>patent</b>      | <b>Peachtree</b> | 33:18, 21          |
| <b>output</b>      | <b>paragraph</b>  | 33:2, 17           | 17:18            | <b>phone</b>       |
| 12:19              | 70:15, 18,        | 65:13              | <b>people</b>    | 9:20               |
| <b>outreach</b>    | 20, 22            | 67:3, 9, 16        | 14:1             | 34:5, 11           |
| 20:21              | 71:10             | <b>Paul</b>        | 18:18            | 69:22              |
| <b>over lapped</b> | <b>paragraphs</b> | 40:20              | 20:6             | 70:2, 4, 9         |
|                    | 65:9, 11          | <b>pay</b>         | 24:14            | <b>phones</b>      |
|                    |                   | 45:8               | 25:15            | 9:2, 5             |
|                    |                   |                    | 35:22            | 13:14              |
|                    |                   |                    | 36:4             | 14:4               |

|                  |                    |                    |                    |                    |
|------------------|--------------------|--------------------|--------------------|--------------------|
| 17:21            | 66:4, 20           | <b>pretty</b>      | 35:25              | 43:18, 20,         |
| 18:9 31:5        | <b>points</b>      | 19:23              | 39:8               | 22 55:15           |
| 34:12            | 27:24              | 61:7               | 41:20, 24          | 56:6               |
| 46:21, 23        | <b>popular</b>     | <b>previous</b>    | 42:16              | 57:6, 8            |
| 68:5, 7, 11      | 9:5                | 11:1               | 43:8, 9            | <b>projects</b>    |
| <b>physics</b>   | <b>port</b>        | 59:22              | 44:3, 4            | 33:14              |
| 7:16, 20         | 15:4               | <b>previously</b>  | 46:20              | 50:9               |
| 10:6             | <b>portal</b>      | 58:18              | 47:8, 23           | 56:12              |
| <b>picking</b>   | 51:22              | <b>primary</b>     | 48:3 65:2          | <b>properly</b>    |
| 38:6             | <b>position</b>    | 36:19              | <b>products</b>    | 38:8               |
| 66:12            | 29:18, 19          | <b>primitive</b>   | 24:12, 14,         | 52:11              |
| <b>pipeline</b>  | 35:5               | 37:10              | 15 36:5            | 70:3               |
| 36:22            | 36:11              | <b>principles</b>  | 41:23              | <b>protocol</b>    |
| <b>place</b>     | <b>positions</b>   | 17:2               | 44:17, 20,         | 38:22              |
| 19:11            | 27:19              | <b>printers</b>    | 23, 24             | 47:11              |
| 21:18            | <b>possibly</b>    | 64:18              | 45:2, 14           | <b>protocols</b>   |
| <b>plan</b>      | 20:2               | <b>prior</b>       | 47:10              | 9:18, 21           |
| 51:18, 24        | <b>posted</b>      | 65:16, 19          | 56:13              | 33:11              |
| 53:5, 10,        | 23:23              | 66:2               | <b>professors</b>  | 42:14              |
| 16               | <b>posting</b>     | <b>priority</b>    | 33:1               | 43:2               |
| <b>plans</b>     | 57:2               | 65:12              | <b>program</b>     | 47:10, 14          |
| 51:2, 7          | <b>potential</b>   | 68:4, 11           | 12:1, 14           | 48:5               |
| 53:14, 21        | 25:1               | 69:19, 21          | 13:6, 9, 12        | <b>provide</b>     |
| <b>platform</b>  | <b>potentially</b> | <b>proceedings</b> | 14:5               | 62:3               |
| 42:6 62:5        | 39:7               | 65:13              | 16:2, 18           | 63:17              |
| 68:9             | 43:15              | <b>process</b>     | 17:19              | <b>provided</b>    |
| <b>play</b>      | <b>prepare</b>     | 63:24              | 23:5               | 54:10              |
| 6:2              | 4:25               | 64:3               | 24:21, 23          | <b>provider</b>    |
| <b>plugged</b>   | <b>presence</b>    | <b>processing</b>  | 25:3, 6            | 19:5               |
| 42:21            | 25:4               | 15:6               | 28:6               | <b>providing</b>   |
| <b>podcasts</b>  | <b>present</b>     | 50:22              | 65:22              | 19:20              |
| 54:13            | 6:9                | 53:17              | <b>programmabl</b> | <b>public-</b>     |
| <b>Podzinger</b> | <b>presented</b>   | 55:5               | <b>e</b>           | <b>facing</b>      |
| 53:24            | 41:25              | 56:25              | 42:7               | 63:1               |
| 54:3, 6, 9       | <b>president</b>   | 64:12              | <b>programming</b> | <b>publication</b> |
