

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

MICROSOFT CORPORATION,)
)
) Petitioner,)
) IPR2026-00182
 vs.) IPR2026-00184
)
 QOMPLX LLC,)
)
) Patent Owner.)
)
 _____)

REMOTE VIDEOCONFERENCE DEPOSITION OF

DR. JOHN R. BLACK, JR.

TAKEN ON FRIDAY, AUGUST 7, 2026

9:01 A.M. Pacific Daylight Time

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Reported by:
Kelly Schindele, CSR No. 8357
Job No. 1568782

Page 2 1 APPEARANCES OF COUNSEL: 2 (All appearances are via videoconference.) 3 For the Petitioner: 4 KLARQUIST SPARKMAN, LLP 5 BY: SAM THACKER, ESQ. 6 BY: ANDY MASON, ESQ. 7 World Trade Center, One 8 121 SW Salmon Street, Suite 1600 9 Portland, Oregon 97204 10 503-595-5300 11 samuel.thacker@klarquist.com 12 andy.mason@klarquist.com 13 14 For the Patent Owner: 15 LOWENSTEIN & WEATHERWAX LLP 16 BY: COLETTE WOO, ESQ. 17 BY: NATHAN LOWENSTEIN, ESQ. 18 1016 Pico Boulevard 19 Santa Monica, California 90405 20 310-307-4500 21 woo@lowensteinweatherwax.com 22 lowenstein@lowensteinweatherwax.com 23 -AND- 24 IRELL & MANELLA 25 BY: DOMINIK SLUSARCZYK, ESQ. 1800 Avenue of the Stars, Suite 900 Los Angeles, California 90064 310-203-7945 dslusarczyk@irell.com	Page 4 1 REMOTE DEPOSITION; FRIDAY, AUGUST 7, 2026 2 9:01 A.M. 3 4 THE STENOGRAPHER: Good morning. My name 5 is Kelly Schindele, and my California CSR number is 6 8357. 7 Mr. Black, can you please raise your right 8 hand. 9 10 DR. JOHN R. BLACK, JR., 11 having been first duly administered an 12 oath remotely by the reporter, was examined 13 and testified as follows: 14 15 EXAMINATION 16 BY MS. WOO: 17 Q. Good morning, Dr. Black. Thank you so much 18 for your time. Is there any reason why you might 19 not be able to provide truthful and accurate 20 testimony today? 21 A. No, there is not. 22 Q. Okay. Are you currently under the 23 influence of any substance that may preclude you 24 from providing truthful and accurate testimony? 25 A. I am not.
Page 3 1 INDEX 2 WITNESS: JOHN R. BLACK, JR. 3 EXAMINATION 4 BY MS. WOO 5 6 7 EXHIBITS 8 (None) 9 10 11 INSTRUCTION NOT TO ANSWER 12 (None) 13 14 15 INFORMATION TO BE SUPPLIED 16 (None) 17 18 19 20 21 22 23 24 25 PAGE 4	Page 5 1 Q. Do you understand that you're testifying 2 under oath? 3 A. I do. 4 Q. Okay. And if you would like to access any 5 documents during the questioning, I would just ask 6 that you let me know what document you're reviewing 7 so I know the basis of your opinion. Is that fair? 8 A. Sounds good. 9 Q. Perfect. Approximately how many hours did 10 you spend preparing for your deposition today? 11 A. Quite a few. Let's see. I started on the 12 weekend, through last night. Probably about 40 13 hours all told. 14 Q. Okay. And generally what did you do to 15 prepare? 16 A. I reviewed the two challenged patents 17 several times and some of the incorporated 18 references as well, my declarations that were served 19 alongside the IPR petitions in this matter. 20 Also some of the citations in my 21 declaration. There are numerous citations to other 22 prior art or articles. I've looked at those. 23 I certainly looked at the articles or the 24 documents that form the grounds for prior art that I 25 use in my declarations. So, lots of documents.

1 Q. Okay. I am going to put a copy of your
2 declaration in the -- one of two IPRs in the chat,
3 and that's the one concerning the 934 patents.

4 Please let me know when you can open it.

5 A. Ms. Woo, do you prefer that I use the one
6 you're sharing, or can I use a separate clean copy
7 that I have?

8 Q. You can use a separate clean copy. This is
9 mostly for the benefit of the court reporter.

10 A. Okay. And just to be clear, I have nothing
11 open right now on my machine, other than Zoom and
12 now I'm going to open this document.

13 Q. Okay. So, just let me know when you have
14 it open.

15 A. It's open.

16 Q. Okay. So, did you review any materials
17 outside of those listed in your declaration while
18 preparing for this deposition?

19 MR. THACKER: Objection. Form.

20 THE WITNESS: I think I may have looked at,
21 for example, Dr. Malek's declaration, which wouldn't
22 have been available, obviously, when I wrote mine.
23 And maybe portions of the POPR, so other filings in
24 the IPR generally from patent owners.

25 ///

1 BY MS. WOO:

2 Q. Okay. Is there any change in your opinions
3 as stated in your declaration?

4 A. I'm not aware of any opinion I'd like to
5 change. I still stand by all the opinions set forth
6 in my declaration.

7 Q. Okay. Is the CV that's attached to this
8 declaration, is that the most current version of
9 your CV?

10 A. It's dated April 8th, 2025. So, I probably
11 have added, you know, some minor further things.
12 But it's mostly up to date. I update it every few
13 months typically. So, the most up to date would
14 probably be within the last three months.

15 Q. Is there a place where I can find the most
16 up-to-date version of your CV, then?

17 A. On my website I have a link that says,
18 "Curriculum Vitae," and that would just be whatever
19 the most up-to-date version is.

20 Q. Okay. So, I'm just going to go to the
21 website, then.

22 Oh, I think I found it.

23 Okay. So, I'm just going to download this
24 and put a copy in the chat.

25 I just sent that.

1 So, just let me know when you have it open.

2 A. I'll open the vitae you just shared.

3 Q. Yes.

4 A. Okay.

5 Q. Is this the most current version of your
6 CV?

7 A. Let me check.

8 Q. Uh-huh.

9 A. I mean, if it's from the website, it should
10 be, but I'll double-check.

11 Q. Uh-huh.

12 A. That looks up to date, July 27th, 2026.

13 Q. Perfect. I do see that you're now an
14 adjunct professor; is that correct?

15 A. It's adjoint. I know they share the same
16 prefix. So, yeah, adjoint as of February, I think.

17 Q. Is there any particular reason for the
18 title change?

19 A. Yeah. My role changed and my funding
20 source changed from where it used to be to now soft
21 money.

22 Q. I see. So, I see you have a list of
23 classes taught. Did you cover multifactor
24 authentication in any of these classes?

25 A. Yes. I cover that -- that topic in at

1 least the Foundations of Computer and Network
2 Security class.

3 Let me see if I have the title right. So,
4 that would be CSCI 6268, as well as in the Ethical
5 Hacking class, which might have a couple of
6 different numbers here. It looks like CSCI 5413.

7 There's an undergrad version, too, that I
8 don't see. It has a separate number. But I think I
9 just listed the graduate version of that class.

10 Q. Okay. So, I see you have network security
11 as a topic for both of these classes. Can you
12 describe what "network security" meant?

13 A. Sure. So, it's a very broad topic and it
14 has lots of different topics within it, but
15 basically looking at fundamentally how networks
16 work. Often I require that network class as a
17 prerequisite so they come in knowing the basics.

18 And then we talk about, well, you know how
19 TCP/IP works. What are the attacks that occur here
20 and what are the countermeasures to prevent those
21 attacks?

22 And we look at web-based applications, the
23 typical login flow, provide your username and your
24 password, how does that work, what are its
25 vulnerabilities, you know, could it be a brute-force

1 attack, and what are the countermeasures?

2 And then multifactor is an improved
3 security measure on top of the simple and
4 traditional username and password kind of login, so
5 we cover that as well.

6 Several more topics I can go into as well
7 that would fall under that umbrella.

8 Q. So, I think you mentioned like a login
9 flow. Can you maybe go into more detail on this
10 login flow or this username/password you mentioned?

11 A. Sure. So, most people are familiar with
12 this experience where you say, I want an account
13 with Wells Fargo. And so if you don't already have
14 one, you have to sign up.

15 And when you sign up, you choose a
16 username, and it has to be something no one else has
17 chosen before. It has to be unique.

18 And then you choose a password. And
19 sometimes they'll impose requirements like it has to
20 be 10 characters, upper, lower case, a digit,
21 punctuation, those kind of things. Wells Fargo
22 enforces those requirements on the password.

23 And once you overcome the hurdles, it
24 creates an account. And what it typically does is
25 on the Wells Fargo side, not in your browser, but

1 once you supply your username and your password on
2 the browser, it sends it encrypted over the network
3 to Wells Fargo, and the server will then create an
4 entry in a database, most often in a relational
5 database, where it will say, create a new row, and
6 it will say, Colette Woo is the username and
7 whatever password you supplied, and it will do
8 what's called hashing.

9 So, it doesn't store the password exactly
10 as you typed it. It transforms it into this kind of
11 jumbled format so that someone can't just steal it.
12 In case they are compromised, there's a break-in,
13 the bad guys don't suddenly get all the username and
14 passwords at once, which could create huge problems,
15 obviously.

16 So, the password is somewhat obscured by
17 this process. And then it says, "Success. You are
18 now" -- "you now have an account."

19 And then -- at least in the old days,
20 that's the simplest flow. The next visit you would
21 supply the same username and the same password, and
22 it would transform your password the same way it did
23 the first time and make sure that the jumbled
24 version matched the jumbled version they've got
25 stored. And if it does, they log you in. And if

1 not, they say, "Try again. Your password is wrong,
2 doesn't match," something like that.

3 Nowadays, especially for something like
4 Wells Fargo, you're often going to be given a second
5 challenge, which is, I'm going to text you a
6 six-digit number, and you have to prove that not
7 only do you know your password, but you also have
8 control of the text message channel associated with
9 this account. And if you can't meet that challenge,
10 then it says, "Sorry. You can't log in."

11 But if you can, if you can prove you also
12 are able to receive texts at this phone number, then
13 you have proven in two ways that you're truly whom
14 you claim to be. That's called two-factor, and
15 that's part of multifactor authentication. It is
16 now kind of a standard part of the login flow for
17 many, many websites.

18 Q. So, just drilling down into that, so when
19 you're creating an account, why do you need this
20 unique username?

21 MR. THACKER: Objection. Form, scope.

22 THE WITNESS: Because typically in the user
23 database on the server side, the username is going
24 to be the identifier that distinguishes you from all
25 other registered users.

1 And so if Colette Woo appears twice exactly
2 the same, then when you appear and you want to log
3 in, the system can't determine which one you are, so
4 that would be a problem.

5 BY MS. WOO:

6 Q. So, assuming you put in your password
7 correctly, the system can't choose the correct
8 Colette Woo based off of that password?

9 MR. THACKER: Objection. Form, scope.

10 THE WITNESS: That's interesting. I mean,
11 I've never in my life -- and this is all I do for a
12 living. I've never in my life thought, hey, let's
13 let them have redundant -- you know, let's allow
14 duplicate usernames, and then we'll just check every
15 username that matches to see if that password -- I
16 guess there's a very unlikely corner case where like
17 you mistype your password, but you type it in for
18 the other user and you get in. It doesn't sound
19 very likely.

20 But I've never seen a system designed that
21 way where it's -- you know, the password
22 distinguishes between users. It's always the
23 username distinguishes between users, and then you
24 have a single correct password you have to supply.

25 ///

1 BY MS. WOO:

2 Q. Okay. And then why is a second factor --
3 why does that improve security? Why is not just
4 knowing that unique password or that hidden password
5 good enough?

6 MR. THACKER: Same objections. Form,
7 scope.

8 THE WITNESS: So, passwords are really
9 often a terrible security mechanism, and we're kind
10 of stuck with them at this point. Consumers are
11 used to them and systems are built with them.

12 But there are countless examples of
13 passwords being leaked. People leave them on their
14 desk. People share them between different websites.
15 So, if one is compromised, the attacker knows to try
16 the same password at a different place.

17 There are times when an insecure connection
18 is used and an attacker can sniff a wire and grab
19 the password. If it's encrypted, that's harder.

20 And at times, even though I said on the
21 database side all the passwords are hashed, they're
22 jumbled, that's what they're supposed to do, but
23 there are plenty of instances where websites have
24 failed to do the hashing step, and they just store
25 plain, visible passwords on the server, and so now a

1 bad guy gets into the server and steals all the
2 passwords, including the usernames, and gets access
3 to every single account. That's happened.

4 And so passwords -- also, traditionally
5 passwords haven't always been 10 characters in upper
6 and lower case. Sometimes people use really -- like
7 123, ABC, and so passwords can be guessable. People
8 use their birthdays, things like this.

9 So, passwords have all of these kinds of
10 undesirable properties, so standing alone, they --
11 they really don't reach the level of security we
12 would like, especially when it comes to the more
13 sensitive resources like banks and your stock
14 portfolio or anything you care deeply about.

15 BY MS. WOO:

16 Q. Okay. So, you mentioned the code as the
17 potential second factor. But then you also said
18 that simple passwords can be cracked easily, I
19 guess.

