

LIBRARY OF CONGRESS
UNITED STATES COPYRIGHT OFFICE
SIXTH TRIENNIAL 1201 RULEMAKING HEARINGS

Friday,
May 29, 2015

Library of Congress
Mumford Room
Washington, D.C.

Reported by: Christine Allen,
Capital Reporting Company

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

2
3 UNITED STATES COPYRIGHT OFFICE:

4 JACQUELINE C. CHARLESWORTH
5 MICHELLE CHOE
6 SY DAMLE
7 JOHN RILEY
8 STEVE RUWE
9 REGAN SMITH

10
11 NATIONAL TELECOMMUNICATIONS AND INFORMATION
12 ADMINSITRATION:

13 JOHN MORRIS

14
15
16
17
18
19
20
21
22
23
24
25

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

2 (9:03 a.m)

3 PROPOSED CLASS 27:

4 SOFTWARE-NETWORKED MEDICAL

5 DEVICES

6 MS. CHARLESWORTH: Good morning,
7 everyone. Welcome to the last of the seven hearing
8 days of the Sixth Triennial Rulemaking proceeding.
9 You can say you were there.

10 I see some repeat customers and some new
11 faces. I'm Jacqueline Charlesworth, General
12 Counsel of the U.S. Copyright Office. I along
13 with my colleagues here will be presiding over
14 this hearing, which concerns networked medical
15 devices. I am going to just ask them to quickly
16 go down the line and introduce themselves.

17 MS. CHOE: Michelle Choe, Ringer Fellow.

18 MS. SMITH: Regan Smith, Assistant
19 General Counsel.

20 MR. DAMLE: Sy Damle, Deputy General
21 Counsel.

22 MR. RUWE: Steve Ruwe, Assistant General
23 Counsel.

24 MR. RILEY: John Riley, Attorney
25 Advisor.

1 MR. MORRIS: John Morris with NTIA.
2 While I have the mike, can I just express my
3 appreciation from NTIA to the Copyright Office for
4 the courtesy of allowing us to participate in the
5 couple weeks of hearings. It's been very helpful
6 for us to be able to ask some questions, so thank
7 you.

8 MS. CHARLESWORTH: Good. We will always
9 take appreciation, so thank you, Mr. Morris. As
10 I've explained before, the purpose of these
11 hearings is not so much to go over what you have
12 already submitted in writing, which we have all
13 read carefully, but to kind of focus on the issues
14 that seem most contentious or most in dispute, as
15 well as factual areas where perhaps we have
16 questions or the record may not be as complete as
17 we would like it to be, and finally, a lot of
18 times we are looking at sort of the scope of the
19 exemption and how broad or narrow, how to tailor
20 it to the uses in question.

21 With that in mind, the format we have
22 been following is we will have you start with an
23 opening statement, and I will warn you we often do
24 interrupt with questions, and end up usually with
25 a very good discussion, and we will sort of

1 discuss the issues that way.

2 Once we sort of get through that, if
3 people have things to add or something comes up,
4 you want to comment on it, if you tip your placard
5 up, we will call on you and allow you to respond.

6 Before we get into the actual
7 discussion, just a couple of things. We are only
8 supposed to have four mikes on at a time, so it is
9 helpful if you can turn it off when you are not
10 talking. We try not to talk over one another. I
11 try to call on people rather than have a free form
12 discussion.

13 With that said, if you could quickly
14 tell me who you are and the interest you
15 represent, and then we will go back to Mr. West
16 and he can begin with the opening remarks. Dr.
17 West, excuse me.

18 MR. SELLARS: Actually, let me clarify
19 one point. My name is Andrew Sellars. I am from
20 the Harvard Law School Cyberlaw Clinic
21 representing a coalition of medical device
22 researchers, including Mr. West. I should clarify
23 Mr. West is not a doctor. I think that was a
24 mistake. He has a Bachelor's Degree and is a
25 computer researcher and software engineer.

1 MS. CHARLESWORTH: Well, we promoted
2 you.

3 MR. SELLARS: I'm sure he appreciates
4 the promotion.

5 MS. CHARLESWORTH: I was right when I
6 said "Mr." to begin with. Mr. West, if you want
7 to introduce yourself. I think we sort of heard
8 who you are, but just for the record.

9 MR. WEST: My name is Ben West. I'm an
10 independent researcher.

11 MR. SELLARS: My name is Andrew Sellars.
12 As I said before, I'm attorney for Mr. West, Mr.
13 Jerome Radcliffe, Mr. Hugo Campos, and Ms. Karen
14 Sandler, who are the coalition of medical device
15 researchers that are petitioning for this
16 exemption.

17 As we said in our comment --

18 MS. CHARLESWORTH: Sorry. I just wanted
19 everyone to introduce themselves first for the
20 record. I take it you want to go first, Mr.
21 Sellars.

22 MR. SELLARS: If that's possible, yes,
23 thank you.

24 MR. SIY: Sherwin Siy, Public Knowledge.

25 MS. MOY: Laura Moy, New America's Open

1 Technology Institute.

2 MS. CHARLESWORTH: Okay. You may now
3 have the floor, Mr. Sellars.

4 MR. SELLARS: Thank you, Ms.
5 Charlesworth and members of the panel, good
6 morning. The exemption that the coalition are
7 seeking here is designed to ensure that research
8 that is already being conducted into medical
9 devices is allowed to continue now that these
10 devices, largely at the suggestion of independent
11 research, have begun to adopt technological
12 protection measures governing access to their
13 source code and data outputs.

14 I would like to actually begin with Mr.
15 West, who with this panel's permission, would like
16 to read a brief statement sort of describing his
17 own research and how it is implicated by
18 technological protection measures, if that is
19 okay.

20 MS. CHARLESWORTH: Yes, that's fine.

21 MR. WEST: Hi, my name is Ben West. I
22 have type I diabetes and I use a variety of
23 medical devices such as continuous glucose
24 monitors and insulin pumps. I'm a software
25 engineer. While I was living and working in San

1 Francisco, I learned that my CGM and my pump
2 contained a wealth of information that was very
3 important to pursuing my therapy.

4 However, the information provided by
5 these devices is sometimes delayed or even
6 sometimes unavailable. I started looking closely
7 at these devices starting around 2009 or 2008, the
8 information that they store and the ways in which
9 they operate.

10 My continuous glucose monitor is a two
11 part system. There is a small sensor that I
12 insert under my skin and I replace it every seven
13 days, and there is a handheld receiving computer
14 which displays the current glucose value along
15 with 6, 9, and 12 hour trends.

16 The sensor transmits a new sensor value
17 every five minutes, and the handheld receiving
18 computer shows the last value with an overall
19 trend.

20 My collaborators and I are a group of
21 like- minded patients, or often parents of
22 patients. We used a variety of reverse
23 engineering techniques to analyze the data that is
24 stored in this handheld computer. The vendor's
25 own software is used to retrieve up to three

1 months of data from the device, so we used a
2 combination of hardware and software USB sniffers
3 to create a transcript of the interactions that
4 the vendor typically has with these devices.

5 After studying these transcripts along
6 with our other research, the community as a whole
7 was able to obtain valuable information that is
8 sometimes not shown to the -- it is information
9 that is available on the device but not always
10 shown or available to the patient.

11 An example of this is the handheld
12 computer does not show the delta or the difference
13 between my current glucose number and the previous
14 one from five minutes ago. Using our knowledge of
15 the protocol to fetch the data from the handheld
16 computer, we were able to provide patients with
17 not only the glucose and the trend, which is
18 usually provided, but also the delta from this and
19 the previous readings.

20 We've gone a step further to provide
21 software that conveniently shows this information
22 on mobile phones.

23 MR. DAMLE: I'm sorry to interrupt. I'm
24 just sort of curious, if you can explain why it is
25 important to have that additional piece of data or

1 why that is useful to you. That would just be
2 helpful for us to know.

3 MR. WEST: Sure. There is a display
4 that has the current glucose number. Depending on
5 what that number is, I may need to take action. I
6 may need to leave the room or go get glucose or go
7 take medicine. Because it is changing all the
8 time, it's really, really important to get a good
9 idea of where it has been and where it's going.
10 Being able to tell the last one was -1, I've only
11 changed one point in the last five minutes, versus
12 I've changed 10 points in the last five minutes.
13 That's a very important cue for what I need to do.

14 MS. CHARLESWORTH: Does the trend just
15 say up or down?

16 MR. WEST: Yes.

17 MS. CHARLESWORTH: I see. It's not a
18 numerical value?

19 MR. WEST: Right.

20 MS. CHARLESWORTH: That's helpful.

21 Thank you.

22 MR. WEST: We provide this information
23 through a mobile -- a wearable software suite, so
24 we put this on mobile phones and wearable devices.
25 This has allowed families to regain common

1 liberties. For example, we regularly hear from
2 patients who tell us their diabetic children are
3 now able to attend school or miss less school
4 because of the remote monitoring.

5 This is not something you can do with
6 just the device, you have to get the data off the
7 device and then transmit it somewhere else where
8 it can be remotely displayed.

9 MS. CHARLESWORTH: Can you explain how
10 it impacts the school day or why they wouldn't be
11 able to attend school, how this would permit that?

12 MR. WEST: Sure. There is often a sense
13 that you are okay for the next three hours
14 roughly, but beyond three hours, it's very
15 difficult to predict. There needs to be action
16 every three hours, and because you're taking
17 insulin, too much insulin could lead to death or
18 very nasty things.

19 For a parent to send their child to
20 school with this very dangerous situation, the
21 schools are not always prepared to handle that
22 situation. This allows the parent from work or
23 from home to monitor and keep in touch with the
24 people that are taking care of that child.

25 Because of that, these are often

1 scenarios where the child -- they are making a
2 decision to not go to school or to not go on walks
3 with the grandparents or not go to sleepovers
4 because the people that are providing the care
5 don't have the needed facilities to handle it.

6 The remote monitoring piece allows the
7 parent or someone else to keep track of what's
8 going on remotely. That enables the choice to say
9 okay, we are going to go to school, we are going
10 to go on this first walk with grandpa alone, those
11 types of activities.

12 MS. CHARLESWORTH: Would the child in
13 your scenario also have a device or a phone with
14 them where they would be able to see, for example,
15 the trend or the information, so is the concern
16 that the child still needs adult supervision in
17 terms of interpreting the data? The child would
18 have information with them, right, at school?

19 MR. WEST: Yes. Typically, children
20 younger than 14 or so typically do not perform the
21 therapy. It's usually someone else that's helping
22 them perform the therapy. That means the children
23 are usually not monitoring this to enact therapy
24 on their own.

25 MS. CHARLESWORTH: I'm sorry. I don't

1 mean to belabor this point too much. When they go
2 to school, do they take a phone or device that is
3 the monitor --

4 MR. WEST: Yes.

5 MS. CHARLESWORTH: And then maybe show
6 it to the school nurse? I guess I'm trying to
7 understand the need for remote access versus
8 whatever is with the child at the time.

9 MR. WEST: Yes, so typically what
10 happens is -- this is my rig. What will happen is
11 we will provide a child with this exact thing, and
12 we will put it in their book bag or even in a spy
13 belt, which is just a belt. That stays with them.
14 Someone else is providing the interpretation and
15 telling them what to do.

16 MS. CHARLESWORTH: Okay.

17 MR. WEST: And coordinating the care.
18 For example, if the child goes low during school,
19 a parent at work can call the school and tell them
20 you need to get my kid out of gym class and give
21 them some sugar because they have too much
22 insulin.

23 MS. CHARLESWORTH: Do you know of any
24 specific children who have taken advantage of that
25 technology or who were not able to go to school

1 because they did not have the technology?

2 MR. WEST: Yes. We have a Facebook
3 group called "CGM in the Cloud." This group was
4 created last year. We now have 12,000 members
5 that are in this group, around 4,000 of those
6 people have adopted this kind of system. It's
7 proving to be very, very popular, very, very much
8 in demand, and it is very much meeting a need.

9 MS. CHARLESWORTH: Thank you. That's
10 very helpful. You can continue with your remarks.

11 MR. WEST: Thank you. Good questions.
12 This is only possible through the remote
13 monitoring that our research has allowed. Access
14 to this information can also be used to assess the
15 confidence or the quality of the glucose estimate
16 shown on the device. It is showing me a number
17 but how good is that number. Is it stale. Is it
18 accurate. Is it inaccurate.

19 For a variety of reasons, the glucose
20 estimate on the devices can be incorrect. For
21 some causes such as a new insertion, new sensor
22 insertion, or if I'm dehydrated, the receiver can
23 stop showing glucose estimates altogether. It
24 might show three question marks instead of
25 numbers.

1 Yet, there is still data available from
2 the sensor and from the device. Once again, our
3 research has been able to get that raw data out of
4 the device and we are able to make use of it,
5 where otherwise you would get no data at all.

6 Even when no glucose estimate is
7 provided, the metadata from the sensory hardware
8 itself can be used to accurately estimate glucose
9 levels.

10 In addition, even when glucose estimates
11 are provided, they may be inaccurate. Our
12 research uncovered that patients may receive
13 inaccurate or false readings when pressure is
14 applied to the sensor. For example, when someone
15 sleeps on a sensor. In these events, the raw sensor
16 data can be used to identify when the glucose
17 estimate is incorrect or even when the sensor is
18 beginning to fail.

19 I was able to do these things because
20 the device is unencrypted on models that are
21 currently available on the market. However, I've
22 learned the next version of the device that I will
23 use for my insulin pump does have encryption.
24 This device is already sold overseas, and will
25 soon replace similar devices in the United States.

1 The vendor is Medtronic.

2 I'm asking for this exemption so that
3 the work we have been doing to improve the quality
4 of life for people with diabetes can continue.

5 MR. DAMLE: I have a somewhat technical
6 question about how you were able to sort of make
7 this work for you. Is all you are doing
8 pulling data off the device? Are you changing the
9 software of the device in any way, or are you only
10 sort of looking at what the readouts are and
11 pulling them off and then doing something with it?

12 MR. WEST: Good question. Right now,
13 our design behind all of this is to read only. We
14 are not affecting the behavior, we are not
15 changing anything on the device. In fact, we have
16 gone to great lengths to make sure that our usage
17 of this device matches exactly what the vendors
18 themselves do to audit what happens on that
19 device.

20 MR. DAMLE: That raises an interesting
21 question, I think, for the lawyers, which is why
22 an exemption would be necessary if all that is
23 being accessed is data. Mr. Sellars?

24 MR. SELLARS: Sure, I'd be happy to
25 address that. The reason why the exemption is

1 necessary is because on many devices that are on
2 the market today and on more that are coming out
3 in the near future, even accessing the data itself
4 would mean circumventing a technological
5 protection measure.

6 As we noted in our exemption, some of
7 these devices, the data outputs would be protected
8 under copyright and some would not. I don't think
9 AdvaMed disputes us on that point. It would
10 largely depend upon the selection and arrangement
11 of the information itself.

12 As we also mentioned in our comments,
13 Mr. West is one of four researchers that are doing
14 different forms of medical device research that
15 are all related to analyzing the source code or
16 data outputs of devices. Some of this research is
17 done as a matter of personal safety and
18 monitoring. A lot of information that is critical
19 to a patient's care is inside of a device and is
20 sometimes not made available to the patient.

21 Sometimes the symptoms of things, such
22 as a cardiac event, can be indistinguishable from
23 other day to day occurrences, such as dizziness or
24 fatigue. If I'm dizzy, I'm not going to be sure if
25 I have allergies, I missed breakfast, or I'm

1 having a cardiac episode. My device knows but in
2 many cases it wouldn't necessarily let me know.

3 MR. RUWE: Would the device that Mr.
4 West was addressing -- is that going to address
5 cardiac arrest symptoms? I think what Sy's
6 question was about, at least I'd like to ask if he
7 wasn't asking, is the information that Mr. West
8 was addressing in the glucose monitor, is that the
9 sort of data that anyone is asserting copyright
10 ownership on or copyrightability of?

11 MR. SELLARS: The statements of AdvaMed
12 and the National Association of Manufacturers
13 indicate they are asserting ownership in things
14 including sequel databases and other ways in which
15 this data might be ranged.

16 I would also note in some devices, the
17 data is not streamed in real time, it's
18 dispatched, and when there is a dispatch of data,
19 there is often a greater affordance for an
20 arrangement or selection of particular
21 information. Also, sometimes this data will
22 include metadata about the patient, including who
23 their primary care physician is, who they are,
24 their date of birth, and other information that
25 might be relevant to their care.

1 MR. RUWE: Is there any detail of the
2 type of data in the readout that Mr. West just
3 addressed?

4 MR. SELLARS: AdvaMed asserts that a
5 copyright exists there. In many cases, it's not
6 clear until you actually do the reverse
7 engineering whether or not a work would be
8 protectable, and of course, as we all know,
9 reasonable courts can disagree on the edge here.

10 As this Office has noted in prior
11 rulemakings, when there is an edge case about a
12 state of the existence of a work, they should
13 proceed to the merits of the exemption.

14 MR. RUWE: Also, Mr. West, just to
15 clarify, the ways in which you are enabling real
16 time monitoring, is that only accessing the data
17 coming off the sensor itself, or does that also
18 involve accessing the monitor, the vendor's
19 monitor and data that may reside there?