| 55:13            | 50:4               | <b>processors</b>  | 28:11              | <b>s</b>           |
| <b>point</b>     | 52:14              | 36:21              | <b>programs</b>    | 30:25              |
| 11:19            | <b>press</b>       | <b>proctored</b>   | 42:8               | 32:17              |
| 25:15            | 45:4               | 7:1                | 64:24              | <b>published</b>   |
| 46:16            |                    | <b>product</b>     | 65:1               | 32:10, 24          |
| 59:2             |                    |                    | <b>project</b>     | 33:3               |
|                  |                    |                    | 27:25              |                    |
|                  |                    |                    | 28:12              |                    |
|                  |                    |                    | 42:3, 5            |                    |

|                                                              |                                                          |                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>publishing</b><br>33:15                                   |                                                          | <b>reason</b><br>48:23                                                                                                                                             | <b>recorded</b><br>12:20<br>22:15<br>17:23<br>19:13                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                                                              | <b>Q</b>                                                 |                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>pull</b><br>5:12 39:4<br>65:7 67:4                        | <b>quality</b><br>52:9                                   | <b>recall</b><br>9:22 10:3<br>11:15<br>13:19<br>16:20, 21,<br>23, 25<br>19:10<br>22:7, 25<br>23:2 24:8<br>31:11, 16<br>44:16<br>46:6<br>47:19<br>52:14, 22<br>68:6 | <b>recruited</b><br>34:25<br><b>redid</b><br>66:6<br><b>redirect</b><br>71:22<br><b>refer</b><br>69:3<br><b>referee</b><br>32:11<br><b>refereed</b><br>32:14<br>33:3<br><b>reference</b><br>67:12<br><b>references</b><br>70:23<br>71:1, 5, 8<br><b>referring</b><br>21:3<br>23:16<br><b>reflect</b><br>64:11<br><b>refractive</b><br>8:12<br><b>register</b><br>20:8<br>59:11<br>61:8<br>69:4, 7<br><b>registered</b><br>61:22<br>70:3<br><b>registratio<br/>n</b><br>66:15, 16,<br>17, 20<br><b>regular</b> |
| <b>pulse</b><br>13:1                                         | <b>quarter</b><br>39:22                                  |                                                                                                                                                                    | <b>regularly</b><br>18:17<br><b>related</b><br>51:12<br><b>releases</b><br>45:4<br><b>relying</b><br>70:23<br>71:2, 4, 9<br><b>remember</b><br>8:19<br>9:16, 24<br>11:12<br>16:24<br>17:7<br>20:13<br>21:13, 21<br>22:23<br>23:7, 9, 24<br>26:9<br>28:18<br>38:17<br>46:15<br>49:13<br>51:8<br>52:13<br>54:5 59:7<br>68:8<br><b>removable</b><br>68:8, 10<br><b>render</b><br>71:16<br><b>reordering</b><br>43:16<br><b>repetition</b><br>12:9, 16<br><b>report</b><br>64:5                                   |
| <b>pulses</b><br>12:20, 22,<br>24, 25                        | <b>question</b><br>17:11<br>65:5<br>69:10, 11            |                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>purchase</b><br>44:22<br>49:19<br>61:19                   | <b>questions</b><br>17:9<br>71:19<br>72:3                |                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>purchased</b><br>35:18<br>40:3, 4<br>50:25                | <b>Quickbooks</b><br>17:15, 16                           | <b>received</b><br>64:20                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                              | <b>R</b>                                                 | <b>recent</b><br>26:7 32:3                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>pure</b><br>51:23                                         |                                                          | <b>recess</b><br>48:19<br>72:1                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>purpose</b><br>22:8<br>23:20, 24<br>24:9, 12,<br>20 67:15 | <b>radios</b><br>18:1, 3<br><b>ran</b><br>34:10<br>41:24 | <b>reco</b><br>55:2                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>pursuant</b><br>4:6                                       | <b>rate</b><br>12:9, 16                                  | <b>recognition</b><br>54:24                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>pursue</b><br>14:8                                        | <b>re-<br/>architect</b><br>44:2                         | <b>recognized</b><br>37:6                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>pursuing</b><br>19:12                                     | <b>reach</b><br>8:18                                     | <b>recollectio<br/>n</b><br>69:12                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>pushed</b><br>48:22                                       | <b>reading</b><br>17:13                                  | <b>reconcile</b><br>63:7<br>64:10                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>put</b><br>22:9, 11<br>35:23                              | <b>real</b><br>42:19, 21<br>43:4, 13<br>55:24            | <b>reconciling</b><br>63:8                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>putting</b><br>28:14<br>29:7                              | <b>realm</b><br>37:22                                    | <b>record</b><br>48:18, 20<br>71:21<br>72:2                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

|                                                                                                                                                         |                                            |                                                                    |                                                                                         |                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------|----------------------------------------------------|
| <b>reported</b><br>37:19, 21                                                                                                                            | <b>reverse</b><br>22:3                     | 62:23                                                              | 46:21, 25<br>52:2 55:5                                                                  | 13 24:5, 6<br>25:12                                |
| <b>reporting</b><br>35:13                                                                                                                               | <b>review</b><br>5:4 17:23<br>18:7         | <b>router</b><br>50:16                                             | <b>sells</b><br>65:2                                                                    | 27:18<br>51:21                                     |
| <b>requirement</b><br>70:1, 7                                                                                                                           | 19:14                                      | <b>run</b><br>28:18<br>42:3                                        | <b>semantic</b><br>53:17                                                                | 52:18<br>53:4, 11<br>54:11                         |
| <b>research</b><br>12:4, 15<br>14:24<br>15:12<br>17:24<br>18:19<br>21:4<br>27:11<br>28:6<br>30:16<br>32:25<br>33:4, 8, 13<br>50:9, 21<br>68:14<br>70:14 | <b>reviewed</b><br>5:2, 9<br>18:4          | 44:13<br>66:15                                                     | <b>semester</b><br>33:22                                                                | 55:19, 22<br>56:3 57:4<br>58:12                    |
|                                                                                                                                                         | <b>reviewing</b><br>19:10                  | <b>running</b><br>21:13<br>29:7 34:7<br>52:1 56:4                  | <b>senior</b><br>30:10, 12                                                              | 62:15<br>63:12<br>66:3                             |
|                                                                                                                                                         | <b>reviews</b><br>19:11                    | <b>rural</b><br>19:6                                               | <b>sense</b><br>27:12<br>32:18, 19,<br>24 36:3                                          | <b>sets</b><br>34:7                                |
|                                                                                                                                                         | <b>revise</b><br>29:24                     |                                                                    | <b>separate</b><br>34:4<br>35:22<br>40:12<br>41:3<br>54:2, 25<br>64:22<br>70:8          | <b>setting</b><br>25:20<br>58:21<br>59:15<br>61:11 |
|                                                                                                                                                         | <b>rewriting</b><br>28:15                  | <b>S</b>                                                           |                                                                                         |                                                    |