20 How come for that second factor, you're
21 just sending a code? It seems easy just to guess a
22 number.

23 MR. THACKER: Objection. Form, scope.

24 THE WITNESS: Yeah. So, a password is a
25 long-lived secret word that is typically used by

1 most of us for months or even years, unless we're
2 forced to change it. But you use it repeatedly for
3 logins over and over every time you appear and you
4 want to log in.

5 Whereas an OTP, which stands for one-time
6 password, or that code we're referencing, that's
7 one-time use. And so if a bad guy wants to guess
8 your one-time password, he can't just cycle through
9 all possible, what is it, 1 million possible
10 six-digit numbers, because that thing is known only
11 once. It's only used once. You get one try. And
12 if you get it wrong, the website typically generates
13 a new one that's going to be different. And so you
14 can't just try all 1 million until you get the right
15 answer. You get one shot.

16 And then the next time you log in, even if
17 the bad guy got a hold of that six-digit number,
18 it's going to be different the next time, because
19 it's a randomly generated number.

20 So, it's a moving target, versus the
21 password, which is a static target.

22 BY MS. WOO:

23 Q. Understood.

24 And is that one-time passcode the only
25 method of multifactor authentication you discuss or

1 cover in your classes?

2 MR. THACKER: Objection. Form, scope.

3 THE WITNESS: I cover the method of sending
4 a one-time passcode over a text message as I
5 described. I also discuss sending a one-time
6 passcode over email or over a pager, and how those
7 different methods can confer different levels of
8 security.

9 For example, if somebody has broken into
10 your laptop, they might see your password because
11 you're typing it in. And if they -- if the one-time
12 code comes back over email, well, they're in your
13 laptop, so now they have that, too, right?

14 But if it comes -- the one-time password
15 comes over your phone, well, that's superior because
16 that's a separate, different channel. It's not part
17 of your Internet connection from your laptop.
18 That's the cell phone company connecting to your
19 cell phone, and it's much harder for a bad guy to
20 get control both of your Internet connection and
21 your cell phone connection. Those are completely
22 different ecosystems. And so I teach that that's a
23 much better method than just using email.

24 BY MS. WOO:

25 Q. Is that still applicable with today's

1 Smartphones? Just because I know I'm logged into
2 all my emails on my iPhone.

3 MR. THACKER: Objection. Form, scope.

4 THE WITNESS: Yeah. So, it's a matter of
5 which channel we're talking about, if it's an
6 Internet channel.

7 So, somebody can -- let's say somebody
8 somehow gets a hold of the Comcast connection right
9 outside your home. Your phone is on Wi-Fi. So,
10 it's going through Comcast on the way to the
11 Internet, and they can see all of that. And if a
12 one-time password comes back through the Internet
13 because your email is connected to the Internet,
14 they get that.

15 But if it comes through SMS, that doesn't
16 go over the Internet. That goes over the cellular
17 connection through something called SS7, which is a
18 different technology.

19 And so sitting there sniffing your Internet
20 doesn't do them any good to capture that one-time
21 password.

22 BY MS. WOO:

23 Q. I see. So, that's if the attacker is in an
24 intermediary position between your cell phone and
25 the -- whatever is doing the authentication?

1 A. Right.

2 MR. THACKER: Objection. Form and scope.
3 BY MS. WOO:

4 Q. Okay. Understood.

5 So, in your classes, did you discuss or
6 cover databases in any of them?

7 MR. THACKER: Objection. Form, scope.

8 THE WITNESS: I do, because that login flow
9 we just discussed, as I mentioned, most typically
10 stores user information and hashed passwords and
11 other data in a database, and so part of their
12 homework -- in the ethical hacking class, we set up
13 playground networks that are not part of the
14 Internet, that are set aside just for my class, and
15 they break in. That's the homework.

16 And one of those -- several of those
17 environments include databases where they have to
18 know a lot about how the database is set up in order
19 to exploit or break into it. So, they'd have to
20 understand about databases.

21 BY MS. WOO:

22 Q. And you said how a database is set up.
23 What do you mean by that?

24 MR. THACKER: Objection. Form, scope.

25 THE WITNESS: Okay. So, there's two parts

1 broadly to what people mean when they say a
2 database. There's the database engine, and that's
3 the software that you buy or download, like Oracle
4 or SQL Server, or the one I worked on for six years
5 between my bachelor's and Ph.D. is called Ingres, so
6 I spent six years working on a database engine.

7 And if you want to have a database in, you
8 know, your law firm, the first choice you would make
9 is probably which engine to purchase or just which
10 one to download if you're going to use a free one.
11 There are several free ones, too.

12 And then once you have it, you're then
13 going to design the database, which means you're
14 going to decide how to arrange all the data that you
15 want to put into your data store, the actual
16 collection of information, what metadata do you
17 want? Do you want indexes? Do you want
18 relationships that are built? Do you want to build
19 a schema in a certain way?

20 And people will say database sometimes out
21 of context, and they might mean the engine and they
22 might mean the data store or they might mean the
23 system as a whole.

24 And so when I say how the database is set
25 up, the students don't get a choice of the engine.

1 I give it to them and it's called MySQL, M-Y-S-Q-L,
2 and that's part of the homework.

3 But then a separate person, a designer,
4 design the tables within that database system and
5 said, okay, there's going to be a user table,
6 there's going to be a resource table, there's going
7 to be a password table, and they're going to be
8 related to each other in certain ways. That's the
9 setup that I'm talking about.

10 So, they have to understand -- they have to
11 understand how to talk to the engine to get anything
12 done, and then they have to understand the way that
13 the data are arranged and the metadata is set up and
14 the indexes and all of that, so they can understand
15 how to exploit any weaknesses and get after the
16 information in the data store.

17 So, both of those things have to be
18 understood.

19 BY MS. WOO:

20 Q. And why does the database have to be set up
21 in different ways?

22 MR. THACKER: Objection. Form, scope.

23 THE WITNESS: So, a database engine -- a
24 typical generic database engine can be used in many
25 different ways. You can use it as a repository of

1 user information with passwords. That's the one I
2 described.

3 You can use it to keep a track of your
4 books, your, you know, debits and credits and
5 accounting. You can use it as an accounting system.
6 But it would be set up in a different way.

7 You can use it to receive analytics data
8 from a website. Now it's just keeping track of user
9 clicks and what page views and what URLs were
10 accessed, and those are shipped into a database.
11 That's a very typical use of a database system as
12 well.

13 And you may use the same tool in very
14 different ways, depending on its purpose. Just like
15 if you buy a truck, you know, that truck could be
16 because you are a carpenter and it's going to carry
17 around lots of tools. Or it could be that you put a
18 sleeping bag in it and you live in the truck. I did
19 that for a while. Or it could just be, you know, to
20 get to work.

21 So, it's like the engine is just the tool,
22 but it can be used in many different ways, depending
23 on how you decide to set up the stuff that goes
24 alongside the engine.

25 So, the arrangement of metadata and tables

1 and all of that is a design that the user of the
2 engine has to make.

3 BY MS. WOO:

4 Q. Okay. So, you mentioned Ingres, correct?
5 I think I found the paragraph in your declaration
6 discussing it, which is paragraph 14. It's PDF
7 page 7, if you want a shortcut.

8 So, this is just for my clarification. I
9 think you said SQL for S-Q-L, but I see in this
10 paragraph it says, "an S-Q-L engine."

11 Do you prefer S-Q-L or SQL?

12 A. I'm still going to page -- okay. I see it.

13 Q. Yeah.

14 A. I'm happy either way. People back in the
15 day, this is in the '80s, would say S-Q-L. But
16 SQL has kind of become more and more commonplace
17 over the years. So, if you say SQL, I will know you
18 mean S-Q-L.

19 Q. Perfect. Which it's better than my first
20 instinct, which was squirrel.

21 A. Okay. Yeah. There's no R in there.

22 Q. Yeah. It says, "The company made and sold
23 SQL database products including a SQL engine."

24 So, what is SQL?

25 A. S-Q-L, or SQL, stands for structured query

1 language, and it is the language that you speak to
2 the engine to get things done.

3 So, if you want to retrieve data, you give
4 a SQL command. If you want to add, insert some
5 data, that's a different SQL command. And people
6 who are programmers or database users, specialists,
7 they know this language back and forth.

8 I wasn't writing SQL commands. I was -- I
9 was writing C, the computer language C. I was
10 writing C code to build the engine that would
11 receive those commands and process them and do the
12 proper things to the data store in turn.

13 Q. Okay. And then let me see. Is there such
14 a thing as a non-SQL database?

15 MR. THACKER: Objection. Form.

16 THE WITNESS: Yes. I mean, so when I came
17 to Ingres, it actually only spoke QUEL, Q-U-E-L,
18 which just stands for query language, and it's
19 different from SQL.

20 But SQL became adopted as a standard, and
21 so we had to go and implement SQL on top of QUEL.

22 So, yeah, prior to the introduction of SQL,
23 Ingres was a QUEL database engine. It only spoke
24 QUEL, which is not a SQL database.

25 And then there's been this trend -- this is

1 in the 1980s. There's been this trend for what is
2 called NoSQL databases, which in some cases means
3 NoSQL at all, a complete different query language,
4 or sometimes it means not -- N-O can stand for not
5 only SQL, so it has some SQL language but also some
6 extensions.

7 BY MS. WOO:

8 Q. Okay. Understood.

9 So, you said you were writing code in C for
10 these products. What was the, I guess, scope of
11 your work at Ingres?

12 MR. THACKER: Objection. Form.

13 THE WITNESS: When I first started, I was
14 working on what's called the data type facility.
15 So, in Ingres you can have all kinds of different
16 data types. You can have strings of letters. You
17 can have different letters, different kinds of
18 numbers, floating-point versus integer numbers,
19 versus what are called fixed-decimal numbers. There
20 are called -- there are blobs. There is time,
21 timestamps.

22 So, there are a whole bunch of different
23 kinds of data types that you could specify if you're
24 design- -- if you're the user of our product and
25 you're designing your data store, you can decide,

1 you know, I want this type of data over here and
2 this type over here, and the menu of choices, that
3 was something I worked on.

4 And then later on I moved to a different
5 team and I was working on what's called the
6 transaction logging facility, which is a very
7 different part of the beast.

8 So, those are the two main areas I worked
9 in.

10 BY MS. WOO:

11 Q. Understood. And then what do you mean by
12 "SQL database products" in this paragraph?

13 A. If you were a potential customer, we would
14 offer you the database engine. That's the thing
15 that speaks SQL. We also had related products, like
16 we had a GUI, which is like a graphical front-end,
17 so you wouldn't have to necessarily type in SQL
18 commands. You could just drag and drop and press
19 buttons and so forth, and it would do SQL behind the
20 curtain on your behalf. So, that was another
21 product we had.

22 So, we didn't have just the engine itself.
23 We had some other, you know, related products that
24 went alongside -- you didn't have to buy everything,
25 but we had related products that were also part of

1 our SQL product offering.

2 Q. Okay. And then let's see if I have any
3 questions on that.

4 So, before you started work on this matter,
5 had you heard of a time-series database before?

6 MR. THACKER: Objection. Form.

7 THE WITNESS: For sure, and in different
8 senses. I've heard of a time-series database engine
9 and just a time-series database more broadly.

10 BY MS. WOO:

11 Q. And what's the difference between the
12 time-series database engine and the time-series
13 database?

14 MR. THACKER: Objection.

15 THE WITNESS: You can build what people
16 would call a time-series database without a specific
17 engine. So, you could use -- people use Cassandra
18 or Redis or even relational database products.
19 Cassandra and Redis are NoSQL databases. But you
20 could use a SQL database as well.

21 But basically you can build a time-series
22 database using a nonspecialized engine by designing
23 and arranging the database appropriately.

24 And then, of course, as the industry
25 noticed people were doing this, they said, oh, we're

1 going to produce engines now that have special bells
2 and whistles to support and give -- offer additional
3 features in support of that kind of a database. And
4 so those would be things like InfluxDB or whatever
5 that is a specialized so-called time-series database
6 engine.

7 And the thing is, some people will
8 sometimes drop the word engine. So, they will just
9 say time-series database, and sometimes they mean
10 the data system, or sometimes they mean the engine
11 specifically, and you have to know -- you have to
12 ask what the context is.

13 BY MS. WOO:

14 Q. And what context would you need?

15 MR. THACKER: Objection. Scope, form.

16 THE WITNESS: If I say I'm trying to make a
17 purchase decision between InfluxDB and Prometheus or
18 some other -- ClickHouse or some other product,
19 they're talking about the engine almost certainly
20 because you're saying I'm trying to choose between
21 purchasing different products.

22 BY MS. WOO:

23 Q. And when you're purchasing -- or are you
24 usually purchasing the database without the engine?

25 MR. THACKER: Objection. Form.

1 THE WITNESS: No. It's the reverse.

2 Normally the flow is that you first purchase the
3 engine, and then your IT team installs it, and then
4 you usually have database designers who work for you
5 or you contract, and they understand, okay, we got
6 this engine, which means we have certain features
7 and certain constraints, and now we're going to
8 design the database.

9 Again, it's an ambiguous word, but "design
10 the database" now means we're going to use the
11 database engine we've already purchased, and we're
12 going to work to design how we're going to lay the
13 data out on the disk such that the engine can manage
14 it in the way that we want.