20 MR. WEST: It's both. We have several
21 projects, offshoots, and variants, and we do all
22 those things.

23 MR. RUWE: Thank you.

24 MS. CHARLESWORTH: Are you able under
25 your technology -- I take it there are things that

1 show up on your screen, on the device that you
2 held up, but are you able to do sort of an audit
3 or a printout? What other features, going back to
4 are you printing out something that looks like a
5 report at any point, with columns or headings?
6 How are the data presented?

7 MR. WEST: What we are doing with it is
8 putting it on wearable devices that are
9 glanceable, so I actually -- one of the pieces
10 that we have is this Pebble watch. We are able to
11 put the numbers on our watch. This does a number
12 of things for me, including the ability to just
13 glance at my wrist and then move on with whatever
14 else I need to do.

15 As a result, I don't have to stop
16 whatever it is I was doing to press a button on
17 this device and then maybe do something and then
18 go back to work. Let's say I'm an hourly employee
19 at McDonald's. If this device is constantly
20 causing me to stop working so I can test and take
21 care of this device, that's time I don't do work
22 necessarily, or with this, I can glance at my
23 wrist, and then if nothing needs to be done, I
24 haven't wasted any time.

25 MS. CHARLESWORTH: Your technology does

1 not generate something, what I would call a
2 printout or spreadsheet or tabulation of data?
3 It's individual pieces of data that are
4 transmitted to like a watch or mobile device?

5 MR. WEST: We also store all the
6 information that we collect in a database, and
7 that database is owned and controlled by the user.
8 Does that answer that?

9 MS. CHARLESWORTH: Does it replicate --
10 do you think that replicates a database that the
11 vendor also has? We're trying to figure out sort
12 of the copyright status of the data. In other
13 words, when you generated a database, did you
14 design the selection/arrangement of how the data
15 are presented?

16 MR. WEST: I see. The device has a
17 database in it already, so we are pulling out the
18 records from that, and then we are duplicating
19 those records and storing them in our own
20 database. Our database -- we're just using an off
21 the shelf open source database.

22 MS. CHARLESWORTH: You pull the data
23 from whatever the database arrangement is of the
24 vendor, you are pulling that off through the
25 device --

1 MR. WEST: Through the device.

2 MS. CHARLESWORTH: Then you are creating
3 your own new database using that data and you have
4 decided how to organize the new database?

5 MR. WEST: Correct.

6 MS. CHARLESWORTH: Mr. Sellars?

7 MR. SELLARS: I'd just like to follow on
8 this point very briefly. As we noted in the
9 initial comment, extracting data from a database
10 that is itself unprotectable and putting it into
11 your own database is fair use of the work, as the
12 Assessment Technologies of Wisconsin case versus
13 Wire Data indicates, that the data itself is
14 unprotectable. Extracting it from a protectable
15 expression for other uses is a fair use of that.
16 It is actually not infringing use of that in a
17 copy that might be made in order to perform that
18 extraction in-house is likely a fair use, which
19 was in dicta in that case.

20 If I could address the other members of
21 the coalition very briefly, I think it would be
22 useful to shade in some of the other uses that are
23 being argued for here, amongst the other members
24 of the coalition include Mr. Jerome Radcliffe,
25 whose research has been done into the security of

1 these systems, in particular, insulin pumps and
2 continuous glucose monitors.

3 As the opponents themselves stipulate,
4 the research that was done by Mr. Radcliffe and
5 other researchers like him has already spurred
6 reform in the manufacture of these devices, both
7 the Intellectual Property Owners Association and
8 AdvaMed indicate that reforms were made to these
9 devices after, and the key word being "after,"
10 these vulnerabilities were disclosed by Mr.
11 Radcliffe.

12 His research has also been instrumental
13 in how the Government Accountability Office and in
14 turn the FDA have been regulating these devices.
15 The 2012 GAO study that has spurred a lot of FDA's
16 current reform on cybersecurity cites Mr.
17 Radcliffe extensively as well as several other
18 independent researchers.

19 Additionally, we have Mr. Hugo Campos.
20 Mr. Campos has hypertrophic cardiomyopathy, which
21 is a thickened heart muscle, that can make it
22 difficult at times to pump blood. His research
23 into safety and security is more of a personal
24 nature. He knows from his own research into the
25 field that cardiac events can be triggered by

1 things such as diet or environment, other
2 different triggers of that nature.

3 While the device is recording largely at
4 all times whether or not particular impedance of
5 the heart or other heart activity, it often does
6 not share that data with patients until they go in
7 for a check-up. Based on insurance, that often
8 can be 60 to 90 days later.

9 If I told you that what you had for
10 lunch on February 28 could have killed you and you
11 should not eat it again, I don't know about you, I
12 would be in a lot of trouble because I do not
13 remember what I had for lunch on February 28.
14 That was 90 days ago.

15 What Hugo has been working to do has
16 been to get better access to the data that is
17 already on the device that is often being
18 dispatched off the device on a much more regular
19 basis, often daily, in order to learn more about
20 his heart activity on a day to day basis because
21 things like what he eats or where he goes or what
22 he does can often be triggers for cardiac events.

23 Finally, the fourth and final member of
24 the coalition is Ms. Karen Sandler. She is a
25 lawyer and a software expert and does research

1 into the security of devices at the software
2 level. She along with my co-panelist, Laura Moy,
3 published a study entitled "Killed by Code," which
4 goes into a lot of the vulnerabilities in software
5 to date, and what can be done to spur reform.

6 I'd like to point out, and something
7 that I think is often missed in the discussion of
8 medical device security itself, is while for our
9 own sort of romantic reasons, we always look
10 toward the espionage or the hackers or the sort of
11 interesting forms of vulnerability and intrusion,
12 what Ms. Sandler and Ms. Moy's research has shown
13 is what tends to affect patient lives most is not
14 this sort of stuff, it's bad code. It is design
15 flaws. It is software miscommunication, power
16 management issues, device restarting and not
17 telling anyone and then not functioning as it is
18 supposed to.

19 We cited in our comment the study of
20 Professor Homa Alemzadeh who looked at recall
21 history of devices and found hundreds of recalls
22 per year for software issues on medical devices,
23 and estimates the number of deaths attributable is
24 also in the hundreds.

25 While I think attention has been given a

1 lot to the potential for vulnerability intrusion,
2 and indeed, that is a valid concern, there is a
3 more fundamental concern here which is that the
4 devices simply aren't working as they should be,
5 and as all fields of software research know,
6 having more people conducting studies and testing
7 these vulnerabilities to simulate their
8 environments and use it to detect whether or not
9 there are problems overall always tends to improve
10 the health of these devices.

11 I would also just finally note that we
12 are in an area of regulatory overlap here, that in
13 addition to the Copyright Office, the FCC, the
14 FDA, the Department of Homeland Security, all have
15 a regulatory role in the medical device space, and
16 as has been said many times before by this Office,
17 and as a matter of good practice, the primary
18 responsibility for this rulemaking should be to
19 inquire as to whether or not the implementation of
20 access control measures is diminishing the ability
21 of individuals to make non-infringing uses.

22 On the questions of copyright and
23 piracy, the opposition commenters offer next to
24 nothing to suggest that there would be an issue
25 here in terms of piracy.

1 As we noted in our comment as well,
2 software is never going to replace the need for
3 one of these devices itself. You can't look at
4 the source code of a pacemaker instead of getting
5 a pacemaker. It is essential to your care. The
6 therapy it provides on a utilitarian level and the
7 inseparability of the hardware and software means
8 it is impossible to conceive of a circumstance
9 where access to the data, data outputs, and source
10 code would actually affect the sale of these
11 devices, and in turn, these works.

12 Indeed, as this Office has previously
13 noted, having robust security and verification of
14 security actually can improve the sale of works
15 themselves because now you can say I, independent
16 researcher, looked at the Medtronic insulin pump,
17 I audited it for errors, I found none. I trust
18 this device.

19 That, I think, in my mind, improves the
20 commerciality of the works.

21 MS. CHARLESWORTH: Okay. A couple of
22 questions. You mentioned the FDA issue. There is
23 a fair amount in the record to suggest that many
24 of the devices you would be seeking to circumvent
25 or that the software resides on devices that are

1 in fact fairly heavily regulated, certified,
2 reviewed by the FDA, that I think the suggestion
3 is some of these changes or actions could somehow
4 bring them out of compliance or risk bringing them
5 out of compliance.

6 It's true that is not a copyright issue,
7 but it certainly is sort of a significant issue.
8 I hear you saying it is not a copyright issue, but
9 what about the bigger, sort of the substance of
10 the concern, which is that these devices or that
11 these activities may not be consistent with the
12 FDA's view of the matter?

13 MR. SELLARS: Certainly. I would say
14 that while I agree the opposition commenters did
15 indeed say that, they offered no substantiation to
16 that point whatsoever. Indeed, as we stated at
17 the outset, what the opponents fundamentally miss
18 is that this research is happening now. This is
19 the state of affairs.

20 This is the way in which it is normally
21 done, that there is independent research, and the
22 FDA not only tolerates it, they promote it. They
23 hold hearings where they invite independent
24 researchers to come in. They rely upon their
25 research in order to help better improve their own

1 regulation of these devices. They actively
2 solicit contributions when a person discovers a
3 vulnerability, there is a mechanism that the FDA
4 makes available to report those vulnerabilities or
5 those other issues.

6 Same with the Department of Homeland
7 Security when a cybersecurity issue is found on a
8 device, there is a mechanism by which the
9 Department of Homeland Security allows people to
10 contact them and help them coordinate a response
11 to that issue.

12 I would say the history of the research
13 that is done on this device completely refutes the
14 suggestion that the FDA would not approve of this.
15 My indication is they quite clearly would.

16 MR. RUWE: How would you react to us
17 limiting the exemption in a way that tied the
18 exemption to reporting and working within programs
19 of those other agencies?

20 MR. SELLARS: Sure. I understand there
21 has been a suggestion in a few of the exemptions,
22 including on vehicles and in the general security
23 exemption, to limit the grant of an exemption here
24 only if you disclose the vulnerabilities that are
25 discovered to certain outlets, either to the

1 vendors themselves or to certain agencies.

2 While I agree that the standard course
3 of disclosure is to go to the vendor first when
4 there is an issue, there are absolutely times when
5 it is appropriate instead to go to someone else,
6 including to another agency or perhaps to the
7 press itself.

8 When there is a vulnerability that is
9 not related to something a hacker could use to
10 intrude, if it is instead just a design flaw,
11 there is absolutely no reason why you couldn't
12 just tell the world that there is a problem with
13 this device and you shouldn't use it.

14 We have also in our history a sad
15 tradition of medical companies knowing about
16 vulnerabilities in devices and not telling the
17 public until there is a serious issue. We cite a
18 few specific examples including the Therac-25
19 incident, which involved the linear accelerator.
20 We cited Professors Nancy Leveson and Clark
21 Turner's study on that particular vulnerability.

22 There is also an issue with Guidant
23 pacemakers where a hardware problem in Guidant was
24 known for at least three years by the manufacturer
25 but they did not tell doctors that they knew of

1 the problem until a 21 year old man died as a
2 result of that failure and the New York Times in
3 turn conducted an investigation and uncovered the
4 fact that Guidant knew about this issue.

5 As recently as this year, we have had
6 Wired produce several studies about Hospira
7 infusion pumps that have known vulnerabilities to
8 them, and that Hospira knew about them, and it
9 wasn't until Wired said they were going to publish
10 the story about this issue that they actually
11 issued the notification there was a problem there.

12 While the medical companies, I'm sure,
13 wish to be proactive in responding to issues, they
14 are at times unfortunately reactive. I think it
15 would be bad policy to adopt a limit to the
16 disclosure.

17 I also think it raises serious First
18 Amendment concerns. Under the unconstitutional
19 conditions doctrine, it raises First Amendment
20 issues whenever a government entity premises a
21 benefit, even a discretionary benefit, on a speech
22 based restriction, and restricting the audience of
23 speech is a restriction of speech, as the 10th
24 Circuit said in U.S. West vs. FCC.

25 I think that raises serious First

1 Amendment concerns if you limit the audience of
2 what you can tell someone after you conduct a
3 field of research.

4 MR. RILEY: Is this exemption designed
5 or do you envision the exemption being able to
6 pull data from these devices, data that could
7 otherwise be used or subject to test data
8 exclusivity laws for data that is going to be
9 submitted to regulatory agencies? Like the device
10 or whatever devices related to a medicine where it
11 is pending approval.

12 MR. SELLARS: I think the experience of
13 this research shows there are issues that come up
14 post-market as well as pre-market when it comes to
15 devices being issued. As you indicate, the FDA,
16 when a new device enters a market, has a couple of
17 different regulatory options before them.

18 If a device is sufficiently similar to a
19 device already in the field, they allow for simple
20 notification of the device entering into the
21 market and the new features. If it is a
22 sufficiently novel or dangerous device, instead
23 they go through pre- market approval, where as you
24 note, there are studies that are conducted often
25 at the funding of the manufacturers themselves,

1 and as we know, there are also studies that show
2 funded studies by industry tend to favor the
3 industry outcomes. They have a bias there.

4 I would also note that a lot of the
5 issues that have been found, including by Mr.
6 Radcliffe, are on devices that are already in the
7 market, that are already functioning. New
8 information about them is coming to light.

9 MR. MORRIS: May I jump in?

10 MS. CHARLESWORTH: Absolutely.

11 MR. MORRIS: Mr. Sellars, let me just
12 kind of understand what the exemption is trying to
13 facilitate. I've heard a number of different
14 security problems and different use of data, but
15 are you trying to facilitate or any of your
16 clients trying to do research that would lead to
17 the modification of the software in the device
18 that then goes out and kind of is used on a
19 continuing basis?

20 We have obviously had discussions about
21 automobiles, and I think in those situations, the
22 people actually want to modify the software, and
23 the device of the automobile runs slightly
24 differently.

25 I'm unclear whether that is something

1 you and your clients are trying to achieve.

2 MR. SELLARS: No. The exemption here is
3 seeking to access the source code and data outputs
4 of the device, not to modify the software that is
5 in the devices. I think there is a suggestion
6 that frankly I find a bit absurd, that people
7 would be doing some of this vulnerability testing
8 on devices used in patient care.

9 The normal course is that when you are
10 developing a technology that compliments a device
11 or you are trying to access information about how
12 the device is functioning, you use explanted
13 devices. That is the normal course.

14 MS. CHARLESWORTH: You anticipated the
15 question I was about to ask. There are sort of
16 two branches to your request. One is data
17 readouts from actual patients, like Mr. West here,
18 and then the other branch is sort of the security
19 and vulnerability testing. As you just said, you
20 just reiterated something I think I saw in your
21 comments, which is it would be explanted devices
22 that would not be used again for real patients.

23 Is that your proposal?

24 MR. SELLARS: That is the proposal. I
25 would note, however, the two exemptions are quite

1 linked together. As Mr. West's comments earlier
2 noted, when you are accessing device data about a
3 patient's health, you are often also learning
4 about how the device itself is functioning.

5 As Mr. West indicated, there is an error
6 that exists in continuous glucose monitors today,
7 which is what he knows as the pressure error, if
8 you lean on a sensor, it malfunctions, it produces
9 bad data.

10 While there are research done both in
11 terms of individual patients and on the aggregate,
12 one can often inform the other together. In terms
13 of the vulnerability testing, that is done on
14 explanted devices.

15 MS. CHARLESWORTH: Right. I see them as
16 somewhat distinct requests, although they are
17 blended together in the proposal, because the
18 scope of the devices or the actual devices in one
19 case would be presumably being used by actual
20 patients and in the other case, it is sort of the
21 opposite would be true, they would not be in use
22 by a lot of patients.

23 I think there was another concern about
24 the fact that once they had been tested, they
25 would then go back into clinical use.

1 MR. SELLARS: My understanding is that
2 once a device has been tested, it is no longer
3 sterile and can't be used in implantation. I know
4 some studies by Kevin Fu at the Archimedes
5 Research Center at the University of Michigan that
6 have discussed some of the difficulty you have
7 when testing devices to simulate human activity
8 because once a device is out of its packaging, my
9 understanding is you can no longer use that device
10 in patient care.

11 MS. CHARLESWORTH: Steve? You're good?
12 Did I ask your question?

13 MR. RUWE: (Off microphone.)

14 MS. CHARLESWORTH: Great minds think
15 alike. Mr. Siy?

16 MR. SIY: Thank you. I think I just
17 wanted to touch on a few points that were
18 discussed earlier. One of them was with regard to
19 the copyrightable works issue. I know some of the
20 discussion earlier was about whether or not the
21 data structures and the formats themselves were
22 copyrightable.

23 I think certainly AdvaMed and some of
24 the opponents have made the case that some of
25 them would be, as Mr. Sellars pointed out, fair

1 uses or uses of the uncopyrightable elements of
2 those things.

3 I do want to stress there are also
4 copyrightable works contained within the software
5 of the device itself, and those works are
6 frequently going to be accessed if not necessarily
7 copied under Section 106 through the use of any of
8 these uses.

9 Also, in the course of security testing
10 on explanted devices, copies may be made and ran
11 in temporary storage and to the question earlier,
12 modifications might be made in the course of that
13 testing.

14 MS. CHARLESWORTH: That's helpful.
15 Thank you. Did you have anything else?

16 MR. SIY: No, I think I will yield my
17 time.

18 MS. CHARLESWORTH: Actually, as long as
19 we are on the law, you have a fair use claim here.
20 What are the other sources of law you would be
21 relying on to access those works if any or the
22 data compilations?