|                                                                                                                                                         | <b>robotic</b><br>58:4                     | <b>schedule</b><br>29:22                                           |                                                                                         | <b>Shaped</b><br>8:5                               |
| <b>researcher</b><br>32:20                                                                                                                              | <b>robotics</b><br>60:5, 14,<br>21, 22, 23 | <b>school</b><br>11:24<br>16:8 65:2                                |                                                                                         | <b>share</b><br>34:3                               |
| <b>reserved</b><br>30:10                                                                                                                                | <b>role</b><br>30:10, 19<br>34:25<br>36:3  | <b>science</b><br>7:16, 24<br>14:10, 14<br>26:8<br>27:9, 16,<br>20 | <b>series</b><br>29:8                                                                   | <b>shell</b><br>6:12                               |
| <b>respond</b><br>43:3                                                                                                                                  | 46:16                                      | 27:9, 16,<br>20                                                    | <b>server</b><br>21:11                                                                  | <b>shipped</b><br>34:1<br>43:10                    |
| <b>response</b><br>42:15                                                                                                                                | 55:18<br>56:2                              | <b>scraped</b><br>54:13                                            | <b>service</b><br>45:9<br>51:19                                                         | <b>shop</b><br>59:21                               |
| <b>responsibil<br/>ity</b><br>29:23                                                                                                                     | <b>roles</b><br>55:16                      | <b>search</b><br>53:18, 25<br>54:10, 14,<br>15, 22<br>55:3, 6      | <b>services</b><br>19:20<br>44:20<br>52:4, 6<br>53:7 55:5                               | <b>short</b><br>48:8                               |
| <b>responsiven<br/>ess</b><br>52:9                                                                                                                      | <b>rolled</b><br>52:12                     |                                                                    | <b>set</b><br>6:19, 25<br>17:3<br>19:21<br>20:1, 3,<br>20, 23<br>21:2, 6<br>23:2, 6, 9, | <b>show</b><br>66:12<br>71:6                       |
| <b>rest</b><br>41:6<br>43:17<br>62:21                                                                                                                   | <b>rollout</b><br>52:6                     | <b>section</b><br>5:24<br>27:14, 18                                |                                                                                         | <b>sic</b><br>41:10                                |
| <b>resume</b><br>27:14<br>53:18                                                                                                                         | <b>room</b><br>4:17                        | <b>sell</b><br>26:22, 25<br>37:3                                   |                                                                                         | <b>side</b><br>39:18<br>40:2                       |
|                                                                                                                                                         | <b>roommate</b><br>20:15                   |                                                                    |                                                                                         |                                                    |
|                                                                                                                                                         | <b>rosters</b>                             |                                                                    |                                                                                         |                                                    |

|                    |                   |                    |                   |                 |
|--------------------|-------------------|--------------------|-------------------|-----------------|
| <b>sign</b>        | 14:23             | 44:16              | 41:3 54:1         | 58:10           |
| 24:7               | 18:1, 3           | 46:8               | 64:21             | 66:14           |