15 BY MS. WOO:

16 Q. Okay. And when did you first hear of
17 time-series databases?

18 MR. THACKER: Objection. Form, scope.

19 THE WITNESS: That's a hard question
20 because it's going to be beyond 10 years. I don't
21 think in the 1980s. I don't think I had heard it
22 then. Even though we had a time-based data type at
23 Ingres, I'm not sure that I heard anybody refer to
24 their database system as a time-series database at
25 that point.

1 Probably more in like early 2000s, so I'm
2 going to say 2010, but I could be off by as much as
3 five years in either direction.

4 BY MS. WOO:

5 Q. And has your understanding of the
6 fundamentals of a time-series database changed since
7 then?

8 MR. THACKER: Same objection. Form, scope.

9 THE WITNESS: I would say dramatically,
10 yes.

11 BY MS. WOO:

12 Q. How so?

13 A. Well, initially the term meant to me that
14 the data store was arranged in a certain way using a
15 generic general-purpose database engine.

16 But these became massively popular. I
17 don't know exactly when. I think they were merging
18 around 2015 to 2020, somewhere in there. And then
19 vendors began making special-purpose engines to
20 cater to those who wanted to build out more powerful
21 time-series database systems, and those systems --
22 those engines have evolved and continue to evolve to
23 this day, because they add more features and
24 existing features become more sophisticated.

25 So, this area has exploded over that time

1 frame.

2 Q. And you said "special-purpose." What did
3 you mean by that?

4 MR. THACKER: Objection. Form.

5 THE WITNESS: So, you can use a
6 general-purpose database that is designed -- the
7 engine is designed so that it can work or, like I
8 said, you can store your homework or your taxes or
9 your books, or it can be used as a time-series
10 database if it's organized in the correct way.

11 But if you're a company who makes an
12 engine, you could say, hey, I'm going to take all
13 the normal operations of a standard engine and I'm
14 going to add specific features to the engine itself
15 to make it specialized, such that certain
16 time-series databases will work better. They'll be
17 faster or they have desirable features that are
18 built into the engine itself, and that will be a
19 selling point to certain people.

20 BY MS. WOO:

21 Q. Okay. Let me just see if I have any more
22 questions on your CV.

23 I think that's all I had on your CV. So, I
24 was going to move to Kirti next, which seems a
25 natural stopping point, if we need like a

1 five-minute break or so.

2 So, would you like a five-minute break, or
3 would you like to keep going?

4 A. Yeah. My cat's in the hospital and my wife
5 is calling me, so I'm going to call her back, if
6 that's okay.

7 Q. Okay. Do you need more than five minutes?

8 A. Could we do 10?

9 Q. Yeah, of course.

10 So, why don't we go off the record for 10
11 minutes and be back at 9:48.

12 (Recess taken from 9:39 a.m. to 9:49 a.m.)

13 MS. WOO: Back on the record.

14 BY MS. WOO:

15 Q. I'm going to drop a copy of Kirti into the
16 chat. And it's fine if you want to use your clean
17 copy, Dr. Black. This is mostly for the court
18 reporter.

19 But just let me know when you have Kirti
20 open.

21 A. I have it.

22 Q. So, can you scroll to figure 4, please.

23 A. I'm there.

24 Q. What does figure 4 depict?

25 A. And just to let you know, I'm scrolling

1 down in the document to look at what Kirti says
2 about figure 4 as well.

3 Q. Okay.

4 A. Okay. So, one aspect of Kirti's disclosure
5 is this kind of idea of batch processing. I think
6 the patent said every four to six hours was an
7 example of how that might be done.

8 So, this is a process that would run
9 periodically for that aspect of Kirti, where it
10 would -- this is the security monitor. I think they
11 call it the cloud loader, or something like that,
12 where the security agent of Kirti would go out and
13 connect to -- it could be one cloud, but it also
14 could be multiple clouds, depending on how it's
15 configured, and it goes in and it says, for all the
16 users that I care about, download all the
17 information that you have about their activity.

18 And so this is basically the ingestion step
19 from the crawler -- I can't remember if it's called
20 the crawler or the loader in Kirti. It retrieves it
21 and then it stores it in what's called the analytics
22 database, in figure 4 and 406. It stores that in --
23 I believe it's 211, which is the repository.

24 And then it does some analysis in 408 and
25 then generates reports or threat intelligence,

1 meaning a report that says everything looks fine or
2 something looks amiss over here.

3 So, that's the process for the batch
4 processing portion.

5 Q. Okay. And let's get into that. So,
6 starting with figure 4. I don't know if you need to
7 scroll back up. But do you see there's this shape
8 that says, "Start"?

9 A. Yes.

10 Q. So, what triggers that start?

11 MR. THACKER: Form.

12 THE WITNESS: I believe in the narrative
13 portion of the spec, it says this is done every four
14 to six hours, for example. That's one possible
15 timing.

16 So, whenever this batch process is
17 triggered, typically this is done with like a cron
18 job or something where you -- on a computer you can
19 say at these times, I want you to run this process.
20 So, the start is done on a schedule in the case of
21 this batch processing stuff.

22 BY MS. WOO:

23 Q. And then 402, it says, "Connect to one or
24 more clouds"?

25 A. Uh-huh.

1 Q. This might be my misunderstanding of a
2 cloud network, but are the clouds already connected
3 to that central system? Why does it need to connect
4 to the clouds?

5 MR. THACKER: Objection. Form.

6 THE WITNESS: Yeah. So, "connect" can mean
7 physically connect, and I think that's what you're
8 saying, like, well, isn't that in place? Yes,
9 that's in place.

10 But "connect" in this case is a software
11 connection. So, you know, you're connected right
12 now to the Internet, which means you're, in a sense,
13 connected to everything in the world, but you build
14 a specific software connection to Zoom, let's say,
15 by engaging in a protocol where your computer
16 reaches out to the Zoom server and says, "I want to
17 make a connection."

18 That means a software connection, which
19 establishes context and counter -- each side has a
20 counter to talk about how many packets have gone
21 back and forth and air control, all kinds of other
22 things on top of the physical hardware itself that
23 establish the kind of connection that's being
24 discussed here.

25 ///

1 BY MS. WOO:

2 Q. Understood.

3 And then for the next step, 404, it says,
4 "Retrieve activity data from target clouds."

5 I noticed a couple minutes ago you said
6 that retrieving that activity data might just be
7 about users that I care about. What did you mean by
8 that?

9 A. And so in Kirti, it's a system to monitor
10 users within your organization. And so Kirti's
11 agent will go to each of these clouds and say, "I
12 need to know activity information for all the people
13 that I'm empowered to ask about."

14 So, let's say like Salesforce. If you go
15 to Salesforce and ask for all of your employees, I
16 want to know all their activity, you have the
17 authority to ask that.

18 But you don't have the authority to ask
19 about users from Salesforce who might work for a
20 different company, that you have no business
21 retrieving their activity data from them.

22 So, it would be confined to -- I mean,
23 Kirti explains this as there's what's called a
24 tenant, and the tenant is -- has this administrative
25 power because they're like the administrator for

1 your company, and they know all of the user accounts
2 for that company, and so when they go out to each of
3 the clouds using their administrator credentials,
4 they say, "Give me all the activity data for all of
5 these employees," and those employees have to be
6 under the control of the tenant. And if you go
7 outside of that, you don't have the power to
8 retrieve any data that's not relevant.

9 Q. Understood. Okay.

10 Okay. And then what is activity data?

11 A. Broadly speaking, activity data is, you
12 know, everything that the users have been up to. I
13 don't know that if in my -- I'm going to just search
14 through my declaration now real quick, if that's
15 okay --

16 Q. Sure.

17 A. -- and see if I say any more on that.

18 It says it 31 times. That's a lot.

19 Q. If it helps, I think in Kirti at column 10
20 there's some discussion.

21 A. Okay. That's helpful. Thank you.

22 So, on column 10, line 25, can include
23 information made accessible by the cloud application
24 relating to the use of and/or actions taken with the
25 user account. That's very broad.

1 Oh, information such as user logs, audit
2 trails, logout -- login and logout statistics. So,
3 that would include attempts to log in, successful
4 logins, failed logins, logging out, IP addresses,
5 devices used.

6 So, presumably device IDs from various
7 devices that were used to interact with the cloud
8 resource, cloud resources that were accessed, files,
9 folders.

10 So, in a way, that's almost just like
11 saying everything you do that is recorded by the
12 cloud application will be then retrieved by Kirti,
13 by Kirti's invention.

14 Q. And then close by where you started
15 reading, so that's line 25, in column 10, it says
16 that "Activity data can include various types of
17 information made accessible by a remotely hosted
18 cloud application system to a system external to the
19 cloud application system."

20 What is the system external to the cloud
21 application system?

22 MR. THACKER: Objection. Form.

23 THE WITNESS: I'm trying to find where
24 you're reading from here.

25 ///

1 BY MS. WOO:

2 Q. It's at column 10, line 25. That's where
3 the sentence starts.

4 A. Okay. Wow, that's a confusing sentence. I
5 need to read it a couple of times.

6 Okay. I haven't studied this sentence,
7 particular sentence, in detail until right now. But
8 it seems to say that the information retrieved from
9 the cloud in the box we're talking about, the
10 retrieval step, that could include information that
11 the cloud has, not because it's hosted locally, but
12 because it has retrieved it from some external
13 system, say, with credentials.

14 So, in other words, if Salesforce is using
15 Google as it's credential repository, and it's
16 retrieved information from Google as part of the
17 information it has, then when Kirti comes along and
18 says, "Give me everything you've got," some of that
19 information retrieved from the cloud may not be
20 stuff that originated there. It may have originated
21 elsewhere and just is being held by that cloud
22 application in that case.

23 Q. Okay. And then moving along to -- I think
24 I was on step 408, was I? So, it says, "Categorize
25 and structure activity data." What does that mean?

1 A. Kirti describes quite at length. Once it
2 gets the data from the cloud, target cloud, and
3 stores it in the database, it then does all kinds of
4 analyses and they describe tons of different ways
5 you could perform this analysis, machine learning
6 and statistical and so forth.

7 And prior to that, it kind of sorts and
8 categorizes things into buckets to help that
9 analysis be more efficient. So, there's like this
10 preparation step where it kind of triages the
11 information that was gathered in order to be able to
12 then conduct its analysis and generate reports from
13 that analysis.

14 Q. Okay. And then so step 410 is "Generate
15 system reports and/or threat intelligence."

16 So, what is this system report?

17 MR. THACKER: Objection. Form.

18 THE WITNESS: A system report is kind of a
19 holistic view of the state of the system. It could
20 be everything is fine. It could be something looks
21 amiss.

22 I think Kirti gives examples in figures,
23 maybe 8, of kind of what an administrator overview
24 of the system state looks like on a -- like a GUI
25 overview panel. So, those kinds of reports.

1 Sometimes the reports are printed, and so
2 you just get a long list of, you know, status okay
3 on these clouds. This one needs someone to look
4 after it because something is wrong, that kind of
5 thing. That's a status report.

6 And threat intelligence is just anything
7 that looks like it might be a problem that needs to
8 be investigated.

9 BY MS. WOO:

10 Q. Okay. And then what is time-series data?

11 MR. THACKER: Objection. Form.

12 THE WITNESS: Just generically as a term of
13 art in computer science, time-series data, usually
14 information can be of all different shapes and sizes
15 that is collected or transmitted to you on a fairly
16 regular basis, doesn't have to be at strict
17 intervals, but on a fairly regular basis, that has
18 timestamps.

19 So, if you're taking a measurement of the
20 temperature outside your house and every five
21 minutes or something like that, but it has this kind
22 of character of it's, you know, giving measurements
23 or information collected over time such that you
24 could do historical analysis and say yesterday at
25 noon to noon-30, what did the temperature curve look

1 like outside my house, something like that.

2 BY MS. WOO:

3 Q. Is the report generated from that
4 time-series data also time-series data?

5 MR. THACKER: Objection. Form.

6 THE WITNESS: I mean, if somebody called it
7 time-series data, I would let it pass, but I would
8 think, strictly speaking, it might not qualify
9 because it's a representation of that data.

10 So, maybe I'm being too pedantic, but it's
11 showing time-series data, but it's maybe in a
12 cumulative form or an aggregate form. So, I guess
13 it still is in a way, but it's represented
14 differently. So, it might depend on the report.

15 I can imagine a report that's generated
16 from time-series data that just says it's hot
17 outside. I'm not sure that's time-series data.
18 That's kind of a summation or an inference.

19 But a report could have literally line by
20 line, you know, at this time it was this, and at
21 this time it was this. If that's your report, that
22 seems like that is time-series data.

23 BY MS. WOO:

24 Q. So, what would you require to call
25 something time-series data?

1 MR. THACKER: Objection. Form.

2 THE WITNESS: I would say that it generally
3 would be information that is acquired fairly often
4 over time, and that information includes a timestamp
5 on each measurement or collection of information
6 that is received or is recorded or is somehow
7 presented to you.

8 BY MS. WOO:

9 Q. Okay. And then getting to that last step
10 in figure 4, it says, "End." What triggers the end?

11 MR. THACKER: Objection. Form.

12 THE WITNESS: Since this is a burst of
13 activity that occurs every four to six hours, for
14 example, then once it's completed its collection,
15 storage analysis, and report generation, that task
16 is complete. And typically in a computer, the
17 process that did it would then terminate, and then
18 you would be back on the clock waiting for the next
19 time that you do the set of steps again.