23 MR. SIY: Sure. Plain access itself
24 would not be an infringing use. Access that led
25 to or acquired essential step copies would of

1 course fall under Section 117, access and use that
2 required modifications would also fall under
3 Section 117, to the extent those might not even
4 apply in the hypothetical situation, which I don't
5 believe we are facing here, that the software
6 itself is not held to be owned by the patient, I
7 think fair use applies incredibly strongly in this
8 case.

9 MS. CHARLESWORTH: What is the position
10 in terms of you mentioned the ownership issue, do
11 you know what the practice is? Maybe Mr. Sellars
12 can address this in terms of what the
13 manufacturers say in terms of who owns the
14 software.

15 MR. SELLARS: Certainly. Of course, in
16 terms of intellectual property ownership of the
17 software, they, of course, own it. In terms of
18 chattel ownership of the device itself, we
19 uncovered no evidence to suggest anything other
20 than the patient being the chattel owner of the
21 device, and the opponents asserted no ownership
22 claims to the contrary.

23 MS. CHARLESWORTH: They are not
24 asserting -- when you get a glucose monitor, is
25 there a license?

1 MR. SELLARS: My understanding is that
2 there is no license that is signed at that time.

3 MS. CHARLESWORTH: Signed or --

4 MR. SELLARS: Or given. There is no
5 license in my understanding. Our research did not
6 uncover any license.

7 MS. CHARLESWORTH: It sounds like there
8 is not a practice which is prevalent with a lot of
9 other consumer goods of the manufacturer saying
10 you are using the software and the device that are
11 under a license.

12 MR. SELLARS: Yes, and I think that also
13 speaks to their being no real after market use of
14 these devices other than the research we have
15 discussed here, nor is there a reasonable way of
16 suggesting that a person could ever lose ownership
17 of something like a pacemaker.

18 MS. CHARLESWORTH: What about going back
19 to the permanent exemptions in 1201, do any of
20 those help the reverse engineering? You want to
21 address some of that?

22 MR. SIY: I think Mr. Sellars' written
23 submission covers this very nicely. Again, these
24 might apply in certain cases, but they do not
25 cover the field of the exemptions being requested,

1 and therefore, at best would be an incomplete
2 solution for some of the uses for some of the
3 devices.

4 MS. CHARLESWORTH: Okay. Anything
5 further?

6 (No response.)

7 MS. CHARLESWORTH: Ms. Moy, did you want
8 to speak?

9 MS. MOY: Yes. Thank you again for
10 having this hearing and for allowing me to speak
11 here. It's difficult to add anything really large
12 and substantive to what has already been said so
13 eloquently, so I will try to keep my comments this
14 morning brief and just make a few points.

15 First, as others have commented and as
16 we have said extensively in the record in written
17 comments from multiple parties, vulnerabilities
18 have to be discovered so they can be fixed. There
19 is no other way to do it.

20 We know through a large body of research
21 and writing on this topic that there are serious
22 vulnerabilities in medical devices, both the types
23 of software bugs that Ms. Sandler and I and a
24 couple of other authors wrote about in our 2010
25 paper, "Killed by Code," as well as

1 vulnerabilities that have to do with security.

2 Device manufacturers are doing really
3 great work making life saving devices, and they
4 work very hard to make the devices as safe as they
5 possibly can, but code inevitably has bugs. It is
6 practically impossible if not actually impossible
7 for manufacturers to eliminate all the bugs before
8 devices go on the market.

9 Bugs in medical device software and
10 firmware could lead to serious injury or even
11 death for patients through things like delivery of
12 inappropriate shock or inappropriate dosage of
13 insulin, other types of incidents we have heard
14 about.

15 In addition, problems of medical device
16 software and firmware could expose patients'
17 private records, and this is something we both
18 write about in our 2010 paper and have also
19 discussed in comments.

20 We know that medical identity theft is a
21 serious threat right now, and accordingly medical
22 records have been the target of a number of really
23 high profile breaches that we have all heard about
24 in the news over the last year. Vendors of
25 medical software and devices are struggling to

1 protect against that threat.

2 We have to assist researchers in finding
3 these vulnerabilities as soon as possible so they
4 can be addressed, preferably before bugs either
5 lead to harm to patients or before security
6 vulnerabilities lead to the loss of private data.

7 MS. CHARLESWORTH: On that point, one of
8 the claims made in the opposition papers is that
9 allowing this sort of circumvention in some cases
10 could lead to like inappropriate access to third
11 party medical records.

12 In other words, let's say you have a
13 device that is running off a central software
14 system and you circumvent and you kind of get into
15 other patients' records, I don't know if that is
16 something you can address or the others, but is
17 that first of all a real possibility, and second,
18 if it is, how would we address that in the
19 exemption?

20 MS. MOY: I'll just say briefly that I
21 have seen nothing to suggest that when researchers
22 are working with these devices that they are
23 looking at somehow a manufacturer's database of
24 records, records of multiple patients, but I would
25 also defer to my colleagues who know more about

1 this than I do.

2 MR. SELLARS: Certainly. The best paper
3 I'm aware of that addresses these concerns is one
4 by Daniel Halperin and Kevin Fu and others that
5 addresses the vulnerabilities in pacemakers. This
6 is one of the leading papers on the disclosure of
7 vulnerabilities. He noted there were also privacy
8 concerns.

9 My understanding based on his paper is
10 it was largely about the privacy of the individual
11 whose data was being transmitted, that this data
12 is fairly unidirectional, it goes to the server,
13 and he did not uncover any way by which you could
14 use the medical device to access the computer
15 servers of a Medtronic or Biotronic or Boston
16 Scientific or someone else.

17 I would also note that the opposition
18 commenters produced no evidence of such a way
19 being possible.

20 Finally, I would also note again this is
21 an area of regulatory overlap. If you are using a
22 device to access another's server without
23 authorization and thereby obtaining information,
24 that raises concerns under the Computer Fraud and
25 Abuse Act, 18 U.S.C. Section 1039(a)(2).

1 I think other laws could fill in the gap
2 for bad actors in that scenario.

3 MS. CHARLESWORTH: Just as a factual
4 matter, you sort of addressed this a little bit,
5 is it possible -- are you saying it is not
6 possible to go through an individual medical
7 device and access a central server where other
8 patients' data may be housed? Is that just an
9 impossibility? I don't think you are seeking
10 that. I get that. I'm just wondering whether
11 certain types of circumvention might actually
12 allow you to do that.

13 MR. SELLARS: I have not uncovered a
14 circumstance where that would be possible. It
15 seems like this information is unidirectional, as
16 I said.

17 MS. MOY: Yes, that is also what I have
18 read in my research. The Halperin paper that Mr.
19 Sellars just referenced illustrated that
20 implantable devices, some implantable devices at
21 least were broadcasting the patient's information
22 in the clear, the patient's name, medical record
23 number, perhaps doctor name.

24 The reason for that is when the patient
25 goes to the hospital, if the patient experiences a

1 type of event or requires urgent medical
2 assistance, the device can easily be identified,
3 that the patient can be identified, and that
4 service, whatever medical assistance can be
5 provided to that patient.

6 That was the context in which there was
7 some access to sensitive patient information. It
8 was about, as Mr. Sellars said, the individual's
9 device broadcasting information in an
10 unidirectional manner.

11 MS. CHARLESWORTH: Okay.

12 MR. RUWE: There have been some concerns
13 about negative effects from being able to trigger
14 a device to transmit data beyond the ways in which
15 the data would be transmitted by design, and this
16 was battery concerns. Would it be appropriate to
17 restrict access to data that is being transmitted
18 by design?

19 MS. MOY: We can answer that question,
20 but do you mind if I also finish my opening
21 remarks?

22 MS. CHARLESWORTH: We didn't realize, so
23 please.

24 MS. MOY: Do you want to move with that
25 question first, and then I can come back.

1 MS. CHARLESWORTH: Why don't you answer
2 Mr. Ruwe's question, and then please, by all
3 means, finish your opening remarks.

4 MS. MOY: Okay. Sorry. Your question
5 was about battery drainage?

6 MR. RUWE: And other negative effects
7 from triggering the data transmission beyond the
8 ways in which the manufacturer had designed the
9 data to be transmitted.

10 MS. MOY: As Mr. Sellars was saying and
11 as we were discussing in response to a previous
12 question, research with individual devices that
13 are implantable devices are typically done on an
14 explanted device. Battery drainage is not really
15 a concern.

16 In fact, performing the type of research
17 that security researchers are doing so that
18 vulnerabilities can be addressed is something that
19 can prevent battery drainage in the future from
20 exploitation of vulnerabilities. If someone is
21 accessing your device without your knowledge, an
22 implanted device, because they are taking
23 advantage of a vulnerability to read information
24 about the patient without the patient's knowledge,
25 that is something that could lead to inappropriate

1 battery drainage and hopefully security research
2 that is done that allows manufacturers to address
3 such a vulnerability before it is exploited could
4 avoid that type of problem.

5 MS. CHARLESWORTH: There was another
6 claim on the data prong of this that pinging a
7 device a lot would drain the battery. In other
8 words, if you were gathering data more frequently
9 than had been intended by the manufacturer, you
10 might inadvertently, let's say, drain the battery.
11 Do any of you have a thought on that? Mr.
12 Sellars?

13 MR. SELLARS: Sure. First, I would note
14 that concern is primarily with devices that are
15 implanted instead of attached to the body.
16 Continuous glucose monitors and insulin pumps, the
17 batteries used I believe are AAA batteries or AA
18 batteries. They are replaceable batteries in any
19 event. The battery concern is nonexistent there.

20 Mr. West's testimony showed ways in
21 which getting additional information off the
22 device could be quite relevant to a patient's
23 care.

24 Turning to the question of pacemakers,
25 the research that has been done to date largely

1 concerns using passive interception of data as it
2 is being transmitted. There are devices called
3 interrogators of devices that allow for that.
4 Those are manufactured by the vendors and are
5 largely left in hospitals and environments, and
6 typically in order to get interrogation of
7 information, you would have to speak with the
8 doctor and make an appointment, and your insurance
9 would have to cover it.

10 MS. CHARLESWORTH: I'm sorry. I'm
11 certainly not a medical device researcher.

12 MR. SELLARS: Neither am I.

13 MS. CHARLESWORTH: A mere copyright
14 lawyer struggling with some of this. That didn't
15 quite answer my question. It answered it with
16 respect to the glucose monitor. You can just
17 change the batteries. A pacemaker, limited
18 battery life, very hard to replace the battery.
19 You circumvent a TPM, and you are again sort of --
20 you make your own interrogator, you are
21 interrogating the device much more frequently that
22 was contemplated by the manufacturer.

23 As I understand the claim, that could
24 drain the battery in a way that wasn't expected by
25 the patient or wasn't intended by the doctor

1 overseeing the care.

2 How would you address that concern?

3 MR. SELLARS: It's hard to say the
4 precise concern, as Ms. Moy pointed out, there is
5 research that show that repeated or continuous
6 interrogation of a device would drain a battery.
7 I would also note that the doctor, as you
8 mentioned, often this sort of patient access to
9 data is done in collaboration with a doctor. That
10 is to say a doctor is not always privileged with
11 special access to the data or they have to get it
12 through particular channels, through Biotronic or
13 Medtronic, or one of the other vendors.

14 Often these sorts of experimentations,
15 these ideas, ways in which to get better access to
16 data are not done without a doctor's consultation.
17 They are done with a doctor's consultation. Of
18 course, a doctor can apprise them of the risks in
19 going forward as indeed all doctors do.

20 In our revision to the exemption
21 language in the reply comment we deliberately
22 included the term "informed consent," which we
23 meant to be a signal back to tort law and the
24 theory of informed consent there, where a patient
25 would be apprised of the risks of an operation

1 before going forward, and then affirmative consent
2 would be sought before conducting any sort of
3 access to patient data.

4 MS. CHARLESWORTH: Right. I would say
5 one of the sort of pitches here, as I understood
6 it, is you wouldn't have to go to the doctor to
7 get this data, that you would have immediate
8 access to it.

9 MR. SELLARS: I think that is a
10 distinction between the project you are
11 undertaking versus the particular day to day
12 access of data. When you decide you are going to
13 try and get better access to your data, I think it
14 is quite natural for a person to talk to their
15 doctor saying hey, I'm concerned about cardiac
16 events, I know there are ways by which I can get
17 better access to my data than what the device
18 provides for me, and then would go forward from
19 there.

20 I think most of us when we engage in
21 something that we think complicates our health, we
22 talk to our doctors.

23 MS. CHARLESWORTH: I would go to my
24 local hacker for that.

25 (Laughter.)

1 MS. CHARLESWORTH: Honestly, if it
2 became something you just knew you could do. As I
3 understood it, that was one of the advantages, you
4 didn't have to wait three months for your
5 appointment with a doctor.

6 MR. SELLARS: I think Mr. West can speak
7 to this better than I can.

8 MS. CHARLESWORTH: Mr. West?

9 MR. WEST: My take is if you're going to
10 build an interrogator that does this thing with
11 the battery, you can't do that inadvertently. You
12 can't do that by accident. In order to build an
13 interrogator that is going to manipulate the
14 battery and get it to talk back to you, you must
15 know it does that to the battery.

16 MS. CHARLESWORTH: You might know that.
17 A layperson --

18 MR. WEST: What I'm saying is for
19 someone who is going to create a new interrogator
20 device, in order to successfully create that
21 device, they must know that it does that thing to
22 the battery. That is what they have to build it
23 to do.

24 Does that make sense?

25 MS. CHARLESWORTH: I understand the

1 person building -- I think the concern that was
2 raised in the opposition, and of course, they are
3 not here today to present it in their own words,
4 was just that in that case, you are dealing with
5 an implanted device in a real person, and that
6 real person may not realize reading their data
7 frequently or somehow going through that process
8 could be draining their battery in a dangerous
9 way. That's the concern as I understood it.

10 We're not the FDA here obviously, but we
11 are trying to understand sort of all the
12 parameters that are going into this exemption. I
13 don't know if you have further thoughts.

14 MR. WEST: Under that circumstance, it
15 seems like it would be important for the patient
16 to be correctly informed like when they are
17 getting the device installed, about the risks of
18 what might happen.

19 MS. CHARLESWORTH: Who would be doing
20 that informing?

21 MR. WEST: Whoever is installing the
22 device or who is selling the device.

23 MR. SELLARS: I would also note, if I
24 may, that there is nothing stopping this activity
25 from happening today, and it is not happening.

1 There is no evidence brought by AdvaMed to suggest
2 that is happening.

3 As to devices that do not have
4 encryption on there today, it is possible to
5 create an interrogator that would allow you to do
6 that. We are not seeing evidence of that actually
7 happening. What we are seeing is people building
8 tools that allow for the passive interception or
9 better access to data.

10 As Mr. Siy noted in a blog post he wrote
11 for Public Knowledge, the device often will be
12 accompanied with a monitoring base station that
13 will be transmitting this on a daily basis instead
14 of the 90 days I mentioned earlier.

15 I would find a lot of the concerns
16 indeed raised by the opposition commenters
17 completely unfounded. They are pretending as if
18 this activity isn't happening yet and this is the
19 only hurdle that is preventing it from happening.

20 As to unencrypted devices, this is
21 happening now, and there are not the risks that
22 are being presented by the opposition commenters.

23 MR. RUWE: Did I misunderstand, as far
24 as what you are seeking, what uses are being
25 employed, would it be appropriate for us to limit

1 the exemption to the monitoring of passive, for
2 passive monitoring of implanted devices? Would
3 that be problematic?

4 MR. SIY: I believe it would be. I
5 think the opposition by AdvaMed merely suggests a
6 hypothetical drain in certain uses. I think that
7 drawing a bright line rule -- if we are concerned
8 about battery life, drawing a bright line rule
9 based upon what is being transmitted and the
10 characteristics of transmission rather than the
11 characteristics of the battery, it seems to me a
12 poor fit.

13 In fact, as Mr. West has pointed out,
14 many of the problems that we are seeking to
15 address here come from the fact that information -
16 - that insufficient information is being received
17 through the existing process as dictated by the
18 manufacturer.

19 MR. MORRIS: Can I follow up on the
20 hypothetical in the opposition and perhaps ask Mr.
21 West in his capacity as an actual patient, is
22 there a scenario, in a hypothetical, where say
23 there is a glucose monitor that gets fully
24 implanted, that expects to have a 10 year battery
25 life, but using your technique to gather

1 additional data, it might only have an eight year
2 battery life, so that means he might have to have
3 an additional surgery an extra couple of years
4 early.

5 Do you envision there could be
6 scenarios where a patient could decide the extra
7 information is worth having the surgery to your
8 shorter than the 10 year battery life?

9 Ultimately, are there scenarios where
10 the information that the manufacturer is not
11 originally offering but you are offering would be
12 a decision the patient might want to make?

13 MR. WEST: I think that is conceivable,
14 yes. I think it is also conceivable that someone
15 could come up with an auditing technique that is
16 tweaked such that actually it makes the device
17 last longer. That is an equally likely
18 possibility, not just by auditing this device
19 using my crazy method it could shorten the life,
20 but the other thing it could do just as equally,
21 just as a hypothetical, is extend the life, or as
22 you mentioned, provide much, much better value
23 that may make it worth it.