| <b>signed</b>      | 28:16, 17,        | 47:19              | <b>stages</b>     | <b>starts</b>   |
| 13:17              | 18 29:7,          | 58:24              | 19:25             | 60:2            |
| <b>signing</b>     | 11 35:20          | <b>specificall</b> | 36:22             | <b>state</b>    |
| 25:2               | 36:12, 14,        | <b>y</b>           | <b>standalone</b> | 4:11            |
| <b>SIM</b>         | 20 37:8,          | 9:20               | 40:12             | 37:10           |
| 67:13, 15,         | 9, 12, 19,        | 31:14              | <b>standard</b>   | <b>station</b>  |
| 20, 24, 25         | 22 38:13,         | <b>speech</b>      | 19:2              | 19:1 47:9       |
| 68:1, 5, 8,        | 21, 25            | 50:21              | <b>standards</b>  | <b>stations</b> |
| 12 69:23           | 39:11, 14,        | 54:24              | 19:8              | 18:2, 14        |
| 70:10              | 19, 23            | 55:1               | 70:12             | 19:8            |
| <b>similar</b>     | 40:11             | <b>spelled</b>     | <b>stands</b>     | 46:25           |
| 33:14              | 41:2              | 4:12               | 69:1              | 47:3            |
| <b>simultaneou</b> | 42:11, 13         | <b>spend</b>       | <b>start</b>      | <b>stay</b>     |
| <b>s</b>           | 44:8, 13          | 55:21              | 17:4              | 10:12           |
| 38:3               | 45:11             | 58:20              | 19:17             | 11:24           |
| <b>sit</b>         | 47:17, 20         | <b>spent</b>       | 21:1              | 43:18           |
| 18:23              | 51:19             | 47:12              | 22:14             | <b>stayed</b>   |
| 22:17              | 64:15, 19         | 58:24              | 58:4, 9           | 10:9, 13        |
| <b>sites</b>       | 65:3              | 59:2, 13,          | <b>start-up</b>   | 18:20           |
| 43:6               | <b>software-</b>  | 14                 | 34:20             | 43:21           |
| <b>sitting</b>     | <b>to-service</b> | <b>sphere</b>      | 38:9, 11          | <b>steam</b>    |
| 22:7               | 52:3              | 42:9, 25           | 49:8              | 22:15           |
| <b>Sloan</b>       | <b>sold</b>       | 43:7               | 56:8, 22          | <b>STEM</b>     |
| 16:8               | 6:10, 12          | <b>spin</b>        | 57:6              | 58:6            |
| <b>slowly</b>      | 37:6              | 49:19              | <b>started</b>    | <b>step</b>     |
| 22:1               | 55:7, 9           | 50:11              | 16:9              | 55:13           |
| <b>small</b>       | 57:6 68:5         | 51:1               | 17:25             | <b>stepped</b>  |
| 21:16              | <b>Sonnet</b>     | <b>spin-out</b>    | 18:1              | 55:8            |
| 39:20              | 15:10, 23         | 40:7, 14,          | 19:18             | <b>Steve</b>    |
| 57:19              | <b>Soo</b>        | 15, 24             | 20:11, 16,        | 35:4            |
| <b>smaller</b>     | 25:18             | 41:5               | 24 21:12,         | <b>stop</b>     |
| 39:24              | <b>Soo's</b>      | 49:20              | 13, 16, 19        | 26:11           |
| 41:1               | 27:1              | 54:4               | 33:20             | 33:4            |
| <b>snippets</b>    | <b>sort</b>       | <b>spoken</b>      | 36:19             | <b>storage</b>  |
| 62:11, 12          | 37:2, 17          | 54:16, 21          | 53:24             | 43:10, 12       |
| <b>social</b>      | <b>speak</b>      | <b>spring</b>      | 55:16             | <b>stores</b>   |
| 56:23              | 46:1 56:1         | 10:10              | 58:6              | 44:25           |
| <b>software</b>    | <b>speaker</b>    | 30:3, 4, 9         | 60:4, 15,         | <b>strategy</b> |
|                    | 54:23             | <b>spun</b>        | 21 64:16          |                 |
|                    | <b>specific</b>   | 40:10              | <b>starting</b>   |                 |
|                    | 35:12             |                    | 30:25             |                 |

|                     |                    |                |                    |                    |
|---------------------|--------------------|----------------|--------------------|--------------------|
| 35:23               | <b>successfull</b> | 11:2, 5, 15    | <b>talks</b>       | <b>telecommuni</b> |
| 39:3, 5             | <b>y</b>           | 13:10          | 67:25              | <b>cations</b>     |
| <b>stream</b>       | 38:19              | 14:16          | <b>target</b>      | 38:14              |
| 15:5                | <b>sum</b>         | 21:5           | 57:2               | <b>Teledyne</b>    |