20 BY MS. WOO:

21 Q. Okay. And then going back to column 10,
22 around line 19. So, you will see it says, "In
23 further embodiments, data is collected and retrieved
24 in real time as events occur, utilizing a realtime
25 computation system such as, for example, Storm. The

1 system may be configured to designate certain events
2 or activity as high-risk events for retrieval near
3 realtime outside scheduled retrieval."

4 Do you see that?

5 A. I do.

6 Q. So, how does the system designate certain
7 events or activities as high-risk events?

8 MR. THACKER: Object to form.

9 THE WITNESS: That would be something -- I
10 don't know if Kirti gives a specific threshold, but
11 that is something that is common in computer
12 security systems, is you lay down a set of
13 parameters that say, like, if any of these
14 indicators are above threshold, that qualifies as
15 something that is considered more severe and needs
16 urgent attention.

17 I can look through Kirti to see if they
18 have any examples of that, but that's a very typical
19 thing, to have certain thresholds that will flag an
20 event as more serious and needing immediate
21 reaction.

22 BY MS. WOO:

23 Q. First you said typical thresholds. What
24 are those typical thresholds?

25 MR. THACKER: Objection. Form, scope.

1 THE WITNESS: For example, let's say that
2 there's an attempted login to the system
3 administrator account. That might be considered a
4 more serious threat than just attempted login to a
5 user account, a generic user account.

6 If the attempt comes from an IP address
7 that is on a known list of high-threat actors, it's
8 coming from a known set of state attackers from
9 Iran, or somewhere where it's on a special list of
10 high alert, and you see that coming in, you might
11 say, "Oh, this is a more serious threat than usual."

12 If a payload comes in from outside and you
13 analyze it and you go, "This is a virus that we've
14 seen before and it's extremely sophisticated and
15 this is really concerning," that might raise a
16 certain flag.

17 So, there are certain kinds of indicators
18 from the analysis that could say, okay, we can't
19 just sit on our hands here. This is a high-risk
20 event. We need to do something more realtime,
21 meaning react in the moment and not wait four to six
22 hours and do another batch processing step.

23 BY MS. WOO:

24 Q. And is a login into, I think you said, an
25 ordinary user account usually a serious threat?

MR. THACKER: Objection. Form, scope.

THE WITNESS: Well, I mean, obviously, if it's the legitimate user, no, right? But if it's an attempt by a bad actor to get into an ordinary user account, those honestly happen all the time.

Like if I stand up a server right now, within 30 minutes there will be login attempts coming from Asia. That's just life on the Internet, right?

And so you can't raise the alarm every single time someone tries to get into any old account, because that's just going to be nonstop all the time.

So, I think, you know, the example I was using, like if they figure out there's an administrator machine that's not supposed to even be accessible and there's a login attempt over there, maybe that's a higher cause for concern.

I don't mean to say that if someone broke into a user account, you would just go, "Oh, I don't care. It's just a regular user." That's cause for concern too. But I'm saying you might have different levels of alarm based on the account type.

BY MS. WOO:

Q. Okay. Let's move on to figure 5B. And

just let me know when you're there.

A. Okay.

Q. What does figure 5B depict?

A. Again, I will need a minute to read through the spec.

Q. Uh-huh.

A. Okay. So, I believe 5B is the extra feature or teaching of Kirti where you can use what's called contextual data to enhance the assessment of information that is collected from one of these clouds.

Q. And what is contextual data?

A. That's what I was spending all that time trying to recall.

I'm looking in column 28 at line 6. They were giving examples such as IP address reputation, user's geographic location.

So, these are things that the cloud wouldn't know, but that you could glean from other sources within Kirti's system.

I think another one -- in a different figure, they give the example of -- I think it's travel information. Let me check real quick.

Yeah. So, on figure 5A, knowing what your itinerary is, where you are physically, and then

looking for actions that don't match with where you're supposed to be, so the user's geographical location, those are other contextual clues that could feed into the overall assessment of whether something is not right or looks amiss.

Q. And you said it's data you can glean from other sources.

So, I guess the first part of the question is, what do you mean by "glean"?

MR. THACKER: Objection.

THE WITNESS: So, some systems will keep a list of, for example, IP reputation scores. So, Kirti, for example, might have a separate database that's not part of the Salesforce, and it says, I know these IP addresses are on the watch list or blacklisted, or typically it's not just black and white. It's, you know, there's a reputation score for each IP address.

And so it can consult those kinds of scores to put into the blender before it figures out whether a login attempt, let's say, looks worrisome if it's coming from an IP address with a bad score.

That's not something that the cloud application would tell you. That's a separate database that Kirti would manage itself.

BY MS. WOO:

Q. And what's the difference between activity data and contextual data?

MR. THACKER: Objection. Form.

THE WITNESS: I think activity data is data related to user activity. So, if you go into Salesforce and you log in from this city using this device from this IP at this time and you access these resources, all of that's activity data because it's stuff you're doing.

But if you log in from an IP address that has a bad score, that's not something you did. That's something that's external to your activity, but it's useful information as well. And so that would be context to your activity, but not part of your activity.

BY MS. WOO:

Q. Okay. So, going back to figure 5B itself, again, you see that "Start" at the top of figure 5B?

A. I do.

Q. What triggers that start?

MR. THACKER: Objection. Form.

THE WITNESS: So, unlike in figure 4 where it described it as having this batch processing every four to six hours, I don't see that here. So,

1 I don't know that Kirti specifies that this has to
2 be done on a batch processing schedule, like the
3 prior set of steps, or it could also be done in
4 realtime, as we just described. There are times
5 when Kirti describes reacting to a realtime threat,
6 and it could implement these steps as part of a
7 realtime threat as well.

8 Start, you know, flow chart doesn't always
9 mean it has to be on a schedule. It just means I'm
10 going to describe algorithm. The first thing you do
11 is at the start, and then the termination of the
12 algorithm is at the end, and those steps can be
13 plugged into various other processes.

14 So, I think here I would read Kirti,
15 without reading the entire document right now again,
16 I would read it as, this is an algorithm, a set of
17 steps we can perform, and they could be performed as
18 part of the batch processing, or they could be
19 performed as part of the realtime processing.

20 BY MS. WOO:

21 Q. Okay. And then so you see in figure 5B, it
22 says, "Generate threat model."

23 If you recall, in figure 4 it says,
24 "Generate threat intelligence." Is there a
25 difference between threat intelligence and a threat

1 model?

2 MR. THACKER: Objection. Form.

3 THE WITNESS: I'm not sure if Kirti
4 specifically sets out a difference, but typically in
5 the art, threat intelligence is a report. So,
6 it's -- you know, it's the end product of analysis.

7 Whereas threat model is just an abstract
8 model that tries to characterize the levels of
9 threat, the dimensions of threat, and the
10 information we have, but isn't necessarily a final
11 output.

12 You don't typically output the model.
13 Kirti might say you do. But I'm not aware of any
14 disclosure where it says to output the model.
15 That's usually an intermediate step containing
16 certain information before the report is issued.

17 BY MS. WOO:

18 Q. And would you consider a threat model to be
19 time-series data?

20 MR. THACKER: Objection. Form, scope.

21 THE WITNESS: It certainly could contain
22 time-series data. You could say my model has a list
23 of, you know, timestamped incidents occurring over a
24 series of times, and that is information that I'm
25 containing in the model in order to set up further

1 analysis.

2 But you could also have a threat model that
3 doesn't have such things.

4 BY MS. WOO:

5 Q. So, if you go to the description of
6 figure 5, that's in column 24. I'm looking around
7 line 33. So, it says -- oh, just let me know when
8 you get there.

9 A. I'm with you.

10 Q. Okay. So, "One or more threat models are
11 generated using the activity data and contextual
12 data. Threat models can include baseline user
13 profiles over various periods of time," and so on.

14 So, what does it mean for a threat model to
15 include baseline user profiles?

16 A. Yeah. So, a user profile is often going to
17 be, you know, when do you typically log in, and when
18 do you log out, and what days of the week do you
19 work, and are you working on weekends, and do you
20 normally access this resource, or is that an unusual
21 thing for you to do, right?

22 And so the system will build a picture of
23 your normal activity to say, this is common. This
24 is standard. This is routine. This is what your
25 activity looks like. And it says over time.

1 So, in other words, you know, if you shift
2 projects, you might start to work on different
3 resources than the ones you used to, or you might
4 start working late hours because you have a
5 deadline.

6 So, you know, your profile, your activity
7 profile could change over time, and so I think
8 that's why they're saying that, you know, it tracks
9 it over time.

10 Q. And how is that included with the threat
11 model?

12 MR. THACKER: Objection. Form.

13 THE WITNESS: It says, "as discussed
14 further above." And I'm trying to find out if it
15 discloses an example of how you would represent the
16 user profile over time or if it just stops there.

17 So, I think what it's referring to is the
18 formulas in the left column, in column 23, where
19 it's computing these various scores, and those
20 formulas talk about, let's say, download counts.
21 How often do you download resources in a one-week
22 period, let's say. Downloads per day, I see that in
23 the denominator in column 23.

24 So, if you have that statistic, then that
25 could be put into the threat model for a particular

1 user, and then you could say, well, if this user
2 suddenly is downloading a thousand times more than
3 usual, looks like they're getting ready to quit the
4 company, or it's a bad actor who's gotten in and is
5 taking all of our stuff, right?

6 So, the number of downloads on average
7 versus the download activity now could raise a flag.
8 BY MS. WOO:

9 Q. And are those statistics time-series data?

10 MR. THACKER: Objection. Form.

11 THE WITNESS: Once again, I think if
12 somebody said that's time-series data, I wouldn't
13 really complain about it. But strictly speaking,
14 it's a statistic derived from time-series data.

15 I will say that in time-series database
16 engine lingo, like I said, they have these
17 specialized engines now that are really good at
18 time-series data. There's something called
19 roll-ups, and roll-ups are when you -- instead of
20 keeping every timestamp and every measurement, you
21 replace that with a summary statistic that gives
22 like an average, and that's still called time-series
23 data, even though it's a statistic derived from the
24 underlying timestamps.

25 So, in that world it's pretty common even

1 to call like a computed-to-average statistic still
2 time-series data. So, I guess I would say that some
3 people might still call it time-series data.

4 Strictly speaking, I would say -- if I were
5 being, you know, pedantic, I would say it's a
6 statistic derived from time-series data, but you
7 could still call it that if you wanted to.

8 BY MS. WOO:

9 Q. And why do those engines do those roll-ups?

10 MR. THACKER: Objection. Form, scope.

11 THE WITNESS: It's my understanding -- I
12 don't work in the world where I manage time-series
13 data every day, but it's my understanding that it's
14 a common desirable feature that, in particular for
15 data from the distant past, you might not need to
16 keep every single measurement or all the information
17 from, you know, your user profile from five years
18 ago.

19 And so it's desirable to look at some --
20 maybe that older historical data and just collapse
21 it into an average in the interest of saving space,
22 for example. That's called a roll-up.

23 BY MS. WOO:

24 Q. I see.

25 So, are the baseline profiles themselves

1 time-series data?

2 MR. THACKER: Objection. Form.

3 THE WITNESS: I think so, in the sense that
4 the profile contains time-series data and examples
5 given. As long as you include summary statistics
6 and averages as being time-series data and those are
7 in the user profile, then I would say that the user
8 profile contains time-series data.

9 BY MS. WOO:

10 Q. And then if you look back at figure 5, you
11 generate this threat model in 506, and then you use
12 the threat model in 508. But afterwards, what
13 happens to that threat model?

14 A. I'm sorry. We're in the figure 5B?

15 Q. Yeah.

16 A. And then 508, "Determine likelihood of
17 anomalous activity using the threat model." So, you
18 have this profile of a user. What does their normal
19 activity look like?

20 And then you use further techniques to say
21 that, you know, their activity currently -- or the
22 activity recently collected is in line with their
23 past behavior, or it seems very divergent from their
24 past behavior, in which case, in the latter case,
25 you might raise a flag. So, you do the analysis.

1 Q. And then once you have that model and
2 you've done the analysis, do you discard the model?
3 What happens to it?

4 MR. THACKER: Objection. Form.

5 THE WITNESS: So, I'm looking at column 24,
6 line 40.

7 BY MS. WOO:

8 Q. Uh-huh.

9 A. And that's discussing step 508. So,
10 there's some process -- analysis process that
11 determines the likelihood of anomalous activity.

12 And then it can generate a risk score for
13 each user, and those can be used to prioritize what
14 are called remediation. And there's a bunch of
15 different remediation steps that are described in
16 the patent.

17 Q. But the threat model itself, is it obsolete
18 after this process, or do we still want it? What
19 happens to that threat model?

20 MR. THACKER: Objection. Form.

21 THE WITNESS: I don't think Kirti says what
22 you do with it once you're done, you know, running
23 through the steps of figure 5B.

24 One possibility is you could store it
25 somewhere. That would probably make sense. If

1 you've done all these computations in column 23, you
2 might want to save it so you don't have to repeat
3 those computations, especially if the next threat
4 model can benefit from, you know, work that was
5 already done. That would be advantageous.

6 But Kirti doesn't say what it does with it,
7 whether it starts anew every time or whether it
8 tries to keep some portions of work so it doesn't
9 have to re-perform those steps.