24 MS. CHARLESWORTH: Mr. Sellars? I do
25 want to get back to Ms. Moy.

1 MR. SELLARS: Certainly. Very briefly,
2 I would say also just to build upon what Mr. West
3 just said, the personalization of care is an area
4 of national concern right now. It was part of the
5 President's State of the Union Address, this idea
6 of precision medicine, this idea of personalizing
7 and customizing care is very much in accordance
8 with other branches of government in terms of
9 national policies, that we are finding that better
10 health outcomes are coming when we consider the
11 patient more as an individual, and these sorts of
12 techniques can benefit that as well.

13 I am happy to turn it over to Ms. Moy.

14 MS. CHARLESWORTH: Thank you. Ms. Moy,
15 back to you.

16 MS. MOY: Sure. I just have two more
17 quick points to make. My second point is
18 vulnerability should be disclosed, that doctors
19 and patients considering devices can incorporate
20 the considerations both about the integrity of the
21 code and security considerations into their
22 decision making.

23 I would argue that medical professionals
24 and patients have a right to as much information
25 we can provide as possible about the safety and

1 security features of the devices they might be
2 considering, especially for surgical implantation,
3 and robust security research will help medical
4 professionals and patients make informed choices.

5 There was one opposition commenter who
6 noted that information about security research of
7 these devices or just research in general about
8 these devices could affect the cost/benefit
9 analysis being performed by doctors and patients.

10 That is probably as it should be. If
11 I'm considering an ICD and I have a choice between
12 a St. Jude device and a Medtronic device, and
13 there is a recent news article that suggests the
14 St. Jude device is delivering inappropriate shocks
15 that have led to death, that is an important piece
16 of information for me as a patient that I would
17 want to incorporate into my decision making as I
18 decide along with my doctor which device to adopt.

19 That is something that Karen Sandler
20 herself was considering when she and I wrote this
21 paper in part, following up on her decision to get
22 an implantable device, and she really wanted to
23 take a look at the code so she could make an
24 informed decision about which device to get, and
25 that was really what sparked her research into

1 this area.

2 My third and final point is just that
3 vulnerabilities should be disclosed to help the
4 FDA gauge how well the device review and approval
5 process is doing at ferreting out serious problems
6 before devices go on the market.

7 As Mr. Sellars has pointed out, the FDA
8 has in fact solicited input from the security
9 research community. The security research
10 community is doing important research now that
11 informs the process at the FDA, and in part, the
12 reason that the FDA has been taking additional
13 steps in the recent past to enhance medical device
14 cybersecurity is a response to the very important
15 work of independent medical device researchers in
16 this area.

17 Thanks again for the opportunity to
18 speak about this. I am happy to answer any
19 questions.

20 MS. CHARLESWORTH: On that last point,
21 the record suggested that a lot of -- I think it
22 has been mentioned here -- a lot of devices
23 actually don't currently have TPMs, a lot of FDA
24 regulated devices. As you now mentioned, the FDA
25 has sort of stepped up its interest in this area.

1 Can you sort of give me an overview of
2 like how many of the devices that would be covered
3 by your proposed exemption actually are currently
4 subject to TPMS? I think you suggested the
5 suggestion is that many more will be in the near
6 future and how probable that is. I don't know if
7 Ms. Moy is in the best position, Mr. Sellars. Any
8 of you.

9 MR. SELLARS: I would be happy to
10 address that. In pages six through eight of my
11 initial comment, we highlight a few specific
12 examples from the vendors themselves.
13 Unfortunately, often we are relying on the vendors
14 themselves to state whether or not they have these
15 things because we are still trying to build
16 additional research here.

17 Some research that is included in
18 Appendix B to our comment discloses other specific
19 examples. It is very hard for me to give you a
20 percentage. I just don't know.

21 In terms of future adoption, in October
22 the FDA issued new guidance for cybersecurity in
23 devices which strongly encourages encryption, and
24 my understanding from talking to people who work
25 in the space, when the FDA strongly encourages

1 something, that becomes de facto law because they
2 go through approval through the FDA.

3 It is not simple speculation or
4 conjecture. We have the FDA now looking at the
5 cybersecurity of devices as they are being
6 approved.

7 MS. CHARLESWORTH: Mr. West?

8 MR. WEST: I currently use a Medtronic
9 pump, the next pump that will come on the market
10 from Medtronic has encryption built into it. For
11 someone like me, this means that I will be losing
12 access to the data on that device.

13 MS. CHARLESWORTH: Thank you. Do my
14 colleagues have any more questions?

15 (No response.)

16 MS. CHARLESWORTH: Mr. Siy?

17 MR. SIY: Thanks. I just wanted to make
18 one final comment, with regard to the overlapping
19 jurisdiction question, and I think to the extent
20 that the Copyright Office might be considering
21 policy considerations with regard to health,
22 privacy, battery life and things like that, as Mr.
23 Sellars and Mr. West pointed out, these things,
24 this research is already happening, and as they
25 also said, the TPMs are coming.

1 With the increasing adoption of those
2 TPMs, that is what is altering the status quo, and
3 that is what is increasingly creating the need for
4 the exemption. In other words, I think what is
5 changing here -- what is happening is the status
6 quo is being altered to at least maintain that in
7 the best interest of the patients and the
8 researchers and requires the granting of the
9 exemption.

10 MS. CHARLESWORTH: Thank you very much.
11 Thank you, panelists. This was a particularly
12 interesting proposal, and an area I hadn't thought
13 much about before. I really appreciate you being
14 here today.

15 We are going to take a break before our
16 final panel. The last panel of the day is
17 literary works, assistive technologies. We are
18 ending a little bit early. We will stay on track
19 for 10:45. We will be back here for Proposed Class
20 9.

21 Thank you again. We will see some of
22 you perhaps later.

23 (Recess.)

24 PROPOSED CLASS 9: LITERARY WORKS
25 DISTRIBUTED

1 ELECTRONICALLY ASSISTIVE TECHNOLOGIES

2 MS. CHARLESWORTH: Order in the court.

3 I think this is our smallest and final panel of
4 the Sixth Triennial Rulemaking proceeding. Thank
5 you for coming.

6 We are going to be considering Proposed
7 Class 9, literary works distributed
8 electronically, assistive technologies. Both of
9 our panelists have been here before, so I will
10 spare you the long version of the introduction.

11 We will state our names for the record,
12 and then we will have you do that. If you want to
13 proceed with your remarks, we will be grateful to
14 hear them.

15 I'm Jacqueline Charlesworth, General
16 Counsel of the Copyright Office. I and my
17 colleagues will be presiding over this hearing.

18 MS. CHOE: Michelle Choe, Ringer Fellow.

19 MS. SMITH: Regan Smith, Assistant
20 General Counsel.

21 MR. DAMLE: Sy Damle. I'm Deputy
22 General Counsel.

23 MR. RUWE: Steve Ruwe, Assistant General
24 Counsel.

25 MR. RILEY: John Riley, Attorney

1 Advisor.

2 MR. MORRIS: John Morris with NTIA.

3 MR. REID: I'm Blake Reid. I'm here on
4 behalf of the Samuelson-Glushko Technology Law and
5 Policy Clinic and our partners at the American
6 Foundation for the Blind, the American Council for
7 the Blind, and the American Association of People
8 With Disabilities.

9 Just quickly before Jonathan introduces
10 himself, I wanted to pass on the regrets of Mark
11 Richert from the American Foundation for the
12 Blind. He was supposed to join us today. He is
13 actually in Alabama giving the commencement
14 address at the Birmingham School of the Blind. A
15 weather system blew through and delayed his
16 flight. He is deeply sorry he cannot be here. We
17 will do our best to fill in in his stead.

18 MS. CHARLESWORTH: I am sorry he
19 couldn't make it. I hope he gets safely home.
20 Thank you, Mr. Reid. Mr. Band?

21 MR. BAND: I'm Jonathan Band. I'm here
22 on behalf of the Library Copyright Alliance.

23 MS. CHARLESWORTH: Okay. Mr. Reid, you
24 may proceed.

25 MR. REID: Thank you. We appreciate the

1 opportunity to speak one more time and apologies
2 that we have to be the closing act here. I know
3 you have seen a lot of us this week.

4 You have also seen a lot of contentious
5 exemptions this week and strong arguments on both
6 sides, and a lot of really complicated issues. I
7 learned an awful lot just watching. We hope this
8 exemption is one of the simplest and one of the
9 easiest decisions you have to make. It is very
10 basic.

11 It guarantees the right of people who
12 are blind or visually impaired to read books.
13 That is a civil and a human right and it
14 underscores the ability to access information and
15 participate in a democratic society.

16 I think the good news is it is also very
17 uncontroversial. We are asking for a straight
18 across renewal of an exemption that the Office has
19 recommended and the Librarian has granted several
20 times in the past. We are not asking for any
21 modifications from the last round.

22 It is largely unopposed and you even
23 heard from the American Association of Publishers
24 who notwithstanding some reservations supports the
25 exemption.

1 The circumstances of the exemption have
2 not changed except for marginally from last time.
3 It is still necessary for folks to do
4 circumvention, both on an individual and on an
5 authorized entity level. It is still necessary to
6 enable assisted technologies.

7 I think we have even more evidence,
8 although I don't think it was ever in controversy,
9 that the use we are talking about is non-
10 infringing, after the HathiTrust case last year,
11 and there is still very limited availability and
12 issues with advertising of non-circumventing
13 alternatives like eBooks made available in an
14 accessible format, audio books, and that sort of
15 thing.

16 The only changed circumstance I think is
17 really material is the Marrakesh Treaty, for which
18 we think at least at a minimum the granting of
19 this exemption is necessary to put the United
20 States in compliance with that treaty.

21 In short, we really hope you will grant
22 the exemption. I am happy to answer any questions
23 you have. That is all I have.

24 MS. CHARLESWORTH: Before we get into
25 any questions or move on to Mr. Band, I just

1 wanted to thank you and your students for helping
2 to make a record in this particular class. It has
3 been very helpful. The written material has been
4 helpful to help establish a need for an exemption
5 here.

6 Mr. Band?

7 MR. BAND: I will be really brief.
8 Blake said basically everything I wanted to say,
9 just two points. One, no one is opposing this
10 exemption. The second point, just to reiterate
11 the Marrakesh Treaty point. I certainly hope the
12 United States ratifies the treaty within the next
13 three years, and we would need to have this
14 exemption in place to comply with the treaty. I
15 think that alone would be an adequate basis for
16 renewal of the exemption.

17 MS. CHARLESWORTH: On that point, on the
18 Marrakesh point, can you elaborate a little bit on
19 the question of the relationship between this
20 exemption and the treaty?

21 MR. BAND: The treaty has a provision, I
22 believe it is Article VII, that indicates
23 countries need to have a way for people who are
24 blind or authorized entities have to have a way to
25 circumvent technological protection measures in

1 order to take advantage of any exception under the
2 treaty.

3 That would map directly on this
4 exemption. It would be better obviously if it was
5 a statutory exception so that you would not have
6 to renew it every three years, but since that is
7 beyond the power of this body, we would have the
8 exemption to enable someone to circumvent in order
9 to take advantage of an exception consistent with
10 the treaty.

11 MS. CHARLESWORTH: Okay. Thank you, Mr.
12 Band. Do any of my colleagues have any questions?

13 MS. CHOE: Yes. This is for both of
14 you. The Association of American Publishers in
15 their comments mentioned the EPUB 3 and HTML 5
16 formats. If you could provide more information
17 about those formats and how they work or don't
18 work as alternatives.

19 MR. REID: Sure. This actually goes
20 into a broader point that I was hoping to make,
21 which is that we are actually very hopeful those
22 formats, EPUB 3 in particular, will some day see
23 widespread adoption in the industry and actually
24 provide a non- circumventing alternative. In
25 fact, I am hopeful that in our lifetimes, unlike

1 the other exemptions that I have spoken on behalf
2 of this week, that some day I will be able to send
3 you guys a letter and say we are not seeking
4 renewal of this exemption because all of the books
5 that are being put out by the publishers are
6 coming out in EPUB 3 format, it's accessible, it
7 interoperates with screen readers and text-to-
8 speech functionality, and Braille displays.

9 I think there is some hope that the
10 publishing industry will move in that direction,
11 and I think as AAP pointed out, the unfortunate
12 reality is we are not there yet, and I don't think
13 we are going to get there in the next three years.

14 It may be a very different story three
15 years down the line, but at this point, adoption
16 by publishers has been inconsistent. The
17 availability of titles in those formats and the
18 interoperability of titles that are purchased on
19 particular platforms, with particular readers,
20 still isn't there.

21 I guess all I can say is stay tuned. I
22 hope to have a different answer to that question
23 next time around. We are not there yet.

24 MR. BAND: I will just add that even if
25 we come to a point three years from now, six years

1 from now, where all new books coming out, eBooks
2 coming out, meet that standard, you still will
3 always have the problem with Legacy books.

4 I think we would still have to be
5 seeking an exemption for Legacy eBooks because not
6 everything is going to be up to that technology.

7 MR. REID: It is worth noting that
8 addressing the sort of access to the archive is
9 going to be a really hard problem to address
10 because every year that goes by, the books are not
11 coming out in those formats, we are also creating
12 a volume of books that doesn't exist in an
13 accessible format.

14 There are also a number of other
15 challenges related to accessibility, like the user
16 interfaces on devices like tablets and phones on
17 which people are reading these books. The
18 technology has a long way to go.

19 I really would encourage you guys -- I'm
20 sorry Mark was not able to be here today -- if you
21 have a relative or family member or friend who is
22 blind or visually impaired, ask them to go through
23 the process of how they use a tablet or E-reader
24 to read a book even when it is made available in
25 an accessible format.

1 You will think that it is broken first.
2 You will hear this computerized voice talking
3 really fast, and you will start hearing the book
4 being read. Think of Siri reading a very long book
5 to you. This is not an ideal solution.

6 I think the technology has a long way to
7 go. I also want to emphasize this exemption isn't
8 going to fix everything about eBook accessibility,
9 and I want to make sure that we don't claim that
10 it does. At least at this point, it is a really
11 helpful Band-Aid for folks who are looking to
12 either engage in self help or looking to make
13 books available, for example, to their students or
14 to their clients at an authorized entity.

15 That is why we are asking for renewal.

16 MS. CHARLESWORTH: Okay. Any further
17 questions?

18 (No response.)

19 MS. CHARLESWORTH: Congratulations.
20 This has been the shortest panel, and a good way
21 to wrap up these hearings. Thank you both very
22 much for being here on behalf of your clients
23 today.

24 This will conclude the Sixth Triennial
25 Rulemaking hearings. We are getting out a little

1 early. We can have a nice lunch. It is Friday.

2 Thank you all again and to those who watched from

3 the audience for being here today.

4 (Whereupon, at 10:59 a.m., the

5 proceedings were adjourned.)

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

1 CERTIFICATE OF NOTARY PUBLIC

2

3 I, CHRISTINE ALLEN, the officer before whom the
4 foregoing proceeding was taken, do hereby certify
5 that the proceedings were recorded by me and
6 thereafter reduced to typewriting under my
7 direction; that said proceedings are a true and
8 accurate record to the best of my knowledge,
9 skills, and ability; that I am neither counsel
10 for, related to, nor employed by any of the
11 parties to the action in which this was taken;
12 and, further, that I am not a relative or employee
13 of any counsel or attorney employed by the parties
14 hereto, nor financially or otherwise interested in
15 the outcome of this action.