| <b>strike</b>       | 42:2               | 30:17          | <b>targeted</b>    | 41:10, 14          |
| 69:20               | <b>summer</b>      | 33:11, 12      | 19:18              | <b>telemedia</b>   |
| <b>structure</b>    | 11:1, 3            | 34:5, 9, 16    | <b>targeting</b>   | 21:5               |
| 37:18               | <b>support</b>     | 37:24          | 20:18              | 30:16              |
| <b>structures</b>   | 71:6, 17           | 38:14          | <b>tax</b>         | 65:20              |
| 8:6                 | <b>supported</b>   | 39:14          | 45:9               | <b>telephone</b>   |
| 28:22, 24           | 19:9               | 43:12          | <b>taxes</b>       | 33:25              |
| 29:15               | 42:14              | 44:6, 9,       | 45:7               | 34:9, 10           |
| <b>student</b>      | <b>surprised</b>   | 12, 15, 18     | <b>teach</b>       | 37:24              |
| 16:4, 7, 10         | 45:19              | 45:1, 12       | 64:17              | <b>telephony</b>   |
| <b>students</b>     | <b>switch</b>      | 55:6           | <b>teaching</b>    | 10:1               |
| 30:11               | 15:17              | 56:10, 18      | 27:12              | <b>ten</b>         |
| <b>studied</b>      | <b>switched</b>    | 57:18          | 28:2, 21           | 48:12              |
| 14:18               | 19:19              | 63:12          | 29:14, 18,         | 71:22, 24          |
| <b>study</b>        | <b>switches</b>    | 65:2, 20       | 20 30:4            | <b>tens</b>        |
| 7:3, 4              | 14:21, 22          | <b>T</b>       | <b>tech</b>        | 48:1               |
| 46:18               | 15:14, 18          | <b>TA</b>      | 64:23              | <b>tenure</b>      |
| <b>stuff</b>        | <b>switching</b>   | 29:21          | <b>technical</b>   | 66:8               |
| 11:10               | 11:2, 4, 15        | 30:9, 12       | 44:3               | <b>Teradyne</b>    |
| 38:7                | <b>sworn</b>       | <b>taking</b>  | <b>technologie</b> | 34:23              |
| <b>subgroup</b>     | 4:6                | 26:14          | <b>s</b>           | 35:6, 7, 14        |
| 43:24               | <b>system</b>      | 28:13          | 37:23              | 36:11, 15,         |
| <b>subject</b>      | 9:20               | 56:16          | 41:22              | 18 37:6            |
| 10:15               | 12:19              | <b>talk</b>    | 50:10              | 38:12, 14          |
| 65:13               | 34:1, 10           | 18:23          | 51:5               | 39:2, 21           |
| <b>submitted</b>    | 38:2               | 21:7, 10       | <b>technology</b>  | 40:4, 7, 9,        |
| 33:2                | 52:8, 10           | 46:12          | 7:11               | 24 41:5,           |
| <b>subscribe</b>    | 53:9               | 56:21          | 19:16              | 8, 14, 15          |
| 24:7                | 54:24              | 63:23          | 49:23              | 46:3, 17           |
| <b>subscriber</b>   | 55:2 57:4          | 66:11          | 50:12, 22          | <b>Teradyne's</b>  |
| 69:14               | 59:6               | <b>talked</b>  | 51:3               | 39:16, 18          |
| <b>subscription</b> | 61:17, 25          | 18:3           | 54:8, 12           | <b>term</b>        |
| 57:20               | 62:17, 19          | 30:21          | 55:9               | 10:10              |
| <b>successful</b>   | 63:6 64:6          | <b>talking</b> | 56:6, 17           | 30:12              |
| 40:21               | 66:20, 24          | 23:15          | <b>telecommuni</b> | 52:21              |
|                     | <b>systems</b>     | 34:22          | <b>cation</b>      | <b>test</b>        |
|                     | 8:24               | 46:7           | 9:6, 8, 10         | 36:12, 14,         |
|                     |                    | 67:17          |                    | 21 37:12,          |

|                  |                  |                 |                    |                    |
|------------------|------------------|-----------------|--------------------|--------------------|
| 24 38:13         | <b>thesis</b>    | 27:6            | <b>traditional</b> | <b>type</b>        |
| 39:11, 23        | 8:1, 16, 18      | 35:14           | <b>ly</b>          | 15:3               |
| 40:11            | 12:5, 8          | 41:6            | 39:15              | <b>types</b>       |
| 41:2, 18         | 13:2             | 43:17           | <b>traffic</b>     | 14:25              |
| 42:6, 10,        | 18:22            | 45:16, 25       | 15:3               | <b>typical</b>     |
| 12, 15, 18,      | 32:22            | 47:12, 25       | <b>transaction</b> | 34:5               |
| 22 43:2,         | <b>thing</b>     | 52:25           | 45:1, 12,          | <b>typically</b>   |