10 BY MS. WOO:

11 Q. And where would it be stored?

12 MR. THACKER: Objection. Form.

13 THE WITNESS: I mean, there are options,
14 right? So, that's up to the designer.

15 In Kirti, I don't think -- again, I might
16 be wrong here, because I don't have it memorized,
17 but I don't think it says something about store the
18 model or don't store the model or store the model
19 here. But you would have options as the designer of
20 the system.

21 If you're going to store it, you would
22 likely store it in persistent memory, so on disk.
23 Whether you put it into the repository 211 or a
24 separate place, that would be a design decision.
25 And I guess there could be trade-offs. I would have

1 to think about it.

2 BY MS. WOO:

3 Q. Okay. And then earlier you mentioned
4 time-series databases that support roll-ups. Do you
5 know some examples of such time-series databases?

6 MR. THACKER: Objection. Form, scope.

7 THE WITNESS: I'm sure -- and, again, to be
8 clear, we're talking about engines when we say
9 database now.

10 BY MS. WOO:

11 Q. Okay.

12 A. So, examples of engines that support
13 roll-ups, and I'm not going to go search, obviously,
14 right now, but from memory, I'm going to say
15 probably InfluxDB, TimescaleDB, I think Prometheus,
16 I think ClickHouse. I think those engines do have
17 that feature.

18 But, again, you know, that's just one of a
19 list of different features that they would have
20 specific to time series, and I hope I'm remembering
21 correctly.

22 Q. And do all of those products, are they just
23 the engine? Do they come without like an underlying
24 storage, I suppose?

25 MR. THACKER: Objection. Form, scope.

1 THE WITNESS: Yeah. I mean, you can think
2 of like the engine as a librarian. So, she is going
3 to be like the authority that's organizing the data
4 store, the file cabinets or whatever.

5 And then when you want to store something
6 in the database system, you hand it to her and she
7 is the one who is in charge of figuring out where it
8 goes, how to index it. And when you ask for it
9 later, she is the one who knows how to use the
10 metadata to go and find it, right?

11 So, it's not a perfect analogy. But when
12 you purchase a database engine, it's like hiring
13 that librarian and putting them in charge of taking
14 care of all your data.

15 And you're not supposed to go to the file
16 cabinet yourself. That's a no-no, right? You're
17 supposed to always go through the authority.

18 But when you hire the librarian, typically
19 it doesn't come with like 50 bookshelves' worth of
20 books. That's something else that you -- you have
21 to create -- you have to allocate disk space for her
22 use. I'm mixing metaphors.

23 When you buy an engine, you're going to
24 install the software on your machine or your cluster
25 or whatever, and then you're going to have to

1 provide for that engine lots of disk space and
2 direct it toward that disk space and say, this is
3 your work area, and it's up to you to organize it
4 and put the things you need to put, where you need
5 to put them, and build indexes for fast retrieval,
6 whatever you need. This is your space, and that's
7 the data store.

8 And you're going to tell it, you know, I
9 want a table like this, and I want an index like
10 that, and I want a key over here, and you can speak
11 SQL or some other language to it. And it's the one
12 that lays out the files on the disk and so forth.

13 BY MS. WOO:

14 Q. So, the database engine, can it go with any
15 data store?

16 MR. THACKER: Objection. Form, scope.

17 THE WITNESS: In the sense that you could
18 buy -- for example, you could buy a time-series
19 database engine, something with all the latest and
20 greatest features for time series, and then you
21 could just put your taxes in there, right? You
22 don't even use any of those features.

23 And it would still store things and
24 retrieve things, and it would seem like maybe you
25 bought something overkill for the job, but it can

1 store things that wouldn't be considered time-series
2 data.

3 So, yeah, it's pretty -- it can store
4 almost anything, basically. It's a database.

5 BY MS. WOO:

6 Q. And then if I just had empty disk space and
7 called it my data store, could I use any engine with
8 that disk space?

9 MR. THACKER: Same objections. Form,
10 scope.

11 THE WITNESS: Yeah. I can't think of any
12 engine that would say, "I refuse to use a certain
13 kind of disk space." As long as the engine is
14 allowed to open files and insert and read and write
15 to the disk, that's what it needs.

16 BY MS. WOO:

17 Q. And then you said database system earlier.
18 What is that referring to?

19 A. So, I'm using the word database system
20 compound to mean both the engine and the data store
21 that the engine manages.

22 Q. Okay. So, when I'm purchasing -- when I'm
23 trying to purchase a database -- sorry. A fire
24 truck is just going by.

25 So, when I'm trying to purchase, say,

1 Oracle database, am I -- when I see the word
2 "database," am I thinking data store or the data
3 engine or the database system?

4 MR. THACKER: Objection. Form, scope.

5 THE WITNESS: So, when you go to Oracle,
6 you are buying the engine. I mean, they have
7 bundled products where they'll sell you a consultant
8 who will go and help you.

9 But let's ignore that and just say the
10 product itself, the Oracle database, the DBMS, which
11 stands for database management system, it is just
12 the engine. You're getting a license to that, and
13 you install that.

14 And at that point you could be done with
15 Oracle. You don't need to talk to them anymore.
16 And then it's up to your team to now build the
17 database store and direct the engine to organize
18 everything you care about in a certain way.

19 And there's hundreds of different options
20 and tradeoffs, and that's up to you to design the
21 store according to the kind of data you're going to
22 be putting in, according to the kinds of queries
23 you're planning to make later. And if you make bad
24 decisions, those queries may be horribly slow and
25 inefficient and consume too much space.

1 So, you have to be smart about how you
2 design your database. The word "database" is used
3 in so many different ways. But I say there's
4 somebody called a database designer. That's a
5 person who, after the purchase, figures out how to
6 organize all of the constituent components, like
7 tables and indexes and so forth, so that your data
8 store is going to be efficient for all the things
9 you care about.

10 BY MS. WOO:

11 Q. And what exactly is database design?

12 MR. THACKER: Objection. Form, scope.

13 THE WITNESS: So, if that's your life,
14 you're a database designer, you, let's say, buy
15 Oracle. Its flagship product is a relational
16 database. So, you're already an expert in
17 relational databases, and you decide -- and you go
18 and you talk to all of the accountants, if it's
19 going to be accounting data, or you talk to the
20 programmers, if it's going to be a software product,
21 that uses the database. But you figure out what are
22 the constraints, what are the needs, what are the
23 requirements.

24 And then you start to whiteboard like,
25 okay, I'm going to have a table with all of our

1 users over here. I'm going to have a transaction
2 table over here. I'm going to join them together
3 with an ID field. Transaction ID is going to be
4 linked, our user ID is going to go into the
5 transaction table so I know which user performed
6 which transaction.

7 So, all of those decisions, how it's
8 organized, what the relationships are, if you're
9 going to add an index because you want fast queries,
10 you know that people want fast queries, so I'm going
11 to add an index onto the user table, let's say.

12 That person or that team knows how to best
13 design the database so that all of the future
14 requirements are met.

15 BY MS. WOO:

16 Q. So, once you've designed this database, can
17 you use any database engine with that designed
18 database?

19 MR. THACKER: Same objections. Form,
20 scope.

21 THE WITNESS: Probably not, because the
22 design -- typically the order is the reverse. So,
23 you get the engine and then you design according to
24 what -- you know, you're trying to design something
25 so that it works well for your requirements, and

1 some of that may depend on what the engine can do.
2 So, if your design depends on certain
3 features of the engine and then you switch to an
4 engine without those features, that may send you
5 back to the drawing board.

6 MS. WOO: Understood.

7 Let's see. So, we've been going for about
8 an hour. Why don't we take another 10-minute break.

9 THE WITNESS: Okay.

10 MS. WOO: Okay.

11 MR. THACKER: So, 10:55, or 11:55 John's
12 time?

13 MS. WOO: Yeah. Perfect.

14 (Recess taken from 10:45 a.m. to
15 10:57 a.m.)

16 MS. WOO: Back on the record.

17 BY MS. WOO:

18 Q. So, Dr. Black, we were discussing
19 databases. Give me just one moment.

20 So, in column 10, at the bottom of that
21 column. And just let me know when you're there.

22 A. We're in Kirti still?

23 Q. Yeah, Kirti.

24 A. Okay.

25 Q. So, do you see around line 63 it starts, at

1 the very end of that line, "In several embodiments
2 of the invention, the analytics and threat
3 intelligence repository database 211 is built in a
4 NoSQL based infrastructure such as Cassandra or
5 other distributed data processing system," and it
6 goes on.

7 But that word "database" -- "repository
8 database," is that referring to a database system, a
9 database store, or a database engine?

10 MR. THACKER: Objection. Form.

11 THE WITNESS: My read is that the
12 repository database 211 is referring to the system,
13 and then it goes on to explain that it is built on
14 an infrastructure, meaning the engine, which is part
15 of the system, could be Cassandra or other things.
16 Cassandra is an engine.

17 BY MS. WOO:

18 Q. I see. And then in column 11, around the
19 middle of the column, so line 33, it says, "Data
20 stored in an application catalog database."

21 Do you read "application catalog database"
22 to be a database system, a database store, or a
23 database engine?

24 MR. THACKER: Objection. Form.

25 THE WITNESS: I'm sorry. What line was

1 that?

2 BY MS. WOO:

3 Q. That is column 11, starting at line 33.

4 A. Okay. I've read it. Could you please
5 repeat your question?

6 Q. Yeah. So, is that application catalog
7 database a database system, database store, or
8 database engine?

9 A. And you're asking specifically about the
10 term "application catalog database"?

11 Q. Yeah.

12 A. So, that could mean the system as a whole
13 or it could mean the data store, but it can't mean
14 the engine, because you can't store data in an
15 engine.

16 Q. And then --

17 A. I guess -- I'm sorry. I guess I would just
18 read it as the system generally.

19 Q. And why is that?

20 A. Just because that's the safe reading,
21 because that would include the database store, and
22 absent any specific reference to the store, as long
23 as the sentence makes sense that way, that's the
24 place I tend to land when I read these disclosures.

25 Q. And why do you say it's the safe way to

1 read it?

2 MR. THACKER: Objection.

3 THE WITNESS: Because it's just the most
4 generic, so without making further assumptions. But
5 it could refer just to the store, pardon me, itself
6 and that would make sense, and it wouldn't really
7 even create a distinction.

8 BY MS. WOO:

9 Q. Why wouldn't it create a distinction?

10 MR. THACKER: Objection.

11 THE WITNESS: Because if you said, "I left
12 my keys in my house," versus, "I left my keys in my
13 bedroom," it's kind of the same thing. It's just,
14 you know, you're talking about the overall thing or
15 a specific portion, and you store -- it's talking
16 about storing data in.

17 We all know that the ultimate place the
18 data lands is in the data store via the engine. So,
19 you could think of that as a system process or just
20 actually where the data ends up at rest at the end
21 of the process.

22 But every -- a POSITA would know what's
23 going on regardless of which meaning that you gave
24 to that term.

25 ///

1 BY MS. WOO:

2 Q. And do database -- sorry. One second.
3 How typical is it for a database store to
4 come without a database engine?

5 MR. THACKER: Objection. Form, scope.

6 THE WITNESS: In my world it's very common,
7 because I get productions as part of lawsuits, and
8 they just give me the store, and it's for me to go
9 to install an engine to read what's in the store.
10 So, that -- you know, that's one possible way, is
11 that you only get the data store alone.

12 In an enterprise, I don't know how common
13 it would be. I guess it would depend on details.
14 But the normal -- like I said before, the normal
15 sequence is you as a company first decide on which
16 engine, and you install it, and then you design the
17 data store after that.

18 BY MS. WOO:

19 Q. Okay. And then -- sorry. Jumping around.
20 But to the top of column 11, around line 2,
21 do you see, "In some embodiments, the data is first
22 entered into a landing repository 210 and
23 reformatted and/or structured before moving into an
24 analytics repository 211"?

25 Do you see that?

1 A. I do.

2 Q. So, is landing repository 210, is that a
3 database?

4 MR. THACKER: Objection. Form.

5 THE WITNESS: And just to let you know, I'm
6 looking right now through my declaration to see if I
7 discuss that landing repository anywhere.

8 BY MS. WOO:

9 Q. Uh-huh.

10 A. I don't see it in my declaration.

11 I'm looking now through Kirti. On
12 column 4, around line 50, it talks about it a little
13 bit.

14 So, I guess I'll say I haven't considered
15 this question. For example, I don't talk about it
16 in my declaration.

17 Kirti just says it may be in different
18 formats and/or have different ranges of values, and
19 this data may be reformatted or structured before it
20 moves to 211.

21 So, I guess Kirti doesn't specify whether
22 that's a database or it could be just a log file or
23 some other format that wouldn't be a database.

24 Kirti doesn't seem to say that anywhere I
25 can find, what it is, and I don't talk about it in

1 my declaration.

2 Q. Is there a distinction between repository
3 and database?

4 MR. THACKER: Objection. Form, scope.

5 THE WITNESS: I think in certain contexts
6 they can be synonymous. But if you said, you know,
7 I have a repository that's just a log file, it
8 doesn't have any organization to it, it doesn't
9 conjure the notion of a database in that case.

10 So, I think it would depend on context
11 whether those words mean the same thing or different
12 things.

13 BY MS. WOO:

14 Q. And in what contexts would they mean the
15 same thing?

16 MR. THACKER: Same objection. Form and
17 scope.

18 THE WITNESS: Well, the context of Kirti,
19 for example, it explains that the analytics and
20 threat intelligence repository 211 is a database.
21 It calls it, in fact, the repository database.