16

17

18

Christine E. Allen

19

20

CHRISTINE ALLEN
Notary Public in and for the
DISTRICT OF COLUMBIA

21

22

23

24

25



<p><u>1</u> 1 10:10 10 10:12 54:24 55:8 10:45 61:19 10:59 71:4 1039(a)(2 43:25 106 37:7 10th 31:23 117 38:1,3 12 8:15 12,000 14:4 1201 1:6 39:19 14 12:20 18 43:25</p> <hr/> <p><u>2</u> 2008 8:7 2009 8:7 2010 40:24 41:18 2012 23:15 2015 1:9 21 31:1 27 3:3 28 24:10,13 29 1:9</p> <hr/> <p><u>3</u> 3 67:15,22 68:6</p> <hr/> <p><u>4</u> 4,000 14:5</p> <hr/> <p><u>5</u> 5 67:15</p> <hr/> <p><u>6</u> 6 8:15 60 24:8</p>	<p><u>9</u> 9 8:15 61:20,24 62:7 9:03 3:2 90 24:8,14 53:14</p> <hr/> <p><u>A</u> a.m 3:2 71:4 AA 47:17 AAA 47:17 AAP 68:11 ability 20:12 26:20 64:14 72:9 able 4:6 9:7,16 10:10 11:3,11 12:14 13:25 15:3,4,19 16:6 19:24 20:2,10 32:5 45:13 68:2 69:20 absolutely 30:4,11 33:10 absurd 34:6 Abuse 43:25 accelerator 30:19 access 7:12 13:7 14:13 24:16 26:20 27:9 34:3,11 37:21,23,24 38:1 42:10 43:14,22 44:7 45:7,17 49:8,11,15 50:3,8,12,13,17 53:9 60:12 64:14 69:8 accessed 16:23 37:6 accessibility 69:15 70:8 accessible 65:14 68:6 69:13,25 accessing 17:3</p>	<p>19:16,18 35:2 46:21 accident 51:12 accompanied 53:12 accordance 56:7 accordingly 41:21 Accountability 23:13 accurate 14:18 72:8 accurately 15:8 achieve 34:1 acquired 37:25 across 64:18 act 43:25 64:2 action 10:5 11:15 72:11,15 actions 28:3 actively 29:1 activities 12:11 28:11 activity 24:5,20 36:7 52:24 53:18 actors 44:2 actual 5:6 34:17 35:18,19 54:21 actually 5:18 7:14 19:6 20:9 22:16 27:10,14 31:10 33:22 37:18 41:6 44:11 53:6 55:16 58:23 59:3 63:13 67:19,21,23 add 5:3 40:11 68:24 addition 15:10 26:13 41:15 additional 9:25 47:21 55:1,3 58:12 59:16 Additionally</p>	<p>23:19 address 16:25 18:4 22:20 38:12 39:21 42:16,18 47:2 49:2 54:15 56:5 59:10 63:14 69:9 addressed 19:3 42:4 44:4 46:18 addresses 43:3,5 addressing 18:4,8 69:8 adequate 66:15 adjourned 71:5 ADMINISTRATI ON 2:8 adopt 7:11 31:15 57:18 adopted 14:6 adoption 59:21 61:1 67:23 68:15 adult 12:16 AdvaMed 17:9 18:11 19:4 23:8 36:23 53:1 54:5 advantage 13:24 46:23 67:1,9 advantages 51:3 advertising 65:12 Advisor 3:25 63:1 affairs 28:19 affect 25:13 27:10 57:8 affecting 16:14 affirmative 50:1 affordance 18:19 against 42:1 agencies 29:19 30:1 32:9 agency 30:6 aggregate 35:11</p>
---	--	---	---

<p>ago 9:14 24:14 Alabama 63:13 Alemzadeh 25:20 alike 36:15 Allen 1:18 72:3,19 allergies 17:25 Alliance 63:22 allow 5:5 32:19 44:12 48:3 53:5,8 allowed 7:9 10:25 14:13 allowing 4:4 40:10 42:9 allows 11:22 12:6 29:9 47:2 alone 12:10 66:15 already 4:12 7:8 15:24 21:17 23:5 24:17 32:19 33:6,7 40:12 60:24 altered 61:6 altering 61:2 alternative 67:24 alternatives 65:13 67:18 altogether 14:23 am 3:15 5:19 48:12 56:13 58:18 63:18 65:22 67:25 72:9,12 Amendment 31:18,19 32:1 American 63:5,6,7,11 64:23 67:14 America's 6:25 amongst 22:23 amount 27:23</p>	<p>analysis 57:9 analyze 8:23 analyzing 17:15 Andrew 5:19 6:11 another's 43:22 answer 21:8 45:19 46:1 48:15 58:18 65:22 68:22 answered 48:15 anticipated 34:14 anyone 18:9 25:17 anything 16:15 37:15 38:19 40:4,11 apologies 64:1 Appendix 59:18 applied 15:14 applies 38:7 apply 38:4 39:24 appointment 48:8 51:5 appreciate 61:13 63:25 appreciates 6:3 appreciation 4:3,9 apprise 49:18 apprised 49:25 appropriate 30:5 45:16 53:25 approval 32:11,23 58:4 60:2 approve 29:14 approved 60:6 Archimedes 36:4 archive 69:8 area 26:12 43:21 56:3 58:1,16,25 61:12 areas 4:15</p>	<p>aren't 26:4 argue 56:23 argued 22:23 arguments 64:5 arrangement 17:10 18:20 21:23 arrest 18:5 article 57:13 66:22 asserted 38:21 asserting 18:9,13 38:24 asserts 19:4 assess 14:14 Assessment 22:12 assist 42:2 assistance 45:2,4 Assistant 3:18,22 62:19,23 assisted 65:6 assistive 61:17 62:1,8 Association 18:12 23:7 63:7 64:23 67:14 attached 47:15 attend 11:3,11 attention 25:25 attorney 3:24 6:12 62:25 72:13 attributable 25:23 audience 31:22 32:1 71:3 audio 65:14 audit 16:18 20:2 audited 27:17 auditing 55:15,18 authorization 43:23 authorized 65:5</p>	<p>66:24 70:14 authors 40:24 automobile 33:23 automobiles 33:21 availability 65:11 68:17 available 9:9,10 15:1,21 17:20 29:4 65:13 69:24 70:13 avoid 47:4 aware 43:3 awful 64:7</p> <hr/> <p style="text-align: center;">B</p> <hr/> <p>Bachelor's 5:24 bad 25:14 31:15 35:9 44:2 bag 13:12 Band 63:20,21 65:25 66:6,7,21 67:12 68:24 Band-Aid 70:11 base 53:12 based 24:7 31:22 43:9 54:9 basic 64:10 basically 66:8 basis 24:19,20 33:19 53:13 66:15 batteries 47:17,18 48:17 battery 45:16 46:5,14,19 47:1,7,10,19 48:18,24 49:6 51:11,14,15,22 52:8 54:8,11,24 55:2,8 60:22 became 51:2 becomes 60:1</p>
---	---	---	---

<p>begin 5:16 6:6 7:14</p> <p>beginning 15:18</p> <p>begun 7:11</p> <p>behalf 63:4,22 68:1 70:22</p> <p>behavior 16:14</p> <p>behind 16:13</p> <p>belabor 13:1</p> <p>believe 38:5 47:17 54:4 66:22</p> <p>belt 13:13</p> <p>Ben 6:9 7:21</p> <p>benefit 31:21 56:12</p> <p>best 40:1 43:2 59:7 61:7 63:17 72:8</p> <p>better 24:16 28:25 49:15 50:13,17 51:7 53:9 55:22 56:9 67:4</p> <p>beyond 11:14 45:14 46:7 67:7</p> <p>bias 33:3</p> <p>bigger 28:9</p> <p>Biotronic 43:15 49:12</p> <p>Birmingham 63:14</p> <p>birth 18:24</p> <p>bit 34:6 44:4 61:18 66:18</p> <p>Blake 63:3 66:8</p> <p>blended 35:17</p> <p>blew 63:15</p> <p>blind 63:6,7,12,14 64:12 66:24 69:22</p> <p>blog 53:10</p> <p>blood 23:22</p>	<p>body 40:20 47:15 67:7</p> <p>book 13:12 69:24 70:3,4</p> <p>books 64:12 65:14 68:4 69:1,3,10,12,17 70:13</p> <p>Boston 43:15</p> <p>Braille 68:8</p> <p>branch 34:18</p> <p>branches 34:16 56:8</p> <p>breaches 41:23</p> <p>break 61:15</p> <p>breakfast 17:25</p> <p>brief 7:16 40:14 66:7</p> <p>briefly 22:8,21 42:20 56:1</p> <p>bright 54:7,8</p> <p>bring 28:4</p> <p>bringing 28:4</p> <p>broad 4:19</p> <p>broadcasting 44:21 45:9</p> <p>broader 67:20</p> <p>broken 70:1</p> <p>brought 53:1</p> <p>bugs 40:23 41:5,7,9 42:4</p> <p>build 51:10,12,22 56:2 59:15</p> <p>building 52:1 53:7</p> <p>built 60:10</p> <p>button 20:16</p> <hr/> <p style="text-align: center;">C</p> <hr/> <p>Campos 6:13 23:19,20</p>	<p>capacity 54:21</p> <p>Capital 1:18</p> <p>cardiac 17:22 18:1,5 23:25 24:22 50:15</p> <p>cardiomyopathy 23:20</p> <p>care 11:24 12:4 13:17 17:19 18:23,25 20:21 27:5 34:8 36:10 47:23 49:1 56:3,7</p> <p>carefully 4:13</p> <p>case 19:11 22:12,19 35:19,20 36:24 38:8 52:4 65:10</p> <p>cases 18:2 19:5 39:24 42:9</p> <p>causes 14:21</p> <p>causing 20:20</p> <p>Center 36:5</p> <p>central 42:13 44:7</p> <p>certain 29:25 30:1 39:24 44:11 54:6</p> <p>certainly 28:7,13 36:23 38:15 43:2 48:11 56:1 66:11</p> <p>CERTIFICATE 72:1</p> <p>certified 28:1</p> <p>certify 72:4</p> <p>CGM 8:1 14:3</p> <p>challenges 69:15</p> <p>change 48:17</p> <p>changed 10:11,12 65:2,16</p> <p>changes 28:3</p> <p>changing 10:7 16:8,15 61:5</p>	<p>channels 49:12</p> <p>characteristics 54:10,11</p> <p>Charlesworth 2:3 3:6,11 4:8 6:1,5,18 7:2,5,20 10:14,17,20 11:9 12:12,25 13:5,16,23 14:9 19:24 20:25 21:9,22 22:2,6 27:21 33:10 34:14 35:15 36:11,14 37:14,18 38:9,23 39:3,7,18 40:4,7 42:7 44:3 45:11,22 46:1 47:5 48:10,13 50:4,23 51:1,8,16,25 52:19 55:24 56:14 58:20 60:7,13,16 61:10 62:2,15 63:18,23 65:24 66:17 67:11 70:16,19</p> <p>chattel 38:18,20</p> <p>check-up 24:7</p> <p>child 11:19,24 12:1,12,16,17 13:8,11,18</p> <p>children 11:2 12:19,22 13:24</p> <p>Choe 2:4 3:17 62:18 67:13</p> <p>choice 12:8 57:11</p> <p>choices 57:4</p> <p>Christine 1:18 72:3,19</p> <p>Circuit 31:24</p> <p>circumstance 27:8 44:14 52:14 65:16</p> <p>circumstances</p>
--	--	--	---

<p>65:1 circumvent 27:24 42:14 48:19 66:25 67:8 circumventing 17:4 67:24 circumvention 42:9 44:11 65:4 cite 30:17 cited 25:19 30:20 cites 23:16 civil 64:13 claim 37:19 47:6 48:23 70:9 claims 38:22 42:8 clarify 5:18,22 19:15 Clark 30:20 class 3:3 13:20 61:19,24 62:7 66:2 clear 19:6 44:22 clearly 29:15 clients 33:16 34:1 70:14,22 Clinic 5:20 63:5 clinical 35:25 closely 8:6 closing 64:2 Cloud 14:3 coalition 5:21 6:14 7:6 22:21,24 24:24 code 7:13 17:15 25:3,14 27:4,10 34:3 40:25 41:5 56:21 57:23 collaboration 49:9 collaborators 8:20 colleagues 3:13 42:25 60:14</p>	<p>62:17 67:12 collect 21:6 COLUMBIA 72:20 columns 20:5 combination 9:2 comes 5:3 32:14 coming 17:2 19:17 33:8 56:10 60:25 62:5 68:6 69:1,2,11 commencement 63:13 comment 5:4 6:17 22:9 25:19 27:1 49:21 59:11,18 60:18 commented 40:15 commenter 57:5 commenters 26:23 28:14 43:18 53:16,22 comments 17:12 34:21 35:1 40:13,17 41:19 67:15 commerciality 27:20 common 10:25 community 9:6 58:9,10 companies 30:15 31:12 Company 1:18 compilations 37:22 complete 4:16 completely 29:13 53:17 compliance 28:4,5 65:20 complicated 64:6</p>	<p>complicates 50:21 compliments 34:10 comply 66:14 computer 5:25 8:13,18,24 9:12,16 43:14,24 computerized 70:2 conceivable 55:13,14 conceive 27:8 concern 12:15 26:2,3 28:10 35:23 46:15 47:14,19 49:2,4 52:1,9 56:4 concerned 50:15 54:7 concerns 3:14 31:18 32:1 43:3,8,24 45:12,16 48:1 53:15 conclude 70:24 conditions 31:19 conduct 32:2 conducted 7:8 31:3 32:24 conducting 26:6 50:2 confidence 14:15 Congratulations 70:19 Congress 1:4,10 conjecture 60:4 consent 49:22,24 50:1 consider 56:10 considerations 56:20,21 60:21 considering 56:19</p>	<p>57:2,11,20 60:20 62:6 consistent 28:11 67:9 constantly 20:19 consultation 49:16,17 consumer 39:9 contact 29:10 contained 8:2 37:4 contemplated 48:22 contentious 4:14 64:4 context 45:6 continue 7:9 14:10 16:4 continuing 33:19 continuous 7:23 8:10 23:2 35:6 47:16 49:5 contrary 38:22 contributions 29:2 control 26:20 controlled 21:7 controversy 65:8 conveniently 9:21 coordinate 29:10 coordinating 13:17 co-panelist 25:2 copied 37:7 copies 37:10,25 copy 22:17 copyright 1:5 2:2 3:12 4:3 17:8 18:9 19:5 21:12 26:13,22 28:6,8 48:13 60:20 62:16 63:22 copyrightability</p>
---	---	--	---

<p>18:10 copyrightable 36:19,22 37:4 Correct 22:5 correctly 52:16 cost/benefit 57:8 Council 63:6 counsel 3:12,19,21,23 62:16,20,22,24 72:9,13 countries 66:23 couple 4:5 5:7 27:21 32:16 40:24 55:3 course 19:8 30:2 34:9,13 37:9,12 38:1,15,17 49:18 52:2 court 62:2 courtesy 4:4 courts 19:9 cover 39:25 48:9 covered 59:2 covers 39:23 crazy 55:19 create 9:3 51:19,20 53:5 created 14:4 creating 22:2 61:3 69:11 critical 17:18 cue 10:13 curious 9:24 current 8:14 9:13 10:4 23:16 currently 15:21 58:23 59:3 60:8 customers 3:10 customizing 56:7</p>	<p>Cyberlaw 5:20 cybersecurity 23:16 29:7 58:14 59:22 60:5 <hr/>D<hr/>D.C 1:12 daily 24:19 53:13 Damle 2:4 3:20 9:23 16:5,20 62:21 dangerous 11:20 32:22 52:8 Daniel 43:4 data 7:13 8:23 9:1,15,25 11:6 12:17 15:1,3,5,16 16:8,23 17:3,7,16 18:9,15,17,18,21 19:2,16,19 20:6 21:2,3,12,14,22 22:3,9,13 24:6,16 27:9 32:6,7,8 33:14 34:3,16 35:2,9 36:21 37:22 42:6 43:11 44:8 45:14,15,17 46:7,9 47:6,8 48:1 49:9,11,16 50:3,7,12,13,17 52:6 53:9 55:1 60:12 database 21:6,7,10,13,17, 20,21,23 22:3,4,9,11 42:23 databases 18:14 date 18:24 25:5 47:25 day 11:10 17:23 24:20 50:11 61:16 67:22 68:2</p>	<p>days 3:8 8:13 24:8,14 53:14 de 60:1 dealing 52:4 death 11:17 41:11 57:15 deaths 25:23 decide 50:12 55:6 57:18 decided 22:4 decision 12:2 55:12 56:22 57:17,21,24 decisions 64:9 deeply 63:16 defer 42:25 Degree 5:24 dehydrated 14:22 delayed 8:5 63:15 deliberately 49:21 delivering 57:14 delivery 41:11 delta 9:12,18 demand 14:8 democratic 64:15 Department 26:14 29:6,9 depend 17:10 Depending 10:4 Deputy 3:20 62:21 describing 7:16 design 16:13 21:14 25:14 30:10 45:15,18 designed 7:7 32:4 46:8 detail 19:1 detect 26:8 developing 34:10</p>	<p>device 5:21 6:14 9:1,9 11:6,7 12:13 13:2 14:16 15:2,4,20,22,24 16:8,9,15,17,19 17:14,19 18:1,3 20:1,17,19,21 21:4,16,25 22:1 24:3,17,18 25:8,16 26:15 27:18 29:8,13 30:13 32:9,16,18,19,20 ,22 33:17,23 34:4,10,12 35:2,4 36:2,8,9 37:5 38:18,21 39:10 41:2,9,15 42:13 43:14,22 44:7 45:2,9,14 46:14,21,22 47:7,22 48:11,21 49:6 50:17 51:20,21 52:5,17,22 53:11 55:16,18 57:12,14,18,22,2 4 58:4,13,15 60:12 devices 3:5,15 7:9,10,23 8:5,7 9:4 10:24 14:20 15:25 17:1,7,16 18:16 20:8 23:6,9,14 25:1,21,22 26:4,10 27:3,11,24,25 28:10 29:1 30:16 32:6,10,15 33:6 34:5,8,13,21 35:14,18 36:7 37:10 39:14 40:3,22 41:3,4,8,25 42:22 44:20 46:12,13 47:14 48:2,3 53:3,20 54:2 56:19</p>
---	---	--	--