| 5, 11            | 10:18            | 54:22           | 20, 21             | 30:10              |
| 44:1, 14,        | 38:20            | 58:25           | 63:25              |                    |
| 15, 17           | 55:17, 20,       | 59:2, 3, 14     | 64:4, 9            |                    |
| 45:6             | 21               | 60:1 66:9       | <b>transaction</b> | <b>U</b>           |
| 46:5, 9          | <b>things</b>    | 70:1 72:4       | <b>s</b>           |                    |
| 47:9, 14,        | 18:6 21:1        | <b>timeline</b> | 45:1               | <b>undergrad</b>   |
| 18, 20           | 24:1 28:9        | 54:6 61:1       | <b>transistor</b>  | 7:25               |
| 48:4             | 36:1, 21         | <b>times</b>    | 10:20              | <b>undergradua</b> |
| 62:17            | 43:13            | 18:5            | <b>transition</b>  | <b>te</b>          |
| <b>tested</b>    | 44:25            | 28:18           | 11:19              | 7:9, 12, 13        |
| 13:4             | 47:11, 15        | 54:17           | 29:13              | 8:1, 20, 23        |
| 44:22            | 50:19            | 66:7            | <b>transitio</b>   | 9:1, 7             |
| 45:20            | 55:16, 22        | <b>titled</b>   | <b>d</b>           | 10:6 27:7          |
| 47:11, 24        | 57:17            | 31:7            | 40:7 41:4          | 28:5               |
| <b>testers</b>   | 59:5 62:8        | <b>tns-www</b>  | <b>transmissio</b> | <b>underlying</b>  |
| 38:22, 23        | <b>thinking</b>  | 22:3            | <b>n</b>           | 42:14              |
| <b>testified</b> | 59:13            | <b>today</b>    | 31:19              | <b>understand</b>  |
| 4:8              | 63:25            | 4:15            | <b>transmit</b>    | 36:13              |
| <b>testimony</b> | <b>thought</b>   | 16:13           | 8:14               | 46:4 57:1          |
| 5:24             | 20:10            | <b>today's</b>  | <b>traverse</b>    | <b>unit</b>        |
| <b>testing</b>   | 37:11            | 5:1             | 15:21              | 35:10, 12          |
| 35:20            | 39:24            | <b>top</b>      | <b>trials</b>      | <b>units</b>       |
| 36:20, 24        | 46:13            | 18:20           | 5:24               | 36:13, 14          |
| 37:1, 9,         | <b>thousands</b> | 71:11, 13       | <b>trip</b>        | 39:12              |
| 22, 25           | 45:16            | <b>total</b>    | 66:11              | 40:11              |
| 38:22, 23,       | <b>tied</b>      | 38:16           | <b>tuition</b>     | 41:2               |
| 24, 25           | 63:20            | <b>totally</b>  | 30:13              | <b>university</b>  |
| 39:11, 16,       | <b>Tim</b>       | 13:20           | <b>turn</b>        | 27:21              |
| 17 42:8          | 40:18            | <b>touched</b>  | 51:18              | 32:25              |
| 43:25            | <b>time</b>      | 31:18           | 65:9               | <b>unlocked</b>    |
| 44:8 47:7        | 7:3, 4, 6        | <b>town</b>     | 70:15              | 54:20              |
| 57:5             | 10:8, 18,        | 58:5            | <b>Turning</b>     | <b>update</b>      |
| 62:15, 16        | 21 17:17         | <b>track</b>    | 7:8                | 29:24              |
| <b>tests</b>     | 21:14            | 61:15           |                    | 59:4               |
| 36:23            | 25:25            |                 |                    | 61:21              |
| <b>textbook</b>  | 26:14, 16        |                 |                    |                    |
| 16:12            |                  |                 |                    |                    |

|                    |                  |                   |                 |                 |
|--------------------|------------------|-------------------|-----------------|-----------------|
| 64:11              | 22:12, 14,       | <b>watch</b>      | 23 65:19        | 21:18           |
| <b>UPENN</b>       | 15, 16           | 22:17             | 66:3, 25        | 27:8            |
| 15:13              | 53:25            | <b>waveguide</b>  | <b>websites</b> | 31:23           |
| <b>URL</b>         | 54:10, 13,       | 8:10              | 19:21           | 33:4, 19,       |
| 21:21              | 15, 21           | <b>waveguides</b> | 20:3, 24        | 23 34:16        |
| <b>users</b>       | 55:2, 5, 12      | 8:7, 9, 10        | 21:17           | 37:4 38:8       |
| 61:16              | <b>videos</b>    | <b>Wavelength</b> | 22:21           | 43:25           |
|                    | 54:17            | 31:7              | 23:1 44:1       | 44:5            |
| <hr/>              | <b>view</b>      | <b>waves</b>      | 45:15           | 45:24           |
| <b>v</b>           | 43:23            | 8:14              | 47:16, 18       | 47:6            |