22 And so there, I think sometimes it talks
23 about the repository that is a database, but I don't
24 know that that means in 210 that it has to be or
25 that it could not be. It just doesn't seem to be

1 disclosed.

2 BY MS. WOO:

3 Q. And is there a reason you would call
4 something a repository instead of a database?

5 MR. THACKER: Objection. Form, scope.

6 THE WITNESS: I mean, I think it would
7 just -- it would just depend on the preference of
8 the writer, if he or she liked the word or wanted to
9 set it apart explicitly, then you would have a
10 different word. But I think it's just up to the
11 choice of the writer which word to use.

12 Database, you know, has this computer
13 meaning to it. Like, I don't know of database used
14 outside of the computer world. Whereas repository
15 maybe is more general. But, again, you could use
16 them synonymously if you wanted to.

17 BY MS. WOO:

18 Q. And what is the computer meaning of
19 database?

20 MR. THACKER: Objection. Form, scope.

21 THE WITNESS: Database in computer science,
22 again, it could mean -- it could be short for
23 database engine, and then it means a piece of
24 software.

25 Or it could be database store, which means

1 the collection of organized data along with metadata
2 and indexes and everything else. Or it could be
3 short for database system where you're talking about
4 the whole thing altogether.

5 But, again, I don't know that I've heard
6 the word ever used other than in the context of
7 computer science.

8 BY MS. WOO:

9 Q. Let's see. So, in column 8, around
10 line 53, it says, "the application catalog database
11 is a Cassandra database."

12 Do you see that?

13 A. I do.

14 Q. So, with that in mind, is that application
15 catalog database a -- is it referring to a data
16 store, a data engine, or a database system?

17 Sorry. I keep saying data instead of
18 database. It should be database store, database
19 engine, database system.

20 MR. THACKER: Objection. Form.

21 THE WITNESS: I think you read to me
22 something that begins with "In many embodiments."
23 And so I think they're saying that in many of the
24 embodiments disclosed, the application catalog
25 database, here they mean engine, because they say

1 "is," not "comprises" or "is implemented with." It
2 just says, "is a Cassandra database," and Cassandra
3 is an engine. So, here they're using the word
4 "database" to mean the database engine, in certain
5 embodiments at least.

6 BY MS. WOO:

7 Q. Okay. So, what is Cassandra?

8 MR. THACKER: Objection. Form, scope.

9 THE WITNESS: Cassandra is a
10 general-purpose database engine that is very popular
11 and widely used by lots of big companies. It's a
12 wide column, sharded, partition, token based. I
13 mean, I could tell you lots of technical detail.

14 But, basically, it's a NoSQL database that
15 is very fast for writes, W-R-I-T-E, so it's built to
16 ingest a fire hose of data coming at it, typically
17 in cloud environments, typically in a cluster where
18 you have lots of different machines in the system
19 that are absorbing this data.

20 BY MS. WOO:

21 Q. So, you said it's a NoSQL database. What
22 did you mean by that?

23 A. That it's -- I mean, if you look at the
24 language that Cassandra uses, it doesn't -- it kind
25 of looks like SQL, but it's not ANSI standard SQL,

1 and there are extensions to it that are --
2 absolutely look nothing like SQL.

3 So, it's in this category of NoSQL, which,
4 again, sometimes means not only SQL, even though it
5 says N-O.

6 So, you know, it kind of looks like an
7 extension of SQL in many ways, but it's not the
8 standard SQL language that Ingres used, for example.

9 Q. And how is Cassandra distinguished from
10 other NoSQL databases?

11 MR. THACKER: Objection. Form, scope.

12 THE WITNESS: There are tons of NoSQL
13 databases. The things I've talked about with
14 Cassandra are what are often called wide-column
15 NoSQL databases, but there's also -- like in the 147
16 patent, which is incorporated into both of the
17 challenged patents at issue, it talks about Redis,
18 R-E-D-I-S, or Riak, R-I-A-K. Those are called key
19 value stores. Those are organized differently
20 compared to Cassandra.

21 I could probably name 10 others types of
22 engines that are in yet other categories, graph
23 based, geospatial, document oriented. All of those
24 are under the NoSQL umbrella.

25 ///

1 BY MS. WOO:

2 Q. And why have so many different kinds of
3 NoSQL databases?

4 MR. THACKER: Objection. Form, scope.

5 THE WITNESS: Because databases engines
6 have now become specialized in certain cases, and in
7 certain special cases -- like, let's say we are
8 doing a geospatial database. There, I want to know
9 what points are within 10 kilometers of a given
10 point.

11 So, the engine is going to be very good at
12 that. And that might not be something that lines up
13 with SQL. You might need a special different
14 language for that kind of query.

15 So, people just would say, well, SQL is
16 great, but I'm going to do this other thing that's
17 NoSQL that helps the specific features I'm
18 designing.

19 BY MS. WOO:

20 Q. And when you say, "geospatial database,"
21 you mean the database system?

22 A. I mean the engine. So, the engine is going
23 to be particularly tuned to provide features for
24 data that is going to be geographical in nature and
25 it's going to be good at handling that kind of data

1 in the data store.

2 So, yeah, the overall system, I guess, is a
3 geospatial database system.

4 Q. Okay. Understood.

5 So, going back to Kirti, right where we
6 were, in the next sentence, starting at line 54, it
7 says, "In other embodiments, the application catalog
8 database is implemented in other types of databases
9 appropriate to the application."

10 What does that mean?

11 MR. THACKER: Objection. Form, scope.

12 THE WITNESS: So, the prior sentence was,
13 "In many embodiments," and this is, "In other
14 embodiments." So, I suppose that, you know, Kirti
15 is saying there's a plurality of embodiments
16 disclosed. In some cases the engine is Cassandra.
17 In other embodiments, it could be different engines
18 that are not Cassandra, provided that they are, you
19 know, appropriate to the thing that is -- the
20 application catalog database is used for.

21 BY MS. WOO:

22 Q. So, for that phrase "other types of
23 databases," is that referring to the database
24 system, database store, or database engine?

25 MR. THACKER: Objection. Form, scope.

1 THE WITNESS: Again, I'm just checking my
2 declaration to see if I discuss this column.

3 Okay. I don't see a discussion of this in
4 my declaration. So, I would say that the sentence
5 you read to me here, I believe when it says, "other
6 types of databases," it's saying other types of
7 databases in contrast to Cassandra, which is an
8 engine. So, I would read that to mean you can use
9 other engines, not just Cassandra.

10 BY MS. WOO:

11 Q. And just to be clear, you said Cassandra is
12 not a database system?

13 A. I mean, you could call it that and I would
14 be okay with it. But typically when I say,
15 "system," I mean including the data store. And I'm
16 setting that forth today in the deposition so that I
17 can try and be clear about what I'm talking about.

18 But if somebody said Cassandra is a
19 database system, I wouldn't object to that, because
20 sometimes people call an engine a system. Sometimes
21 they call it a DBMS, which stands for database
22 management system.

23 So, outside of the kind of boundaries I've
24 set, people talk colloquially sometimes about things
25 in different ways.

1 Q. Okay. So, I understand these boundaries
2 you've set. But in -- perhaps not this setting. In
3 a more like everyday setting, when someone says,
4 "database," it could mean many things, such as a
5 database system, database engine, or database store?

6 A. That's right.

7 MR. THACKER: Objection.

8 THE WITNESS: Sorry.

9 MR. THACKER: Objection. Form.

10 THE WITNESS: That's right. Colloquially
11 people can use loose language and they can mean a
12 variety of things by the word "database."

13 BY MS. WOO:

14 Q. Got it.

15 And I suppose also within Kirti, it seems
16 to be a little bit mixed up as well.

17 MR. THACKER: Objection. Form.

18 BY MS. WOO:

19 Q. Let me see. So, earlier in column 8, it
20 says, starting around line 9, "The software defined
21 security configuration data received about a cloud
22 application's security controls can be used to
23 generate (306) security controls metadata, that is,
24 normalized descriptors for entering the information
25 into a common database."

1 Do you see that?

2 A. I do.

3 Q. What is a common database?

4 MR. THACKER: Objection. Form, scope.

5 THE WITNESS: Again, just searching my
6 declaration real quick.

7 BY MS. WOO:

8 Q. Uh-huh.

9 A. So, I don't see the phrase "common
10 database" in my declaration. And unless I have an
11 OCR problem, this is the only place that term
12 appears in Kirti, as far as I can tell.

13 Yeah, I guess the answer is, I'm not sure
14 what they mean by a common database, what the word
15 "common" is supposed to mean. And it doesn't seem
16 to be explained here.

17 So, I guess my answer is, I'm not sure.
18 Maybe if I read the surrounding pages for a while
19 and thought more about it, I might have a better
20 idea. But just the sentence by itself, I'm not sure
21 what they mean by a "common database."

22 Q. Is there such a thing as a common database?

23 MR. THACKER: Objection. Form, scope.

24 THE WITNESS: Not out of context on its
25 own. You know, "common" could mean so many

1 different things. I would just be perplexed if
2 somebody walked up and said, "Hey, I have a common
3 database." I don't know what that means.

4 BY MS. WOO:

5 Q. Yeah. Because we've talked about SQL and
6 NoSQL. Would one of those be considered a common
7 database?

8 MR. THACKER: Objection. Form, scope.

9 THE WITNESS: That's not at all what would
10 come to mind with this term. I would think of
11 those -- I would think of certain database engines
12 as general-purpose database engines. Calling them
13 common would be jarring to me. It doesn't seem like
14 a natural word to use there. But, again, I don't
15 know what it means in Kirti.

16 BY MS. WOO:

17 Q. And what do you mean by "general-purpose
18 engine"?

19 A. That it's an engine that is made to handle
20 data well, regardless of the type of data. It's not
21 particularly directed toward, like I said,
22 geospatial data or document data or time-series
23 data. It doesn't have features for any particular
24 type of data. It's just supposed to hold all types
25 of data as best as it can.

1 Q. You said, "hold all types of data." So,
2 are you referring then to the database store, or is
3 it the database engine, database system?

4 MR. THACKER: Objection. Form.

5 THE WITNESS: Yeah. I'm saying that the
6 engine isn't optimized to store in the data store
7 any particular kind of data.

8 I mean, general engines will still have
9 some optimizations around, you know, sorting
10 integers or something, but they're not one of these
11 specific types of engines that we've been talking
12 about.

13 BY MS. WOO:

14 Q. And how is the database engine optimized
15 for storing certain types of data?

16 MR. THACKER: Objection. Form, scope.

17 THE WITNESS: For example, so I worked on
18 data types at Ingres.

19 BY MS. WOO:

20 Q. Uh-huh.

21 A. And I would, you know, control how numbers
22 are sorted or something like that, and I would use
23 as fast an algorithm I could muster to implement
24 that because I knew it was a common thing.

25 People use, you know, integers for account

1 ID or user ID, and commonly we have to store or
2 index those things. And so I would try and, you
3 know, use efficient algorithms in those cases.

4 Q. Understood.

5 Let me see. So, if I have, say, Microsoft
6 Outlook and all my emails there are organized by the
7 time received -- well, first, are those emails
8 time-series data?

9 MR. THACKER: Objection. Form, scope.

10 THE WITNESS: You're saying the data
11 itself, just, you know, the data I assume is
12 unstructured, just like, "Hi, how are you" email
13 messages, but they have timestamps?

14 BY MS. WOO:

15 Q. Yes. And you can be assured they come in
16 at regular intervals.

17 A. Oh, mine are very irregular, very bursty.

18 MR. THACKER: Same objection, if that was a
19 question.

20 THE WITNESS: I guess -- I mean, I guess I
21 would have to think about that for a while. It's
22 not something I considered before this moment.

23 There are definitely email inboxes that
24 every five minutes receive an email giving a
25 measurement of a moisture or temperature, sensor

1 information. I think someone would consider that --
2 might consider that time-series data. The data
3 alone. I'm not talking about the database, if there
4 is one. I'm saying the data, the nature of the data
5 itself.

6 I don't know. Just because data has
7 timestamps on it and it's of all different formats,
8 I don't know if I would go there. I would really
9 have to think about it.

10 And it's, again, not something -- I don't
11 think I've offered an opinion in my declaration on
12 this question. I don't think I've thought about it
13 before.

14 BY MS. WOO:

15 Q. So, what if we go with your scenario that
16 I'm getting these emails about like, say,
17 temperature sensing every five minutes. Would then
18 my Outlook that has all these emails and it is
19 organized by the time I received them, would it be a
20 time-series database?

21 MR. THACKER: Objection. Form, scope.

22 THE WITNESS: I don't know that Outlook is
23 even a database engine. It's just a GUI. You know,
24 it's a graphical menu with buttons showing you a
25 list of things.

1 Internally if it's organized as a database
2 and it has features that, you know, prioritize
3 timestamp as a primary key and is organized around
4 time, it would depend on all kinds of internal
5 details about how Outlook is implemented, which is
6 proprietary.

7 I don't think of it as a database to start
8 with. But I could be wrong. Maybe they use a
9 database internally. And so I guess I would answer,
10 it depends. It depends on the implementation, which
11 isn't public, as far as I know.

12 BY MS. WOO:

13 Q. How about on my phone? I have logs of all
14 the calls, and they are, again, organized by
15 timestamp, and again, I can say I get them, spam
16 calls, at regular intervals. Is that time-series
17 data?