<p>57:1,7,8 58:6,22,24 59:2,23 60:5 69:16</p> <p>diabetes 7:22 16:4</p> <p>diabetic 11:2</p> <p>dicta 22:19</p> <p>dictated 54:17</p> <p>died 31:1</p> <p>diet 24:1</p> <p>difference 9:12</p> <p>different 17:14 24:2 32:17 33:13,14 68:14,22</p> <p>differently 33:24</p> <p>difficult 11:15 23:22 40:11</p> <p>difficulty 36:6</p> <p>diminishing 26:20</p> <p>direction 68:10 72:7</p> <p>directly 67:3</p> <p>Disabilities 63:8</p> <p>disagree 19:9</p> <p>disclose 29:24</p> <p>disclosed 23:10 56:18 58:3</p> <p>discloses 59:18</p> <p>disclosure 30:3 31:16 43:6</p> <p>discovered 29:25 40:18</p> <p>discovers 29:2</p> <p>discretionary 31:21</p> <p>discuss 5:1</p> <p>discussed 36:6,18 39:15 41:19</p> <p>discussing 46:11</p>	<p>discussion 4:25 5:7,12 25:7 36:20</p> <p>discussions 33:20</p> <p>dispatch 18:18</p> <p>dispatched 18:18 24:18</p> <p>display 10:3</p> <p>displayed 11:8</p> <p>displays 8:14 68:8</p> <p>dispute 4:14</p> <p>disputes 17:9</p> <p>distinct 35:16</p> <p>distinction 50:10</p> <p>distributed 61:25 62:7</p> <p>DISTRICT 72:20</p> <p>dizziness 17:23</p> <p>dizzy 17:24</p> <p>doctor 5:23 44:23 48:8,25 49:7,9,10,18 50:6,15 51:5 57:18</p> <p>doctors 30:25 49:19 50:22 56:18 57:9</p> <p>doctor's 49:16,17</p> <p>doctrine 31:19</p> <p>done 17:17 20:23 22:25 23:4 25:5 28:21 29:13 35:10,13 46:13 47:2,25 49:9,16,17</p> <p>dosage 41:12</p> <p>Dr 5:16</p> <p>drain 47:7,10 48:24 49:6 54:6</p> <p>drainage 46:5,14,19 47:1</p>	<p>draining 52:8</p> <p>drawing 54:7,8</p> <p>duplicating 21:18</p> <p>during 13:18</p> <hr/> <p style="text-align: center;">E</p> <hr/> <p>earlier 35:1 36:18,20 37:11 53:14</p> <p>early 55:4 61:18 71:1</p> <p>easiest 64:9</p> <p>easily 45:2</p> <p>eat 24:11</p> <p>eats 24:21</p> <p>eBook 70:8</p> <p>eBooks 65:13 69:1,5</p> <p>edge 19:9,11</p> <p>effects 45:13 46:6</p> <p>eight 55:1 59:10</p> <p>either 29:25 42:4 70:12</p> <p>elaborate 66:18</p> <p>electronically 62:1,8</p> <p>elements 37:1</p> <p>eliminate 41:7</p> <p>eloquently 40:13</p> <p>else 11:7 12:7,21 13:14 20:14 30:5 37:15 43:16</p> <p>emphasize 70:7</p> <p>employed 53:25 72:10,13</p> <p>employee 20:18 72:12</p> <p>enable 65:6 67:8</p> <p>enables 12:8</p> <p>enabling 19:15</p>	<p>enact 12:23</p> <p>encourage 69:19</p> <p>encourages 59:23,25</p> <p>encryption 15:23 53:4 59:23 60:10</p> <p>engage 50:20 70:12</p> <p>engineer 5:25 7:25</p> <p>engineering 8:23 19:7 39:20</p> <p>enhance 58:13</p> <p>ensure 7:7</p> <p>entering 32:20</p> <p>enters 32:16</p> <p>entities 66:24</p> <p>entitled 25:3</p> <p>entity 31:20 65:5 70:14</p> <p>environment 24:1</p> <p>environments 26:8 48:5</p> <p>envision 32:5 55:5</p> <p>episode 18:1</p> <p>EPUB 67:15,22 68:6</p> <p>equally 55:17,20</p> <p>E-reader 69:23</p> <p>error 35:5,7</p> <p>errors 27:17</p> <p>especially 57:2</p> <p>espionage 25:10</p> <p>essential 27:5 37:25</p> <p>establish 66:4</p> <p>estimate 14:15,20 15:6,8,17</p> <p>estimates 14:23 15:10 25:23</p> <p>event 17:22 45:1</p>
---	---	--	---

<p>47:19 events 15:15 23:25 24:22 50:16 everyone 3:7 6:19 everything 66:8 69:6 70:8 evidence 38:19 43:18 53:1,6 65:7 exact 13:11 exactly 16:17 example 9:11 11:1 12:14 13:18 15:14 70:13 examples 30:18 59:12,19 except 65:2 exception 67:1,5,9 exclusivity 32:8 excuse 5:17 exemption 4:19 6:16 7:6 16:2,22,25 17:6 19:13 29:17,18,23 32:4,5 33:12 34:2 42:19 49:20 52:12 54:1 59:3 61:4,9 64:8,18,25 65:1,19,22 66:4,10,14,16,20 67:4,8 68:4 69:5 70:7 exemptions 29:21 34:25 39:19,25 64:5 68:1 exist 69:12 existence 19:12 existing 54:17 exists 19:5 35:6 expected 48:24</p>	<p>expects 54:24 experience 32:12 experiences 44:25 experimentations 49:14 expert 24:25 explain 9:24 11:9 explained 4:10 explanted 34:12,21 35:14 37:10 46:14 exploitation 46:20 exploited 47:3 expose 41:16 express 4:2 expression 22:15 extend 55:21 extensively 23:17 40:16 extent 38:3 60:19 extra 55:3,6 extracting 22:9,14 extraction 22:18 <hr/> F <hr/> Facebook 14:2 faces 3:11 facilitate 33:13,15 facilities 12:5 facing 38:5 fact 16:15 28:1 31:4 35:24 46:16 54:13,15 58:8 67:25 facto 60:1 factual 4:15 44:3 fail 15:18 failure 31:2 fair 22:11,15,18 27:23 36:25</p>	<p>37:19 38:7 fairly 28:1 43:12 fall 38:1,2 false 15:13 families 10:25 family 69:21 fast 70:3 fatigue 17:24 favor 33:2 FCC 26:13 31:24 FDA 23:14 26:14 27:22 28:2,22 29:3,14 32:15 52:10 58:4,7,11,12,23, 24 59:22,25 60:2,4 FDA's 23:15 28:12 features 20:3 32:21 57:1 February 24:10,13 Fellow 3:17 62:18 ferreting 58:5 fetch 9:15 field 23:25 32:3,19 39:25 fields 26:5 figure 21:11 fill 44:1 63:17 final 24:23 58:2 60:18 61:16 62:3 finally 4:17 24:23 26:11 43:20 financially 72:14 finding 42:2 56:9 fine 7:20 finish 45:20 46:3 firmware 41:10,16 first 6:19,20 12:10</p>	<p>30:3 31:17,19,25 40:15 42:17 45:25 47:13 70:1 fit 54:12 five 8:17 9:14 10:11,12 fix 70:8 fixed 40:18 flaw 30:10 flaws 25:15 flight 63:16 floor 7:3 focus 4:13 folks 65:3 70:11 foregoing 72:4 form 5:11 format 4:21 65:14 68:6 69:13,25 formats 36:21 67:16,17,22 68:17 69:11 forms 17:14 25:11 forward 49:19 50:1,18 Foundation 63:6,11 fourth 24:23 Francisco 8:1 frankly 34:6 Fraud 43:24 free 5:11 frequently 37:6 47:8 48:21 52:7 Friday 1:8 71:1 friend 69:21 Fu 36:4 43:4 fully 54:23 functionality 68:8 functioning 25:17</p>
---	--	--	---

<p>33:7 34:12 35:4 fundamental 26:3 fundamentally 28:17 funded 33:2 funding 32:25 future 17:3 46:19 59:6,21</p> <hr/> <p style="text-align: center;">G</p> <hr/> <p>GAO 23:15 gap 44:1 gather 54:25 gathering 47:8 gauge 58:4 general 3:11,19,20,22 29:22 57:7 62:15,20,22,23 generate 21:1 generated 21:13 gets 54:23 63:19 getting 27:4 47:21 52:17 70:25 given 25:25 39:4 giving 63:13 glance 20:13,22 glanceable 20:9 glucose 7:23 8:10,14 9:13,17 10:4,6 14:15,19,23 15:6,8,10,16 18:8 23:2 35:6 38:24 47:16 48:16 54:23 gone 9:20 16:16 goods 39:9 governing 7:12 government 23:13 31:20 56:8</p>	<p>grandpa 12:10 grandparents 12:3 grant 29:23 65:21 granted 64:19 granting 61:8 65:18 grateful 62:13 great 16:16 36:14 41:3 greater 18:19 group 8:20 14:3,5 guarantees 64:11 guess 13:6 68:21 guidance 59:22 Guidant 30:22,23 31:4 guys 68:3 69:19 gym 13:20</p> <hr/> <p style="text-align: center;">H</p> <hr/> <p>hacker 30:9 50:24 hackers 25:10 Halperin 43:4 44:18 handheld 8:13,17,24 9:11,15 handle 11:21 12:5 happen 13:10 52:18 happens 13:10 16:18 happy 16:24 56:13 58:18 59:9 65:22 hard 41:4 48:18 49:3 59:19 69:9 hardware 9:2 15:7 27:7 30:23 harm 42:5</p>	<p>Harvard 5:20 HathiTrust 65:10 haven't 20:24 having 18:1 26:6 27:13 40:10 55:7 headings 20:5 health 26:10 35:3 50:21 56:10 60:21 hear 11:1 28:8 62:14 70:2 heard 6:7 33:13 41:13,23 64:23 hearing 3:7,14 40:10 62:17 70:3 hearings 1:6 4:5,11 28:23 70:21,25 heart 23:21 24:5,20 heavily 28:1 held 20:2 38:6 help 28:25 29:10 39:20 57:3 58:3 66:4 70:12 helpful 4:5 5:9 10:2,20 14:10 37:14 66:3,4 70:11 helping 12:21 66:1 hereby 72:4 hereto 72:14 herself 57:20 hey 50:15 Hi 7:21 high 41:23 highlight 59:11 history 25:21 29:12 30:14 hold 28:23 Homa 25:20</p>	<p>home 11:23 63:19 Homeland 26:14 29:6,9 Honestly 51:1 hope 63:19 64:7 65:21 66:11 68:9,22 hopeful 67:21,25 hopefully 47:1 hoping 67:20 Hospira 31:6,8 hospital 44:25 hospitals 48:5 hour 8:15 hourly 20:18 hours 11:13,14,16 housed 44:8 HTML 67:15 Hugo 6:13 23:19 24:15 human 36:7 64:13 hundreds 25:21,24 hurdle 53:19 hypertrophic 23:20 hypothetical 38:4 54:6,20,22 55:21</p> <hr/> <p style="text-align: center;">I</p> <hr/> <p>ICD 57:11 I'd 16:24 18:6 22:7 25:6 idea 10:9 56:5,6 ideal 70:5 ideas 49:15 identified 45:2,3 identify 15:16 identity 41:20</p>
---	---	--	---

<p>I'll 42:20</p> <p>illustrated 44:19</p> <p>I'm 3:11 6:3,9,12 7:24 9:23 12:25 13:6 14:22 16:2 17:24,25 20:18 31:12 33:25 43:3 44:10 48:10 50:15 51:18 57:11 62:15,21 63:3,21 69:19</p> <p>immediate 50:7</p> <p>impacts 11:10</p> <p>impaired 64:12 69:22</p> <p>impedance 24:4</p> <p>implantable 44:20 46:13 57:22</p> <p>implantation 36:3 57:2</p> <p>implanted 46:22 47:15 52:5 54:2,24</p> <p>implementation 26:19</p> <p>implicated 7:17</p> <p>important 8:3 9:25 10:8,13 52:15 57:15 58:10,14</p> <p>impossibility 44:9</p> <p>impossible 27:8 41:6</p> <p>improve 16:3 26:9 27:14 28:25</p> <p>improves 27:19</p> <p>inaccurate 14:18 15:11,13</p> <p>inadvertently 47:10 51:11</p> <p>inappropriate 41:12 42:10 46:25 57:14</p>	<p>incident 30:19</p> <p>incidents 41:13</p> <p>include 18:22 22:24</p> <p>included 49:22 59:17</p> <p>including 5:22 18:14,22 20:12 29:22 30:6,18 33:5</p> <p>incomplete 40:1</p> <p>inconsistent 68:16</p> <p>incorporate 56:19 57:17</p> <p>incorrect 14:20 15:17</p> <p>increasing 61:1</p> <p>increasingly 61:3</p> <p>incredibly 38:7</p> <p>indeed 26:2 27:12 28:15,16 49:19 53:16</p> <p>independent 6:10 7:10 23:18 27:15 28:21,23 58:15</p> <p>indicate 18:13 23:8 32:15</p> <p>indicated 35:5</p> <p>indicates 22:13 66:22</p> <p>indication 29:15</p> <p>indistinguishable 17:22</p> <p>individual 21:3 35:11 43:10 44:6 46:12 56:11 65:4</p> <p>individuals 26:21</p> <p>individual's 45:8</p> <p>industry 33:2,3 67:23 68:10</p> <p>inevitably 41:5</p>	<p>inform 35:12</p> <p>information 2:7 8:2,4,8 9:7,8,21 10:22 12:15,18 14:14 17:11,18 18:7,21,24 21:6 33:8 34:11 43:23 44:15,21 45:7,9 46:23 47:21 48:7 54:15,16 55:7,10 56:24 57:6,16 64:14 67:16</p> <p>informed 49:22,24 52:16 57:4,24</p> <p>informing 52:20</p> <p>informs 58:11</p> <p>infringing 22:16 37:24 65:10</p> <p>infusion 31:7</p> <p>in-house 22:18</p> <p>initial 22:9 59:11</p> <p>injury 41:10</p> <p>input 58:8</p> <p>inquire 26:19</p> <p>inseparability 27:7</p> <p>insert 8:12</p> <p>insertion 14:21,22</p> <p>inside 17:19</p> <p>installed 52:17</p> <p>installing 52:21</p> <p>instead 14:24 27:4 30:5,10 32:22 47:15 53:13</p> <p>Institute 7:1</p> <p>instrumental 23:12</p> <p>insufficient 54:16</p> <p>insulin 7:24 11:17 13:22 15:23 23:1 27:16 41:13 47:16</p>	<p>insurance 24:7 48:8</p> <p>integrity 56:20</p> <p>intellectual 23:7 38:16</p> <p>intended 47:9 48:25</p> <p>interactions 9:3</p> <p>interception 48:1 53:8</p> <p>interest 5:14 58:25 61:7</p> <p>interested 72:14</p> <p>interesting 16:20 25:11 61:12</p> <p>interfaces 69:16</p> <p>interoperability 68:18</p> <p>interoperates 68:7</p> <p>interpretation 13:14</p> <p>interpreting 12:17</p> <p>interrogating 48:21</p> <p>interrogation 48:6 49:6</p> <p>interrogator 48:20 51:10,13,19 53:5</p> <p>interrogators 48:3</p> <p>interrupt 4:24 9:23</p> <p>introduce 3:16 6:7,19</p> <p>introduces 63:9</p> <p>introduction 62:10</p> <p>intrude 30:10</p> <p>intrusion 25:11 26:1</p> <p>investigation 31:3</p> <p>invite 28:23</p>
---	--	--	--

<p>involve 19:18 involved 30:19 isn't 53:18 68:20 70:7 issue 26:24 27:22 28:6,7,8 29:7,11 30:4,17,22 31:4,10 36:19 38:10 issued 31:11 32:15 59:22 issues 4:13 5:1 25:16,22 29:5 31:13,20 32:13 33:5 64:6 65:12 it's 4:5 10:8,9,17 11:14 12:21 14:6 18:17 19:5,20 21:3 25:14 28:6 40:11 49:3 68:6 I've 4:10 10:10,12 15:21 33:13</p> <hr/> <p style="text-align: center;">J</p> <hr/> <p>Jacqueline 2:3 3:11 62:15 Jerome 6:13 22:24 John 2:5,9 3:24 4:1 62:25 63:2 join 63:12 Jonathan 63:9,21 Jude 57:12,14 jump 33:9 jurisdiction 60:19</p> <hr/> <p style="text-align: center;">K</p> <hr/> <p>Karen 6:13 24:24 57:19 Kevin 36:4 43:4 key 23:9 kid 13:20 killed 24:10 25:3</p>	<p>40:25 knew 30:25 31:4,8 51:2 knowledge 6:24 9:14 46:21,24 53:11 72:8 known 30:24 31:7</p> <hr/> <p style="text-align: center;">L</p> <hr/> <p>language 49:21 large 40:11,20 largely 7:10 17:10 24:3 43:10 47:25 48:5 64:22 last 3:7 8:18 10:10,11,12 14:4 41:24 55:17 58:20 61:16 64:21 65:2,10 later 24:8 61:22 Laughter 50:25 Laura 6:25 25:2 law 5:20 37:19,20 49:23 60:1 63:4 laws 32:8 44:1 lawyer 24:25 48:14 lawyers 16:21 layperson 51:17 lead 11:17 33:16 41:10 42:5,6,10 46:25 leading 43:6 lean 35:8 learn 24:19 learned 8:1 15:22 64:7 learning 35:3 least 18:6 30:24 44:21 61:6 65:18 70:10</p>	<p>leave 10:6 led 37:24 57:15 Legacy 69:3,5 lengths 16:16 less 11:3 let's 20:18 42:12 47:10 letter 68:3 level 25:2 27:6 65:5 levels 15:9 Leveson 30:20 liberties 11:1 Librarian 64:19 Library 1:4,10 63:22 license 38:25 39:2,5,6,11 life 16:4 41:3 48:18 54:8,25 55:2,8,19,21 60:22 lifetimes 67:25 light 33:8 likely 22:18 55:17 limit 29:23 31:15 32:1 53:25 limited 48:17 65:11 limiting 29:17 line 3:16 54:7,8 68:15 linear 30:19 linked 35:1 literary 61:17,24 62:7 little 44:4 61:18 66:18 70:25 lives 25:13 living 7:25</p>	<p>local 50:24 long 37:18 62:10 69:18 70:4,6 longer 36:2,9 55:17 lose 39:16 losing 60:11 loss 42:6 lot 4:17 17:18 23:15 24:12 25:4 26:1 33:4 35:22 39:8 47:7 53:15 58:21,22,23 64:3,4,6,7 low 13:18 lunch 24:10,13 71:1</p> <hr/> <p style="text-align: center;">M</p> <hr/> <p>maintain 61:6 malfunctions 35:8 man 31:1 management 25:16 manipulate 51:13 manner 45:10 manufacture 23:6 manufactured 48:4 manufacturer 30:24 39:9 46:8 47:9 48:22 54:18 55:10 manufacturers 32:25 38:13 41:2,7 47:2 manufacturer's 42:23 Manufacturers 18:12 map 67:3 marginally 65:2</p>
---	---	--	--