| <hr/>              | <b>visit</b>     | <b>web</b>        | 62:4            | 48:9, 14        |
| <b>Vadhri</b>      | 21:8             | 19:20, 23         | 65:16           | 49:9, 24        |
| 70:24              | <b>visited</b>   | 20:1, 5, 8,       | 66:1, 23        | 54:3, 6         |
| <b>vaguely</b>     | 18:17            | 11 21:13          | <b>whatnot</b>  | 58:15           |
| 13:19              | <b>voice</b>     | 22:10             | 11:8 45:2       | 63:22           |
| 69:16              | 34:12            | 23:12, 13,        | 47:14           | 66:1, 21        |
| <b>Vanu</b>        | 38:1, 2, 4,      | 23 25:5           | <b>wide</b>     | <b>worked</b>   |
| 18:12              | 5, 6             | 44:1, 7, 9        | 15:8            | 10:11           |
| <b>venture</b>     | 42:18, 22        | 51:22             | 23:13           | 11:10           |
| 40:13, 22          | 43:2             | 54:14, 16         | <b>widely</b>   | 15:20           |
| 41:1               | <b>volunteer</b> | 58:17             | 9:5             | 34:2            |
| 45:18              | 23:8 66:5        | <b>website</b>    | <b>wireless</b> | 35:16           |
| 46:11              | <b>VP</b>        | 20:1              | 9:18, 21        | 44:10           |
| 49:4               | 54:7 55:8        | 21:2, 6, 22       | 13:19           | 50:5            |
| 50:25              | <hr/>            | 22:8, 13,         | 15:21, 24       | 58:18           |
| <b>verificatio</b> | <b>W</b>         | 14, 18            | 18:2 19:8       | 63:3, 13,       |
| <b>n</b>           |                  | 23:14, 18,        | 31:13, 17,      | 15 65:16,       |
| 44:23              |                  | 20 24:2,          | 19, 20          | 19 66:23        |
| <b>verify</b>      | <b>wafer</b>     | 9, 17, 20         | <b>wires</b>    | <b>workflow</b> |
| 22:6               | 36:23            | 25:7, 13,         | 34:3, 5, 7      | 62:1            |
| <b>Verizon</b>     | 39:16            | 21, 22            | <b>withdrew</b> | 63:13           |
| 49:19              | <b>wallet</b>    | 38:24             | 10:10           | <b>working</b>  |
| 51:1               | 67:18            | 45:22             | <b>word</b>     | 10:17           |
| <b>version</b>     | <b>wanted</b>    | 52:3              | 54:16           | 11:1, 2         |
| 5:18, 21           | 11:23, 25        | 54:12             | <b>words</b>    | 18:21           |
| 6:3 65:3           | 26:13, 15,       | 57:10, 12,        | 54:21           | 22:17           |
| 67:8               | 20 36:10         | 14, 21            | <b>work</b>     | 26:11           |
| <b>Versus</b>      | 59:11            | 58:12, 21,        | 10:8, 15,       | 32:20, 21       |
| 31:8               | 60:18            | 25 59:12,         | 21, 23          | 33:20           |
| <b>video</b>       | 62:2             | 15, 23            | 11:5, 7, 11     | 35:15           |
| 15:4, 5            | <b>wanting</b>   | 60:3, 7, 11       | 12:5, 7, 10     | 41:2, 7         |
|                    | 20:8             | 61:5, 13          | 18:24           | 52:10           |
|                    |                  | 62:25             |                 | <b>works</b>    |
|                    |                  | 63:5, 16,         |                 | 48:16           |

|                  |              |
|------------------|--------------|
| <b>Workshop</b>  | 30:12        |
| 6:9 58:7,        | 40:6         |
| 13 60:2          | 52:12, 14,   |
| 61:5             | 19 59:18     |
| 64:17            | 60:5         |
| <b>world</b>     | <b>years</b> |
| 23:13            | 32:8, 9      |
| 43:4, 6, 13      | 52:24        |
| 55:24            | 59:24        |
| <b>worldwide</b> | 60:9, 17,    |
| 23:12            | 23, 24       |
| <b>would've</b>  |              |
| 59:20            |              |
| <b>write</b>     |              |
| 51:2, 7          |              |
| 53:4, 10,        |              |
| 15, 22           |              |
| <b>writing</b>   |              |
| 28:15            |              |
| <b>written</b>   |              |
| 22:5             |              |
| <b>wrong</b>     |              |
| 70:18            |              |
| <b>wrote</b>     |              |
| 14:23            |              |
| 32:12            |              |
| 51:18, 24        |              |
| 53:16            |              |
| <b>www</b>       |              |
| 22:2             |              |
| <b>www-tns.</b>  |              |
| <b>lcs.mit.</b>  |              |
| <b>edu.</b>      |              |
| 21:24            |              |
| 22:4             |              |
| <hr/>            |              |
| <b>Y</b>         |              |
| <hr/>            |              |
| <b>year</b>      |              |
| 6:10, 13         |              |
| 28:20            |              |