18 MR. THACKER: Objection. Form, scope.

19 THE WITNESS: Again, this is not something
20 I've thought of and it's not considered in my
21 declaration, so I think I would give the same
22 answer, which is I would have to think about it,
23 maybe, especially if, you know -- if you're getting
24 automated calls every minute with a report or
25 something, that could be considered time-series data

1 by some people.

2 But I haven't really, you know, tried to
3 set boundaries around that term before this moment,
4 and so it would take me some time to consider.

5 BY MS. WOO:

6 Q. I can say I'm getting automated calls hour
7 after hour about my car insurance, my debt that I
8 don't have.

9 A. Yeah. Same.

10 Q. Okay. Just a moment.

11 How about a -- I want to say Twitter
12 account, but I know it's called X now. But a
13 Twitter account has all the Tweets, formerly called,
14 and it's organized by the time you posted it. Are
15 those Tweets time-series data?

16 MR. THACKER: Objection. Form, scope.

17 THE WITNESS: That's not normally what I
18 think about time-series data, but if somebody called
19 it that, you know, I guess I would allow for it. I
20 just -- again, I'm going to give you the same
21 answer. I would have to think about whether that
22 seems like it fits or not.

23 Normally time-series data is more like
24 analytics, not just an information feed with
25 timestamps on it.

1 BY MS. WOO:

2 Q. So, say I had one of those Twitter accounts
3 that will say like right now it is this temperature
4 in Monaco, say. And there was once a time where you
5 could download all of that into like an Excel sheet.

6 If I did that, would that Excel sheet be a
7 time-series database?

8 MR. THACKER: Objection. Form, scope.

9 THE WITNESS: Excel is generally not
10 considered as a database by computer scientists.
11 It's not marketed as a database, I don't think.

12 They have a separate product, Microsoft, several
13 separate products called databases. Excel is just a
14 spreadsheet. So, I wouldn't consider Excel to be a
15 database of any kind.

16 BY MS. WOO:

17 Q. And why not?

18 MR. THACKER: Objection to form and scope.

19 THE WITNESS: Because it doesn't have like
20 data organization features and indexing and schemas
21 and the normal things that you would expect in a
22 database engine. It doesn't have those features.

23 BY MS. WOO:

24 Q. So, I'm probably exposing my lack of
25 knowledge, but I know on an Excel sheet you can sort

1 data. You can even have your whole row. If you
2 want to sort by one column, it will sort the entire
3 thing. Why is that not organization?

4 MR. THACKER: Objection. Form, scope.

5 THE WITNESS: That is organization. It's
6 just -- it has many features that are reminiscent of
7 what relational databases look like. It looks like
8 a table.

9 I don't know Excel that well, so maybe it
10 even has the way of linking different spreadsheets
11 together according to IDs and things like that.

12 But I don't know if it has like typical
13 indexing so that you can search for values based on
14 an index and query a row.

15 I don't know that it has any language,
16 query language, which is almost universal with
17 databases. You can't type a command that says
18 retrieve these rows based on these criteria or
19 anything like that.

20 I could be wrong because, again, I don't
21 know Excel. I'm not a power user. But I don't
22 think it has a query language at all.

23 So, it feels like kind of an elementary
24 school version of a database in some ways. It's
25 very -- it's a spreadsheet and it has the flavor of

1 a spreadsheet. So, I don't think many people view
2 it as a database.

3 BY MS. WOO:

4 Q. Okay. And then just a few moments ago you
5 said time-series data normally has analytics. What
6 did you mean by that?

7 A. I think of time-series data as typically
8 being analytics, meaning there's sensor information
9 coming in or user activity information coming in.

10 Analytics is this huge area of computer
11 science that basically, even though it's creepy,
12 sucks in all your interactions with your phone,
13 let's say. So, did you click on an ad? Did you
14 look at this part of a mobile app? How long did you
15 linger?

16 That is very commonly sent -- constantly
17 being sent to Google Analytics or Firebase or some
18 analytics engine that takes in all that data for
19 purposes of, you know, understanding how you use
20 your phone or how best to advertise to you, because
21 that's a big moneymaker. And that's time-series
22 data. You know, it's coming in constantly with
23 information about your interactions, your behavior,
24 your activity over time.

25 Q. So, on my phone I do have like -- on the

1 browser at least, I have a history of all the
2 websites I visited. Is that time-series data?

3 MR. THACKER: Objection. Form, scope.

4 THE WITNESS: So, at least in some
5 browsers, your history is actually stored in an SQL
6 database. I think it's called tiny SQL, or
7 something like that. I don't know if it's organized
8 around time. I'd have to look into that.

9 So, I guess the answer is it could be,
10 depending on certain details.

11 BY MS. WOO:

12 Q. And which details are they?

13 MR. THACKER: Objection. Form, scope.

14 THE WITNESS: If the database is organized
15 around the timestamp as a first-class object and
16 index and really focused on, and maybe if there are
17 reports generated around your activity according --
18 over time, then someone might fairly consider that a
19 time-series database in that case, because it's
20 taking measurements over time and recording them in
21 a database.

22 MS. WOO: Let's see. So, I think we're at
23 a pretty good stopping point, and I hear that lunch
24 just came in. So, why don't we take a break for
25 lunch here.

1 And let's see. How long do you think you
2 need for lunch?

3 THE WITNESS: At least 30 minutes, 45 is
4 fine, too. An hour is probably more than I need.
5 So, whatever everyone else would like within that
6 parameter.

7 MS. WOO: Sam, on your end?

8 MR. THACKER: I have no preference.

9 MS. WOO: Why don't we do 45 minutes, then.

10 THE WITNESS: Okay.

11 MS. WOO: Yeah. Come back at -- what is
12 it? 12:25 on the Pacific Coast time.

13 THE WITNESS: Okay.

14 MS. WOO: All right. Thank you very much.

15 (Lunch recess taken from 11:40 a.m. to
16 12:26 p.m.)

17 MS. WOO: We can go back on the record.

18 BY MS. WOO:

19 Q. I am going to drop a clean copy of the 934
20 patent into the chat. There we go.

21 And then, again, Dr. Black, you can refer
22 to your clean copy. This is for the court reporter.

23 A. Got it.

24 Q. Okay. Just let me know when you have it
25 open.

1 A. I have it.

2 Q. So, let's go to claim 1. And let me know
3 when you're there.

4 A. I'm there.

5 Q. Do you see the limitation "store, in a
6 multidimensional time-series database, information
7 about the request"?

8 A. Yes, I do.

9 Q. Okay. So, for this multidimensional
10 time-series database, is that referring to a
11 database system, a database engine, or a database
12 store?

13 MR. THACKER: Objection. Form.

14 THE WITNESS: It can't be engine because
15 you can't store something in the engine. But it
16 could refer to the system or the store itself. But
17 in any case, the information has to end up in the
18 store of the database.

19 BY MS. WOO:

20 Q. Just one moment.

21 Okay. And then do you see the limitation
22 that says, "receive a request to authenticate a
23 client"? Do you see that?

24 A. I do.

25 Q. And then do you see a little later on,

1 there is a limitation that says, "determining, based
2 at least on the historical information, whether the
3 user account is associated with the previous access
4 request to a network resource"?

5 Do you see that?

6 A. I do.

7 Q. Is there a distinction between a request to
8 authenticate a client and an access request to a
9 network resource?

10 A. Your question is, does the first limitation
11 reciting "receiving a request to authenticate a
12 client," is that different from the "previous access
13 request to a network resource"?

14 Q. Or not so much the receiving, but is a
15 request to authenticate the client, is that
16 different from an access request to the network
17 resource?

18 MR. THACKER: Objection. Form, scope.

19 THE WITNESS: Sorry. It's taking me a
20 minute to unwind the words.

21 BY MS. WOO:

22 Q. Yeah.

23 A. I'm just going to also page through my
24 declaration for a moment, if that's okay.

25 Q. Uh-huh.

1 A. Okay. I don't see this specific question
2 in my declaration anywhere, but I would say that
3 requesting access to a network resource is, I want
4 to open this file, I want to log into this computer,
5 I want to open this network connection. That's
6 different from, I need to authenticate a specific
7 client based on identifier and password.

8 You might do that in response to an access
9 request. You know, you might say, "I need your
10 password and your username if you want to access
11 this." But I wouldn't say those two are equal
12 things.

13 Q. Okay. So, earlier you mentioned like there
14 are login flows. How would this flow? Would the
15 user first request access to a network resource, or
16 would it first request to authenticate itself?

17 MR. THACKER: Objection. Form, scope.

18 THE WITNESS: And so the example I gave
19 where you're logging into, let's say, Wells Fargo,
20 you're requesting access to that account on the
21 Wells Fargo server, and the flow I described, which
22 is, you know, the server says, "I need your username
23 and your password," and you send it, when you send
24 it, I think that maps into the first limitation
25 where there's a request -- I'm saying, "Wells Fargo,

1 please authenticate me. Here's my username and my
2 password." And that's being done because I am
3 trying to access a resource, but it's only part of
4 that attempt.

5 So, after I authenticate myself, it may
6 check other things, like is -- am I allowed to or do
7 I have access to or is there anomalous behavior?
8 So, that's just part of what you might do.

9 BY MS. WOO:

10 Q. Got it. Sorry. The allergies that I
11 mentioned.

12 What in Kirti is the request to
13 authenticate a client?

14 A. So, here I'm going to go to my declaration.

15 Q. Uh-huh.

16 A. And I'm on page 59 of my declaration, which
17 addresses both 1.2 and 1.4 together.

18 Q. Okay. One moment. Let me just get to 59.

19 Okay. I think I'm there.

20 A. So, the section of my declaration goes on
21 for several pages, but it calls out portions of
22 Kirti that talk about logging into applications from
23 different devices and supplying credentials for
24 login.

25 In paragraph 80, "login attempts include a

1 username or other identifier."

2 I believe it also, in 81, talks about
3 "login attempts include a password."

4 So, that would map to the limitation that
5 we're talking about where there's a client
6 authentication attempted using a username and
7 password.

8 Q. And just to clarify, it said the "login
9 attempts that include a username or other
10 identifier." What do you mean by "other
11 identifier"?

12 A. So, let me go see. Kirti, I reference
13 column 15, lines 55 and following.

14 So, here I'm saying, you know, it could be
15 your username or it could be other identifiers that
16 aren't your username. And this is -- if, you know,
17 this is an attack, Kirti talks about receiving a
18 username and password that aren't necessarily valid.

19 Q. I'm sorry. Which line in Kirti were you
20 looking at?

21 A. I was at 15 -- column 15, lines 55 --

22 Q. Got it.

23 A. -- and following.

24 Q. And then what here is the other identifier
25 that you referenced in paragraph 80?

1 A. I mean to say your username or other
2 invalid, suspended, other usernames could be used.

3 Q. Understood. Got it.

4 And let me see. And as we discussed
5 earlier, you usually have that unique username so
6 you can look up the account that you're matching the
7 password to; is that correct?

8 A. Yes.

9 Q. Okay. And then what in Kirti is the access
10 request to a network resource?

11 A. So, I'm looking now in my declaration,
12 page 74. At the end of paragraph 99 I have some
13 citations of what resources were accessed. And then
14 there's a bunch of citations, which I can go through
15 and, I think, pull examples, if you'd like.

16 Q. Sure.

17 A. Okay. So, in the first citation, this is
18 column 10 of Kirti, around line 37, "cloud resources
19 that were accessed (including files and folders in a
20 file management cloud application), employees and
21 contractors in a human resource cloud application,
22 contacts and accounts in a customer relationship
23 management cloud application."

24 So, I guess those are a list of resources
25 that Kirti talks about. I assume there's probably

1 more. I can keep going through the other
2 references.

3 Q. Is there a distinction between the access
4 requests versus what was accessed?

5 MR. THACKER: Objection. Form.

6 THE WITNESS: I mean, my immediate response
7 is yes, because a request could be denied, right?

8 BY MS. WOO:

9 Q. Uh-huh.

10 A. So, an access request, presumably, if it's
11 granted, then you access the resource that was
12 requested. Or access denied, then you are denied
13 accessing it. So, there's a difference there. The
14 requests can go two ways.

15 And then accessing the resource means you
16 were granted access or you got around somehow.

17 Q. So, I see in that paragraph 99 that you
18 were looking at, you say that the historical
19 activity data stored in Kirti's analytics and threat
20 intelligence repository database includes
21 information about previous access requests, such as
22 login and logout statistics, a timestamp, whether
23 that request was successful, and so on and so forth.

24 So, am I understanding this paragraph to be
25 saying that the previous access request is the

1 login?

2 MR. THACKER: Object.

3 THE WITNESS: I wouldn't phrase it that
4 way. I would say that the request was the request
5 to log in, and this paragraph is talking about
6 information about that request, such as, you know,
7 if it was a request to log in, that would be noted,
8 what time, whether it was successful or not, the IP
9 address. All of that information is information
10 related to the request.

11 But the request itself might simply be,
12 "May I please log in? Here's my username and
13 password." And all that other information is
14 interesting to Kirti, and so it collects all that
15 other stuff as well.

16 BY MS. WOO:

17 Q. So, I think I might be getting a little
18 confused, because it seemed like there was some
19 distinction between requests to authenticate and the
20 access request to a network resource.