<p>Mark 63:10 69:20 market 15:21 17:2 32:16,21,23 33:7 39:13 41:8 58:6 60:9 marks 14:24 Marrakesh 65:17 66:11,18 matches 16:17 material 65:17 66:3 matter 17:17 26:17 28:12 44:4 may 1:9 4:16 7:2 10:5,6 15:11,12 19:19 28:11 33:9 37:10 44:8 52:6,24 55:23 63:24 68:14 maybe 13:5 20:17 38:11 McDonald's 20:19 mean 13:1 17:4 means 12:22 27:7 46:3 55:2 60:11 meant 49:23 measure 17:5 measures 7:12,18 26:20 66:25 mechanism 29:3,8 medical 3:4,14 5:21 6:14 7:8,23 17:14 25:8,22 26:15 30:15 31:12 40:22 41:9,15,20,21,25 42:11 43:14 44:6,22 45:1,4 48:11 56:23 57:3 58:13,15 medicine 10:7 32:10 56:6 Medtronic 16:1</p>	<p>27:16 43:15 49:13 57:12 60:8,10 meet 69:2 meeting 14:8 member 24:23 69:21 members 7:5 14:4 22:20,23 mentioned 17:12 27:22 38:10 49:8 53:14 55:22 58:22,24 67:15 mere 48:13 merely 54:5 merits 19:13 metadata 15:7 18:22 method 55:19 Michelle 2:4 3:17 62:18 Michigan 36:5 microphone 36:13 mike 4:2 mikes 5:8 mind 4:21 27:19 45:20 minded 8:21 minds 36:14 minimum 65:18 minutes 8:17 9:14 10:11,12 miscommunicatio n 25:15 miss 11:3 28:17 missed 17:25 25:7 mistake 5:24 misunderstand 53:23 mobile 9:22</p>	<p>10:23,24 21:4 models 15:20 modification 33:17 modifications 37:12 38:2 64:21 modify 33:22 34:4 monitor 8:10 11:23 13:3 18:8 19:18,19 38:24 48:16 54:23 monitoring 11:4 12:6,23 14:13 17:18 19:16 53:12 54:1,2 monitors 7:24 23:2 35:6 47:16 months 9:1 51:4 morning 3:6 7:6 40:14 Morris 2:9 4:1,9 33:9,11 54:19 63:2 move 20:13 45:24 65:25 68:10 Moy 6:25 25:2 40:7,9 42:20 44:17 45:19,24 46:4,10 49:4 55:25 56:13,14,16 59:7 Moy's 25:12 multiple 40:17 42:24 Mumford 1:11 muscle 23:21 <hr/> N <hr/> Nancy 30:20 narrow 4:19 nasty 11:18 national 2:7 18:12</p>	<p>56:4,9 natural 50:14 nature 23:24 24:2 necessarily 18:2 20:22 37:6 necessary 16:22 17:1 65:3,5,19 negative 45:13 46:6 neither 48:12 72:9 networked 3:14 news 41:24 57:13 64:16 nice 71:1 nicely 39:23 non 65:9 67:24 non- circumventing 65:12 none 27:17 nonexistent 47:19 non-infringing 26:21 nor 39:15 72:10,14 normal 34:9,13 normally 28:20 Notary 72:1,20 note 18:16 26:11 32:24 33:4 34:25 43:17,20 47:13 49:7 52:23 noted 17:6 19:10 22:8 27:1,13 35:2 43:7 53:10 57:6 nothing 20:23 26:24 42:21 52:24 notification 31:11 32:20</p>
---	---	---	--

<p>noting 69:7</p> <p>notwithstanding 64:24</p> <p>novel 32:22</p> <p>NTIA 4:1,3 63:2</p> <p>numerical 10:18</p> <p>nurse 13:6</p> <hr/> <p style="text-align: center;">O</p> <hr/> <p>obtain 9:7</p> <p>obtaining 43:23</p> <p>obviously 33:20 52:10 67:4</p> <p>occurrences 17:23</p> <p>October 59:21</p> <p>offer 26:23</p> <p>offered 28:15</p> <p>offering 55:11</p> <p>Office 1:5 2:2 3:12 4:3 19:10 23:13 26:13,16 27:12 60:20 62:16 64:18</p> <p>officer 72:3</p> <p>offshoots 19:21</p> <p>okay 7:2,19 11:13 12:9 13:16 27:21 40:4 45:11 46:4 63:23 67:11 70:16</p> <p>old 31:1</p> <p>open 6:25 21:21</p> <p>opening 4:23 5:16 45:20 46:3</p> <p>operate 8:9</p> <p>operation 49:25</p> <p>opponents 23:3 28:17 36:24 38:21</p> <p>opportunity 58:17 64:1</p>	<p>opposing 66:9</p> <p>opposite 35:21</p> <p>opposition 26:23 28:14 42:8 43:17 52:2 53:16,22 54:5,20 57:5</p> <p>options 32:17</p> <p>order 22:17 24:19 28:25 48:6 51:12,20 62:2 67:1,8</p> <p>organize 22:4</p> <p>originally 55:11</p> <p>others 40:15 42:16 43:4</p> <p>otherwise 15:5 32:7 72:14</p> <p>outcome 72:15</p> <p>outcomes 33:3 56:10</p> <p>outlets 29:25</p> <p>outputs 7:13 17:7,16 27:9 34:3</p> <p>outset 28:17</p> <p>overall 8:18 26:9</p> <p>overlap 26:12 43:21</p> <p>overlapping 60:18</p> <p>overseas 15:24</p> <p>overseeing 49:1</p> <p>overview 59:1</p> <p>owned 21:7 38:6</p> <p>owner 38:20</p> <p>Owners 23:7</p> <p>ownership 18:10,13 38:10,16,18,21 39:16</p> <p>owns 38:13</p>	<hr/> <p style="text-align: center;">P</p> <hr/> <p>pacemaker 27:4,5 39:17 48:17</p> <p>pacemakers 30:23 43:5 47:24</p> <p>packaging 36:8</p> <p>pages 59:10</p> <p>panel 7:5 61:16 62:3 70:20</p> <p>panelists 61:11 62:9</p> <p>panel's 7:15</p> <p>paper 40:25 41:18 43:2,9 44:18 57:21</p> <p>papers 42:8 43:6</p> <p>parameters 52:12</p> <p>parent 11:19,22 12:7 13:19</p> <p>parents 8:21</p> <p>participate 4:4 64:15</p> <p>particular 18:20 23:1 24:4 30:21 49:12 50:11 66:2 67:22 68:19</p> <p>particularly 61:11</p> <p>parties 40:17 72:11,13</p> <p>partners 63:5</p> <p>party 42:11</p> <p>pass 63:10</p> <p>passive 48:1 53:8 54:1,2</p> <p>past 58:13 64:20</p> <p>patient 9:10 17:20 18:22 25:13 34:8 36:10 38:6,20 44:24,25 45:3,5,7 46:24 48:25 49:8,24</p>	<p>50:3 52:15 54:21 55:6,12 56:11 57:16</p> <p>patients 8:21,22 9:16 11:2 15:12 24:6 34:17,22 35:11,20,22 41:11,16 42:5,15,24 44:8 56:19,24 57:4,9 61:7</p> <p>patient's 17:19 35:3 44:21,22 46:24 47:22</p> <p>Pebble 20:10</p> <p>pending 32:11</p> <p>people 5:3,11 11:24 12:4 14:6 16:4 26:6 29:9 33:22 34:6 53:7 59:24 63:7 64:11 66:23 69:17</p> <p>per 25:22</p> <p>percentage 59:20</p> <p>perform 12:20,22 22:17</p> <p>performed 57:9</p> <p>performing 46:16</p> <p>perhaps 4:15 30:6 44:23 54:20 61:22</p> <p>permanent 39:19</p> <p>permission 7:15</p> <p>permit 11:11</p> <p>person 29:2 39:16 50:14 52:1,5,6</p> <p>personal 17:17 23:23</p> <p>personalization 56:3</p> <p>personalizing 56:6</p> <p>petitioning 6:15</p>
--	--	--	---

<p>phone 12:13 13:2 phones 9:22 10:24 69:16 physician 18:23 piece 9:25 12:6 57:15 pieces 20:9 21:3 pinging 47:6 piracy 26:23,25 itches 50:5 placard 5:4 Plain 37:23 platforms 68:19 please 45:23 46:2 point 5:19 10:11 13:1 17:9 20:5 22:8 25:6 28:16 42:7 56:17 58:2,20 66:10,11,17,18 67:20 68:15,25 70:10 pointed 36:25 49:4 54:13 58:7 60:23 68:11 points 10:12 36:17 40:14 56:17 66:9 policies 56:9 policy 31:15 60:21 63:5 poor 54:12 popular 14:7 position 38:9 59:7 possibility 42:17 55:18 possible 6:22 14:12 42:3 43:19 44:5,6,14 53:4 56:25 possibly 41:5 post 53:10</p>	<p>post-market 32:14 potential 26:1 power 25:15 67:7 practically 41:6 practice 26:17 38:11 39:8 pre 32:23 precise 49:4 precision 56:6 predict 11:15 preferably 42:4 pre-market 32:14 premises 31:20 prepared 11:21 present 52:3 presented 20:6 21:15 53:22 President's 56:5 presiding 3:13 62:17 press 20:16 30:7 pressure 15:13 35:7 presumably 35:19 pretending 53:17 prevalent 39:8 prevent 46:19 preventing 53:19 previous 9:13,19 46:11 previously 27:12 primarily 47:14 primary 18:23 26:17 printing 20:4 printout 20:3 21:2 prior 19:10 privacy 43:7,10</p>	<p>60:22 private 41:17 42:6 privileged 49:10 proactive 31:13 probable 59:6 probably 57:10 problem 30:12,23 31:1,11 47:4 69:3,9 problematic 54:3 problems 26:9 33:14 41:15 54:14 58:5 proceed 19:13 62:13 63:24 proceeding 3:8 62:4 72:4 proceedings 71:5 72:5,7 process 52:7 54:17 58:5,11 69:23 produce 31:6 produced 43:18 produces 35:8 professionals 56:23 57:4 Professor 25:20 Professors 30:20 profile 41:23 programs 29:18 project 50:10 projects 19:21 promote 28:22 promoted 6:1 promotion 6:4 prong 47:6 property 23:7 38:16 proposal 34:23,24 35:17 61:12</p>	<p>proposed 3:3 59:3 61:19,24 62:6 protect 42:1 protectable 19:8 22:14 protected 17:7 protection 7:12,18 17:5 66:25 protocol 9:15 provide 9:16,20 10:22 13:11 55:22 56:25 67:16,24 provided 8:4 9:18 15:7,11 45:5 provides 27:6 50:18 providing 12:4 13:14 proving 14:7 provision 66:21 public 6:24 30:17 53:11 72:1,20 publish 31:9 published 25:3 publishers 64:23 67:14 68:5,16 publishing 68:10 pull 21:22 32:6 pulling 16:8,11 21:17,24 pump 8:1 15:23 23:22 27:16 60:9 pumps 7:24 23:1 31:7 47:16 purchased 68:18 purpose 4:10 pursuing 8:3 putting 20:8 22:10</p> <hr/> <p style="text-align: center;">Q</p> <hr/>
--	---	---	--

<p>quality 14:15 16:3 question 4:20 14:24 16:6,12,21 18:6 34:15 36:12 37:11 45:19,25 46:2,4,12 47:24 48:15 60:19 66:19 68:22 questions 4:6,16,24 14:11 26:22 27:22 58:19 60:14 65:22,25 67:12 70:17 quick 56:17 quickly 3:15 5:13 63:9 quite 29:15 34:25 47:22 48:15 50:14 quo 61:2,6</p> <hr/> <p style="text-align: center;">R</p> <hr/> <p>Radcliffe 22:24 23:4,11,17 33:6 Radliffe 6:13 raised 52:2 53:16 raises 16:20 31:17,19,25 43:24 ran 37:10 ranged 18:15 rather 5:11 54:10 ratifies 66:12 raw 15:3,15 react 29:16 reactive 31:14 readers 68:7,19 reading 52:6 69:17 70:4 readings 9:19 15:13</p>	<p>readout 19:2 readouts 16:10 34:17 real 18:17 19:15 34:22 39:13 42:17 52:5,6 reality 68:12 realize 45:22 52:6 really 10:8 40:11 41:2,22 46:14 57:22,25 61:13 64:6 65:17,21 66:7 69:9,19 70:3,10 reason 16:25 30:11 44:24 58:12 reasonable 19:9 39:15 reasons 14:19 25:9 recall 25:20 recalls 25:21 receive 15:12 received 54:16 receiver 14:22 receiving 8:13,17 recent 57:13 58:13 recently 31:5 Recess 61:23 recommended 64:19 record 4:16 6:8,20 27:23 40:16 44:22 58:21 62:11 66:2 72:8 recorded 72:5 recording 24:3 records 21:18,19 41:17,22 42:11,15,24 reduced 72:6</p>	<p>referenced 44:19 reform 23:6,16 25:5 reforms 23:8 refutes 29:13 regain 10:25 Regan 2:6 3:18 62:19 regard 36:18 60:18,21 regrets 63:10 regular 24:18 regularly 11:1 regulated 28:1 58:24 regulating 23:14 regulation 29:1 regulatory 26:12,15 32:9,17 43:21 Reid 63:3,20,23,25 67:19 69:7 reiterate 66:10 reiterated 34:20 related 17:15 30:9 32:10 69:15 72:10 relationship 66:19 relative 69:21 72:12 relevant 18:25 47:22 rely 28:24 relying 37:21 59:13 remarks 5:16 14:10 45:21 46:3 62:13 remember 24:13 remote 11:4 12:6 13:7 14:12</p>	<p>remotely 11:8 12:8 renew 67:6 renewal 64:18 66:16 68:4 70:15 repeat 3:10 repeated 49:5 replace 8:12 15:25 27:2 48:18 replaceable 47:18 replicate 21:9 replicates 21:10 reply 49:21 report 20:5 29:4 Reported 1:18 reporting 1:18 29:18 represent 5:15 representing 5:21 request 34:16 requested 39:25 requests 35:16 required 38:2 requires 45:1 61:8 research 7:7,11,17 9:6 14:13 15:3,12 17:14,16 22:25 23:4,12,22,24 24:25 25:12 26:5 28:18,21,25 29:12 32:3,13 33:16 35:10 36:5 39:5,14 40:20 44:18 46:12,16 47:1,25 49:5 57:3,6,7,25 58:9,10 59:16,17 60:24 researcher 5:25 6:10 27:16 48:11 researchers 5:22</p>
--	---	--	---

<p>6:15 17:13 23:5,18 28:24 42:2,21 46:17 58:15 61:8</p> <p>reservations 64:24</p> <p>reside 19:19</p> <p>resides 27:25</p> <p>respect 48:16</p> <p>respond 5:5</p> <p>responding 31:13</p> <p>response 29:10 40:6 46:11 58:14 60:15 70:18</p> <p>responsibility 26:18</p> <p>restarting 25:16</p> <p>restrict 45:17</p> <p>restricting 31:22</p> <p>restriction 31:22,23</p> <p>result 20:15 31:2</p> <p>retrieve 8:25</p> <p>reverse 8:22 19:6 39:20</p> <p>review 58:4</p> <p>reviewed 28:2</p> <p>revision 49:20</p> <p>Richert 63:11</p> <p>rig 13:10</p> <p>Riley 2:5 3:24 32:4 62:25</p> <p>Ringer 3:17 62:18</p> <p>risk 28:4</p> <p>risks 49:18,25 52:17 53:21</p> <p>robust 27:13 57:3</p> <p>role 26:15</p> <p>romantic 25:9</p> <p>room 1:11 10:6</p>	<p>roughly 11:14</p> <p>round 64:21</p> <p>rule 54:7,8</p> <p>rulemaking 1:6 3:8 26:18 62:4 70:25</p> <p>rulemakings 19:11</p> <p>running 42:13</p> <p>runs 33:23</p> <p>Ruwe 2:5 3:22 18:3 19:1,14,23 29:16 36:13 45:12 46:6 53:23 62:23</p> <p>Ruwe's 46:2</p> <hr/> <p style="text-align: center;">S</p> <hr/> <p>sad 30:14</p> <p>safe 41:4</p> <p>safely 63:19</p> <p>safety 17:17 23:23 56:25</p> <p>sale 27:10,14</p> <p>Samuelson- Glushko 63:4</p> <p>San 7:25</p> <p>Sandler 6:14 24:24 25:12 40:23 57:19</p> <p>saving 41:3</p> <p>saw 34:20</p> <p>scenario 12:13 44:2 54:22</p> <p>scenarios 12:1 55:6,9</p> <p>school 5:20 11:3,10,11,20 12:2,9,18 13:2,6,18,19,25 63:14</p> <p>schools 11:21</p>	<p>Scientific 43:16</p> <p>scope 4:18 35:18</p> <p>screen 20:1 68:7</p> <p>second 42:17 56:17 66:10</p> <p>Section 37:7 38:1,3 43:25</p> <p>security 22:25 23:23 25:1,8 26:14 27:13,14 29:7,9,22 33:14 34:18 37:9 41:1 42:5 46:17 47:1 56:21 57:1,3,6 58:8,9</p> <p>seeing 53:6,7</p> <p>seeking 7:7 27:24 34:3 44:9 53:24 54:14 68:3 69:5</p> <p>seem 4:14</p> <p>seems 44:15 52:15 54:11</p> <p>seen 42:21 64:3,4</p> <p>selection 17:10 18:20</p> <p>selection/ arrangement 21:14</p> <p>self 70:12</p> <p>Sellars 5:18,19 6:3,11,21,22 7:3,4 16:23,24 18:11 19:4 22:6,7 28:13 29:20 32:12 33:11 34:2,24 36:1,25 38:11,15 39:1,4,12,22 43:2 44:13,19 45:8 46:10 47:12,13 48:12 49:3 50:9 51:6 52:23 55:24 56:1 58:7 59:7,9 60:23</p>	<p>selling 52:22</p> <p>send 11:19 68:2</p> <p>sense 11:12 51:24</p> <p>sensitive 45:7</p> <p>sensor 8:11,16 14:21 15:2,14,15,17 19:17 35:8</p> <p>sensory 15:7</p> <p>sequel 18:14</p> <p>serious 30:17 31:17,25 40:21 41:10,21 58:5</p> <p>server 43:12,22 44:7</p> <p>servers 43:15</p> <p>service 45:4</p> <p>seven 3:7 8:12</p> <p>several 19:20 23:17 31:6 64:19</p> <p>shade 22:22</p> <p>share 24:6</p> <p>shelf 21:21</p> <p>Sherwin 6:24</p> <p>shock 41:12</p> <p>shocks 57:14</p> <p>short 65:21</p> <p>shorten 55:19</p> <p>shorter 55:8</p> <p>shortest 70:20</p> <p>showed 47:20</p> <p>showing 14:16,23</p> <p>shown 9:8,10 14:16 25:12</p> <p>shows 8:18 9:21 32:13</p> <p>sides 64:6</p> <p>signal 49:23</p> <p>signed 39:2,3</p>
---	--	--	---

<p>significant 28:7</p> <p>similar 15:25 32:18</p> <p>simple 32:19 60:3</p> <p>simplest 64:8</p> <p>simply 26:4</p> <p>simulate 26:7 36:7</p> <p>Siri 70:4</p> <p>situation 11:20,22 38:4</p> <p>situations 33:21</p> <p>six 59:10 68:25</p> <p>Sixth 1:6 3:8 62:4 70:24</p> <p>Siy 6:24 36:15,16 37:16,23 39:22 53:10 54:4 60:16,17</p> <p>skills 72:9</p> <p>skin 8:12</p> <p>sleepovers 12:3</p> <p>sleeps 15:15</p> <p>slightly 33:23</p> <p>small 8:11</p> <p>smallest 62:3</p> <p>Smith 2:6 3:18 62:19</p> <p>sniffers 9:2</p> <p>society 64:15</p> <p>software 5:25 7:24 8:25 9:2,21 10:23 16:9 24:25 25:1,4,15,22 26:5 27:2,7,25 33:17,22 34:4 37:4 38:5,14,17 39:10 40:23 41:9,16,25 42:13</p> <p>SOFTWARE-NETWORKED 3:4</p>	<p>sold 15:24</p> <p>solicit 29:2</p> <p>solicited 58:8</p> <p>solution 40:2 70:5</p> <p>somehow 28:3 42:23 52:7</p> <p>someone 12:7,21 13:14 15:14 30:5 32:2 43:16 46:20 51:19 55:14 60:11 67:8</p> <p>somewhat 16:5 35:16</p> <p>somewhere 11:7</p> <p>sorry 6:18 9:23 12:25 46:4 48:10 63:16,18 69:20</p> <p>sort 4:18,25 5:2 6:7 7:16 9:24 16:6,10 18:9 20:2 21:11 25:9,10,14 28:7,9 34:15,18 35:20 42:9 44:4 48:19 49:8 50:2,5 52:11 58:25 59:1 65:14 69:8</p> <p>sorts 49:14 56:11</p> <p>sought 50:2</p> <p>sounds 39:7</p> <p>source 7:13 17:15 21:21 27:4,9 34:3</p> <p>sources 37:20</p> <p>space 26:15 59:25</p> <p>spare 62:10</p> <p>sparked 57:25</p> <p>speak 40:8,10 48:7 51:6 58:18 64:1</p> <p>speaks 39:13</p> <p>special 49:11</p>	<p>specific 13:24 30:18 59:11,18</p> <p>speculation 60:3</p> <p>speech 31:21,23 68:8</p> <p>spoken 68:1</p> <p>spreadsheet 21:2</p> <p>spur 25:5</p> <p>spurred 23:5,15</p> <p>spy 13:12</p> <p>St 57:12,14</p> <p>stale 14:17</p> <p>standard 30:2 69:2</p> <p>start 4:22 70:3</p> <p>started 8:6</p> <p>starting 8:7</p> <p>state 19:12 28:19 56:5 59:14 62:11</p> <p>stated 28:16</p> <p>statement 4:23 7:16</p> <p>statements 18:11</p> <p>States 1:5 2:2 15:25 65:20 66:12</p> <p>station 53:12</p> <p>status 21:12 61:2,5</p> <p>statutory 67:5</p> <p>stay 61:18 68:21</p> <p>stays 13:13</p> <p>stead 63:17</p> <p>step 9:20 37:25</p> <p>stepped 58:25</p> <p>steps 58:13</p> <p>sterile 36:3</p> <p>Steve 2:5 3:22 36:11 62:23</p>	<p>stipulate 23:3</p> <p>stop 14:23 20:15,20</p> <p>stopping 52:24</p> <p>storage 37:11</p> <p>store 8:8 21:5</p> <p>stored 8:24</p> <p>storing 21:19</p> <p>story 31:10 68:14</p> <p>straight 64:17</p> <p>streamed 18:17</p> <p>stress 37:3</p> <p>strong 64:5</p> <p>strongly 38:7 59:23,25</p> <p>structures 36:21</p> <p>struggling 41:25 48:14</p> <p>students 66:1 70:13</p> <p>studies 26:6 31:6 32:24 33:1,2 36:4</p> <p>studying 9:5</p> <p>stuff 25:14</p> <p>subject 32:7 59:4</p> <p>submission 39:23</p> <p>submitted 4:12 32:9</p> <p>substance 28:9</p> <p>substantiation 28:15</p> <p>substantive 40:12</p> <p>successfully 51:20</p> <p>sufficiently 32:18,22</p> <p>sugar 13:21</p> <p>suggest 26:24 27:23 38:19 42:21 53:1</p>
---	---	--	---

<p>suggested 58:21 59:4</p> <p>suggesting 39:16</p> <p>suggestion 7:10 28:2 29:14,21 34:5 59:5</p> <p>suggests 54:5 57:13</p> <p>suite 10:23</p> <p>supervision 12:16</p> <p>supports 64:24</p> <p>supposed 5:8 25:18 63:12</p> <p>sure 6:3 10:3 11:12 16:16,24 17:24 29:20 31:12 37:23 47:13 56:16 67:19 70:9</p> <p>surgery 55:3,7</p> <p>surgical 57:2</p> <p>Sy 2:4 3:20 62:21</p> <p>symptoms 17:21 18:5</p> <p>Sy's 18:5</p> <p>system 8:11 14:6 42:14 63:15</p> <p>systems 23:1</p> <hr/> <p style="text-align: center;">T</p> <hr/> <p>tablet 69:23</p> <p>tablets 69:16</p> <p>tabulation 21:2</p> <p>tailor 4:19</p> <p>taking 11:16,24 46:22 58:12</p> <p>talk 5:10 50:14,22 51:14</p> <p>talking 5:10 59:24 65:9 70:2</p> <p>target 41:22</p>	<p>technical 16:5</p> <p>technique 54:25 55:15</p> <p>techniques 8:23 56:12</p> <p>technological 7:11,18 17:4 66:25</p> <p>technologies 22:12 61:17 62:1,8 65:6</p> <p>technology 7:1 13:25 14:1 19:25 20:25 34:10 63:4 69:6,18 70:6</p> <p>TELECOMMUN ICATIONS 2:7</p> <p>temporary 37:11</p> <p>tend 33:2</p> <p>tends 25:13 26:9</p> <p>term 49:22</p> <p>terms 12:17 26:25 35:11,12 38:10,12,13,16,1 7 56:8 59:21</p> <p>test 20:20 32:7</p> <p>tested 35:24 36:2</p> <p>testimony 47:20</p> <p>testing 26:6 34:7,19 35:13 36:7 37:9,13</p> <p>text-to 68:7</p> <p>thank 4:6,9 6:23 7:4 10:21 14:9,11 19:23 36:16 37:15 40:9 56:14 60:13 61:10,11,21 62:4 63:20,25 66:1 67:11 70:21 71:2</p> <p>Thanks 58:17 60:17</p> <p>that's 6:22 7:20</p>	<p>10:13,20 12:21 14:9 20:21 37:14 52:9</p> <p>theft 41:20</p> <p>themselves 3:16 6:19 16:18 23:3 27:15 30:1 32:25 36:21 59:12,14</p> <p>theory 49:24</p> <p>Therac-25 30:18</p> <p>therapy 8:3 12:21,22,23 27:6</p> <p>thereafter 72:6</p> <p>thereby 43:23</p> <p>therefore 40:1</p> <p>thickened 23:21</p> <p>third 42:10 58:2</p> <p>thoughts 52:13</p> <p>threat 41:21 42:1</p> <p>tied 29:17</p> <p>tip 5:4</p> <p>titles 68:17,18</p> <p>today 17:2 35:6 52:3,25 53:4 61:14 63:12 69:20 70:23 71:3</p> <p>tolerates 28:22</p> <p>tools 53:8</p> <p>topic 40:21</p> <p>tort 49:23</p> <p>touch 11:23 36:17</p> <p>toward 25:10</p> <p>TPM 48:19</p> <p>TPMs 58:23 59:4 60:25 61:2</p> <p>track 12:7 61:18</p> <p>tradition 30:15</p> <p>transcript 9:3</p> <p>transcripts 9:5</p> <p>transmission 46:7</p>	<p>54:10</p> <p>transmit 11:7 45:14</p> <p>transmits 8:16</p> <p>transmitted 21:4 43:11 45:15,17 46:9 48:2 54:9</p> <p>transmitting 53:13</p> <p>treaty 65:17,20 66:11,12,14,20,2 1 67:2,10</p> <p>trend 8:19 9:17 10:14 12:15</p> <p>trends 8:15</p> <p>Triennial 1:6 3:8 62:4 70:24</p> <p>trigger 45:13</p> <p>triggered 23:25</p> <p>triggering 46:7</p> <p>triggers 24:2,22</p> <p>trouble 24:12</p> <p>true 28:6 35:21 72:7</p> <p>trust 27:17</p> <p>try 5:10,11 40:13 50:13</p> <p>trying 13:6 21:11 33:12,15,16 34:1,11 52:11 59:15</p> <p>tuned 68:21</p> <p>turn 5:9 23:14 27:11 31:3 56:13</p> <p>Turner's 30:21</p> <p>Turning 47:24</p> <p>tweaked 55:16</p> <p>type 7:22 19:2 45:1 46:16 47:4</p> <p>types 12:11 40:22 41:13 44:11</p>
---	--	---	---

<p>typewriting 72:6</p> <p>typically 9:4 12:19,20 13:9 46:13 48:6</p> <hr/> <p style="text-align: center;">U</p> <hr/> <p>U.S 3:12 31:24</p> <p>U.S.C 43:25</p> <p>Ultimately 55:9</p> <p>unavailable 8:6</p> <p>unclear 33:25</p> <p>unconstitutional 31:18</p> <p>uncontroversial 64:17</p> <p>uncopyrightable 37:1</p> <p>uncover 39:6 43:13</p> <p>uncovered 15:12 31:3 38:19 44:13</p> <p>underscores 64:14</p> <p>understand 13:7 29:20 33:12 48:23 51:25 52:11</p> <p>understanding 36:1,9 39:1,5 43:9 59:24</p> <p>understood 50:5 51:3 52:9</p> <p>undertaking 50:11</p> <p>unencrypted 15:20 53:20</p> <p>unfortunate 68:11</p> <p>unfortunately 31:14 59:13</p> <p>unfounded 53:17</p> <p>unidirectional 43:12 44:15 45:10</p>	<p>Union 56:5</p> <p>United 1:5 2:2 15:25 65:19 66:12</p> <p>University 36:5</p> <p>unlike 67:25</p> <p>unopposed 64:22</p> <p>unprotectable 22:10,14</p> <p>upon 17:10 28:24 54:9 56:2</p> <p>urgent 45:1</p> <p>usage 16:16</p> <p>USB 9:2</p> <p>useful 10:1 22:22</p> <p>user 21:7 69:15</p> <p>usually 4:24 9:18 12:21,23</p> <p>utilitarian 27:6</p> <hr/> <p style="text-align: center;">V</p> <hr/> <p>valid 26:2</p> <p>valuable 9:7</p> <p>value 8:14,16,18 10:18 55:22</p> <p>variants 19:21</p> <p>variety 7:22 8:22 14:19</p> <p>vehicles 29:22</p> <p>vendor 9:4 16:1 21:11,24 30:3</p> <p>vendors 16:17 30:1 48:4 49:13 59:12,13</p> <p>vendor's 8:24 19:18</p> <p>Vendors 41:24</p> <p>verification 27:13</p> <p>version 15:22 62:10</p> <p>versus 10:11 13:7</p>	<p>22:12 50:11</p> <p>view 28:12</p> <p>VII 66:22</p> <p>visually 64:12 69:22</p> <p>voice 70:2</p> <p>volume 69:12</p> <p>vs 31:24</p> <p>vulnerabilities 23:10 25:4 26:7 29:4,24 30:16 31:7 40:17,22 41:1 42:3,6 43:5,7 46:18,20 58:3</p> <p>vulnerability 25:11 26:1 29:3 30:8,21 34:7,19 35:13 46:23 47:3 56:18</p> <hr/> <p style="text-align: center;">W</p> <hr/> <p>wait 51:4</p> <p>walk 12:10</p> <p>walks 12:2</p> <p>warn 4:23</p> <p>Washington 1:12</p> <p>wasn't 18:7 31:9 48:24,25</p> <p>wasted 20:24</p> <p>watch 20:10,11 21:4</p> <p>watched 71:2</p> <p>watching 64:7</p> <p>ways 8:8 18:14 19:15 45:14 46:8 47:20 49:15 50:16</p> <p>wealth 8:2</p> <p>wearable 10:23,24 20:8</p> <p>weather 63:15</p>	<p>week 64:3,5 68:2</p> <p>weeks 4:5</p> <p>Welcome 3:7</p> <p>we're 21:11,20 52:10</p> <p>West 5:15,17,22,23 6:6,9,12 7:15,21 10:3,16,19,22 11:12 12:19 13:4,9,17 14:2,11 16:12 17:13 18:4,7 19:2,14,20 20:7 21:5,16 22:1,5 31:24 34:17 35:5 51:6,8,9,18 52:14,21 54:13,21 55:13 56:2 60:7,8,23</p> <p>West's 35:1 47:20</p> <p>We've 9:20</p> <p>whatever 13:8 20:13,16 21:23 32:10 45:4</p> <p>whatsoever 28:16</p> <p>whenever 31:20</p> <p>Whereupon 71:4</p> <p>whether 19:7 24:4 26:8,19 33:25 36:20 44:10 59:14</p> <p>Whoever 52:21</p> <p>whole 9:6</p> <p>whom 72:3</p> <p>whose 22:25 43:11</p> <p>widespread 67:23</p> <p>Wire 22:13</p> <p>Wired 31:6,9</p> <p>Wisconsin 22:12</p> <p>wish 31:13</p> <p>wondering 44:10</p>
---	--	--	---

<p>work 11:22 13:19 16:3,7 19:7,12 20:18,21 22:11 41:3,4 58:15 59:24 67:17,18</p> <p>working 7:25 20:20 24:15 26:4 29:18 42:22</p> <p>works 27:11,14,20 36:19 37:4,5,21 61:17,24 62:7</p> <p>world 30:12</p> <p>worth 55:7,23 69:7</p> <p>wrap 70:21</p> <p>wrist 20:13,23</p> <p>write 41:18</p> <p>writing 4:12 40:21</p> <p>written 39:22 40:16 66:3</p> <p>wrote 40:24 53:10 57:20</p> <hr/> <p style="text-align: center;">Y</p> <hr/> <p>yet 15:1 53:18 68:12,23</p> <p>yield 37:16</p> <p>York 31:2</p> <p>younger 12:20</p> <p>yourself 6:7</p>			
---	--	--	--