21 How is the login the request to access a
22 network resource?

23 MR. THACKER: Objection. Form.

24 THE WITNESS: When you go to log into a
25 separate computer system, you are trying to open a

1 connection over the network to connect over
2 software, connect to that resource. And sometimes
3 you have already authenticated yourself. There are
4 systems that, you know, just let you in because
5 you've already proven your identity somewhere else.

6 But often it will prompt you and say, "I
7 need your username and password," so then it's
8 saying, "I'm going to have to do client
9 authentication to permit you access to this network
10 resource where the resource is connecting to this
11 other machine."

12 So, each computer, in effect, is a
13 resource, and connecting to it is access request to
14 a resource.

15 BY MS. WOO:

16 Q. Okay. So, breaking it down, the flow is, I
17 request access to a resource, they notice I haven't
18 authenticated myself, so then I request to
19 authenticate myself, and then I get access. And
20 those two requests are sort of packaged into that
21 login?

22 MR. THACKER: Objection. Form.

23 THE WITNESS: I think -- let me think for a
24 second if that makes sense. I know I don't talk
25 about that level of granularity in my declaration.

1 But if I think about the messages that go back and
2 forth when this happens, the first thing is the
3 client says, "I want to log in." I would say that's
4 a request to access a network resource.

5 And then the server says, "Supply" --
6 "You're not authenticated yet. I need you to prove
7 yourself."

8 And so then you type in your username and
9 password, and those two things together represent a
10 request to be authenticated by the server.

11 And then once you pass that, assuming you
12 entered your stuff correctly, then not only is that
13 request to be authenticated, validated, but also
14 your request to log in is also at the same time
15 granted.

16 BY MS. WOO:

17 Q. Okay. So, you said -- I think you
18 mentioned earlier when you initiate this connection
19 between two entities over a network, I think you
20 mentioned a counter. But what information is
21 exchanged in that initial connection?

22 MR. THACKER: Objection. Form.

23 THE WITNESS: It's really complicated, but
24 I'll try to distill the most important parts.

25 When you try to connect your computer to,

1 let's say, another computer over the Internet, the
2 first thing you have to do -- you already have a
3 wired connection, it's called the Internet, or
4 wireless, whatever.

5 You have to first form a software
6 connection. That's called TCP/IP, and that's
7 multistage back and forth, establish these counters
8 I was talking about, and that's kind of like the
9 first step, just being able to talk to them at all.

10 And then there's -- typically next is a
11 cryptographic handshake where you exchange crypto
12 keys so that you can encrypt the connection.

13 And then once all of that's done and you've
14 got a software connection established, the client
15 will then say, "Okay, I want to log in." There's a
16 specific message that indicates that to the server.

17 And then the server typically will go
18 through and say, is this person already
19 authenticated? And if not, I have to give them a
20 challenge, like "Give me your username and
21 password." That can be done automatically or it can
22 be done manually.

23 And then another network packet goes over
24 and says, "Here's the username and password." The
25 server has to authenticate the client by checking

1 the validity of those two pieces of data, and then
2 if that's granted, you pass the client
3 authentication, and then the pending request for the
4 network resource would be then granted after that.

5 BY MS. WOO:

6 Q. Understood.

7 Going back to Kirti, and we discussed how
8 Kirti is gathering this activity data and that
9 includes various statistics about the user activity.

10 Does Kirti's cloud, so the system that the
11 user is trying to log into, does it start gathering
12 that activity data as soon as that connection is
13 initiated, or is it sometime later?

14 MR. THACKER: Objection. Form.

15 THE WITNESS: Again, just perusing my
16 declaration to see if I say anything specific to
17 that question.

18 BY MS. WOO:

19 Q. Uh-huh.

20 A. Okay. I don't think I have an opinion
21 around this question in my declaration. But my
22 reading of Kirti is that, you know, Kirti's
23 invention is not inventing these cloud applications.
24 It envisions a system that includes those cloud
25 applications.

1 And the cloud application -- I think
2 Box.com and Salesforce are given as examples --
3 those are designed by other companies, and they
4 decide what user activity to record. Typically they
5 are going to record login attempts, failures and
6 successes, IP address, all of the stuff that Kirti
7 talks about as activity data.

8 And then Kirti's contribution is this other
9 box that logs into each of these cloud -- one or
10 more cloud servers and says, give me all of that
11 information. You know, I'm authorized to be able to
12 extract all of this because these are workers at my
13 company, and so it pulls all of that information.

14 So, I think your question was, do these
15 cloud providers, do they start recording it right
16 away?

17 You know, in my experience, there's a log
18 file that every time there's some user activity,
19 attempt to log in, goes into a log file. Failed
20 login, goes as the next, you know, timestamp, one
21 second later, login rejected.

22 All of that information is going to go into
23 a log file at the cloud provider that Kirti will
24 then later extract out.

25 Q. And then for using the Wells Fargo example,

1 there are portions of the website that you don't
2 have to log in to access. Would Wells Fargo know
3 anything about the connections that are interacting
4 with those public portions?

5 MR. THACKER: Objection. Form, scope.

6 THE WITNESS: Yes, because Wells Fargo's
7 web server can still collect the IP address that
8 somebody is accessing that page from, can still
9 collect the device type. You know, everything
10 that's disclosed by your browser and by the
11 underlying connection is available to Wells Fargo,
12 even if you haven't authenticated yourself.

13 So, quite a bit of information that's
14 available outside of the client authentication
15 stream.

16 BY MS. WOO:

17 Q. Understood. Let's see.

18 So, turning back to claim 1, do you see the
19 limitation that says, "determine whether an
20 additional verification is required to grant
21 access"? Do you see that?

22 A. Yes.

23 Q. What is that term "additional" relative to?

24 MR. THACKER: Objection. Form.

25 THE WITNESS: My reading is the additional

1 verification is additional relative to the
2 verification of the username and password --
3 sorry -- identifier and password recited in the
4 first limitation.

5 BY MS. WOO:

6 Q. Okay. And then do you see the limitation
7 that starts, "determining, based at least on the
8 historical information, whether the user account is
9 associated with a previous access request to a
10 network resource, wherein the previous access
11 request to the network resource is anomalous
12 relative to a baseline profile of access requests"?
13 Do you see that?

14 A. I think you inserted an extra "the," but,
15 yes, I see that.

16 Q. Sorry. My apologies.

17 But what is the term "previous" relative
18 to?

19 MR. THACKER: Objection. Form.

20 THE WITNESS: Are you referring to one
21 "previous" or the other or both?

22 BY MS. WOO:

23 Q. Both, I believe, because it says, "a
24 previous access request," and then, "the previous
25 access request." The second one is referring to the

1 first one.

2 A. So, they should be the same.

3 Q. Yeah.

4 MR. THACKER: Objection. Form.

5 THE WITNESS: So, I think that means
6 previous to the current first limitation where a
7 client is trying to be authenticated. This is an
8 access request that was made previously to that in
9 time. In other words, it happened before the
10 current access request.

11 BY MS. WOO:

12 Q. Understood.

13 Okay. So, jumping around again. So sorry.
14 But back to your declaration. And then down at your
15 CV, I noticed -- oh, just let me know when you get
16 there.

17 A. To my CV?

18 Q. Yeah.

19 A. Okay.

20 Q. I noticed under "Awards," it says, "A check
21 for \$2.56." What does that mean?

22 A. Maybe the most famous computer scientist
23 who's ever lived is named Donald Knuth, and he's
24 this super perfectionist, and so he offers an award
25 if you can be the first finder of an error in any of

1 his books.

2 And I was -- you know, it's considered kind
3 of an honor to do that because there are almost no
4 errors. And so I found one. And he said, "You're
5 not the first." And so then I found another. And
6 finally the third try, I was the first finder.

7 And so usually people who get these checks
8 don't cash them. They just -- like mine is in a
9 frame on the wall. So, it's a little bit silly
10 because, you know, it's an award in that sense only.

11 Q. And then how long did it take you to find
12 those errors?

13 A. I probably was reading his books for years
14 as a grad student, you know, and I would get so
15 excited if I saw a mistake, and then I would -- and
16 he doesn't do email. So, you have to wait for a
17 letter to come in the mail from Stanford when he
18 gets around to it.

19 So, I was very happy when I finally got a
20 check.

21 Q. Yeah. And then, just to return again, I
22 think at the beginning we discussed the change in
23 title, and you mentioned something about soft money.
24 What were you referring to?

25 A. So, I did a startup in -- I'd have to look

1 at my CV. 2015, I think. Yeah.

2 I took a three-year leave in 2015 to do a
3 startup and held open my normal position. And now
4 I'm trying to do another startup. We sold that one,
5 and I went back to the university. And so I took
6 another one-and-a-half-year leave, and they said,
7 "You can't have more time."

8 And so I decided I would go to what's
9 called a soft-money position, which means now I fund
10 my position via grants. So, I have to, you know,
11 ask the NSF for a grant in order to pay myself out
12 of the grant and pay my students and so forth.

13 Q. I understand. Okay. Because I hadn't
14 heard that term before, and my dad is a professor,
15 so I just --

16 A. Oh.

17 Q. Yeah.

18 A. If you ask him what soft money is, I'm sure
19 he'll tell you all about it.

20 Q. I might ask. Although, he's retired now.

21 A. Okay.

22 Q. So, why don't we take another 10-minute
23 break and get back at -- just say 1:15.

24 A. Sounds good.

25 MR. THACKER: Sounds good.

1 (Recess taken from 1:02 p.m. to 1:16 p.m.)

2 MS. WOO: Back on the record.

3 BY MS. WOO:

4 Q. Dr. Black, at any time today, either during
5 a break or during your testimony, did you talk to
6 anyone about the IPRs or the patents at issue?

7 A. No.

8 Q. At any time today, either during a break or
9 during your testimony, did you send an electronic
10 message to anyone or read an electronic message from
11 anyone about the IPRs or the patents at issue?

12 A. I did not.

13 Q. Thank you. I have no further questions at
14 this time.

15 MR. THACKER: Thanks, Colette.

16 Can we take like a 15-minute break and then
17 come back?

18 MS. WOO: Okay. Yep. That works.

19 MR. THACKER: Why don't we come back at
20 1:35 Pacific.

21 MS. WOO: Yeah.

22 MR. THACKER: Okay. Thanks.

23 (Recess taken from 1:17 p.m. to 1:44 p.m.)

24 MR. THACKER: I have no questions for the
25 witness. So, I think we can be done.

1 MS. WOO: Okay. Do we need to make our
2 orders on the record?

3 THE STENOGRAPHER: Yes, please.

4 MS. WOO: So, I know earlier you said, I
5 think, 10 working days, but is it possible to do a
6 week?

7 THE STENOGRAPHER: Yes. Do you want it by
8 next Friday?

9 MS. WOO: Yes. That would be perfect.

10 And then when can we get a rough?

11 THE STENOGRAPHER: How about over the
12 weekend?

13 MS. WOO: Yes, that's perfect.

14 MR. THACKER: And no rush on the Klarquist
15 copy. And also the witness will review and sign.

16 THE STENOGRAPHER: Can I have the
17 deponent's email address so I can send it to him to
18 review?

19 THE WITNESS: Sure. It's
20 johnblackjr@gmail.

21 THE STENOGRAPHER: Thank you.

22 (The proceedings concluded at 1:47 p.m.)

23 -oOo-

1 DECLARATION UNDER PENALTY OF PERJURY

2
3 I declare under penalty of perjury that I
4 have read the entire transcript of my deposition
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6 read to me, and the same is true and accurate, save
7 and except for changes and/or corrections, if any,
8 as indicated by me on the DEPOSITION ERRATA SHEET
9 hereof, with the understanding that I offer these
10 changes as if still under oath.

11 Dated: _____

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Dr. John R. Black, Jr.

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) SS.

COUNTY OF DOUGLAS)

I, KELLY SCHINDELE, a certified shorthand reporter for the State of California, do hereby certify:

That prior to being examined, the witness named in the forgoing deposition solemnly stated to testify to the truth, the whole truth, and nothing but the truth;

That the said deposition was taken down by me remotely in stenotype at the time and place therein stated and thereafter reduced to typewriting under my direction, and that the deposition transcript is a true and correct record of the proceedings here held.

I further certify that I am not of counsel or attorney for any of the parties hereto or any way interested in the event of this cause, and that I am not related to any of the parties thereto.

Dated: August 12, 2026



KELLY SCHINDELE

CSR NO. 8357

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4	PAGE	LINE	CHANGE FROM	CHANGE TO	REASON
5	<u>30</u>	<u>17</u>	<u>they were merging</u>	<u>they were emerging</u>	<u>transcription error</u>
6	<u>35</u>	<u>21</u>	<u>air control</u>	<u>error control</u>	<u>transcription error</u>
7	<u>39</u>	<u>15</u>	<u>it's credential repository</u>	<u>its credential repository</u>	<u>grammar</u>
8	<u>49</u>	<u>6</u>	<u>go into Cloudforce</u>	<u>go into Salesforce</u>	<u>misspoke?!</u>
9	<u>50</u>	<u>10</u>	<u>describe algorithm</u>	<u>describe the algorithm</u>	<u>transcription error</u>
10	<u>55</u>	<u>1</u>	<u>computed-to-average</u>	<u>computed average</u>	<u>transcription error</u>
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2

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8 therein propounded, except for the
9 corrections or changes in form or
10 substance, if any, noted in the attached
11 Errata Sheet.

12

13 _____
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18 to before me this
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20

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