EXHIBIT 22

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 1              UNITED STATES DISTRICT COURT
 2             NORTHERN DISTRICT OF CALIFORNIA
 3
 4   _____
                                        )
 5   MATTHEW CAMPBELL, MICHAEL          )
     HURLEY, and DAVID SHADPOUR, on     )
 6   behalf of themselves and all       )
     others similarly situated,         )
 7                                       )
                 Plaintiffs,            )
 8                                       )
             vs.                        ) Case No.
 9                                       ) C 13-05996 PJH
                                         )
10   FACEBOOK, INC.,                     )
                                         )
11              Defendant.              )
     _____)
12
13       HIGHLY CONFIDENTIAL - ATTORNEYS' EYES ONLY
14
15           VIDEOTAPED DEPOSITION OF RAY HE
16                Palo Alto, California
17            Friday, September 25, 2015
18                    Volume I
19
20
21   Reported by:
     CHRIS TE SELLE
22   CSR No. 10836
23   Job No. 2144894
24
25   PAGES 1 - 273
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 1    describe as a map between user ID.                    10:19:23

 2         Q.   Between user ID and what?

 3         A.   And share ID.

 4         Q.   What's a share ID?

 5         A.   Share ID is a unique identifier assigned    10:19:37

 6    to a share object.

 7         Q.   What's a share object?

 8         A.   Share object is a, by my definition, and

 9    most engineers' definitions, a Facebook object, FB

10    object, representing a share.                         10:19:58

11         Q.   What is a share?

12         A.   A share is a snapshot of -- well, a share

13    can be many things.  It depends on what you mean

14    by -- in general, it's a instance of a user sharing

15    something.                                            10:20:32

16         Q.   Is each instance of a user sharing

17    something, does each instance of a user sharing

18    something result in the creation of a share object?

19         MR. CHORBA:  Objection.  Vague as to time.

20         THE WITNESS:  Yes, it does depend on the period  10:20:56

21    of time.

22    BY MR. CARNEY:

23         Q.   Okay.  2009 to 2012.

24         A.   I believe so, yes.

25         Q.   At what time period was that different?     10:21:09
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 1        MR. CHORBA:  Objection.  Vague as to          11:04:44

 2    share_count.

 3        THE WITNESS:  Depends on what you mean by

 4    share_count.

 5    BY MR. CARNEY:                                    11:04:48

 6        Q.   What did you mean by share_count when you

 7    used that term in this e-mail?

 8        A.   I couldn't, I don't remember what I meant,

 9    because share_count means two different things.

10        Q.   Okay.  What are the two things share_count  11:05:01

11    means?

12        A.   Depending on the context, in the context

13    of FQL, it either meant, well, in the context of

14    FQL, it always meant the total number of share

15    objects that were created and incremented the share  11:05:21

16    counter for a given URL, a subset of those.

17        Q.   What did you mean by, a subset of those?

18        A.   Not all share objects created are

19    accounted for in the share_count.

20        Q.   Which ones are not?                        11:05:59

21        A.   Any share objects that failed to create,

22    or any race conditions that would have occurred that

23    we didn't check for would not have been counted.

24        Q.   And what is a race condition?

25        A.   In the context of what I just said, if two  11:06:17
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1   people share something at the same time, we would   11:06:23

2   only count it once, within some margin, and, if two

3   people from two different data centers share

4   something at the same time, it wouldn't have been

5   counted more than once. Or, if the, the storage   11:06:36

6   system for the count was not active, you were able

7   to create a share object without affecting the

8   share_count.

9   Q.   Okay.

10   A.   Also, there have been periods of time   11:06:51

11   where we've lost a share_count.

12   Q.   What does that mean?

13   A.   There's been data loss on the container

14   object for certain URLs.

15   Q.   When -- strike that.   11:07:10

16   Did you lose that information at any time

17   between 2009 and 2012?

18   A.   Yes, for certain share, or for certain

19   URLs.

20   Q.   But it's just for certain URLs; it's not,   11:07:22

21   let's say, a global loss of that information.

22   A.   There was a global misaccounting of that

23   information, which could be described as a loss.

24   Q.   When did that occur?

25   A.   I can't say for sure, but I believe in   11:07:39

1   A.   I believe the real time metric counting   11:37:12

2 likes was a somewhat related revision, also merged.

3   Q.   Did you work on the real time metric

4 counting to likes and comments?

5   A.   Yes.   11:37:32

6   Q.   Who was that information made available --

7 strike that question.

8   With respect to the real time metric

9 counting to likes and comments, who was that

10 information made available to? Facebook employees   11:37:46

11 only, or third parties?

12   A.   It would have unreliably been made

13 available to both.

14   Q.   Did you ever determine the cause of the

15 unreliability?   11:38:04

16   A.   Yes.

17   Q.   And what was it?

18   A.   The system that it was based on had a, the

19 system it was based on ran on a set of machines that

20 could not handle the load, among other reasons.   11:38:22

21   Q.   What were the other reasons?

22   A.   They were down sometimes.

23   Q.   And was that functionality replaced with a

24 different real time metric counting to likes and

25 comments?   11:38:44

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1   A.   No.   11:38:44

2   Q.   Do you see the term, API, that's in the

3   comments section?

4   A.   Yes.

5   Q.   What is API, as that term is used there?   11:39:05

6   A.   It's an acronym, actually, initialization.

7   Q.   And in 2009, were there different APIs?

8   A.   It depends on what you mean. Developers

9   commonly refer to multiple APIs as one API, but,

10 yeah.   11:39:35

11   Q.   With different branches under the general

12 API?

13   A.   That's correct.

14   Q.   What different branches existed in 2009,

15 under sort of the umbrella concept of API?   11:39:43

16   A.   I would not be able to make a list of

17 those from memory.

18   Q.   Do you know any?

19   A.   At, depending on time, I might be able to

20 remember a few.   11:40:00

21   Q.   Okay. Do you see down at the bottom of

22 the page, the heading, summary?

23   A.   Yes.

24   Q.   Do you know whether you drafted that

25 summary?   11:40:10

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1   Facebook server stored as a global share object?   02:22:01

2   MR. CHORBA: Objection. Vague as to time.

3   THE WITNESS: It depends on the time period.

4   BY MR. CARNEY:

5   Q.   '09 through 12.   02:22:16

6   A.   Shared data derived from message data, if

7   a message sent to Facebook's server resulted in the

8   creation of a share object, it would, sometimes, and

9   this would only be under the conditions the share

10   object is actually created, under those conditions,   02:22:55

11   it would increment a part of a field on the global

12   share object.

13   Q.   You said --

14   A.   Sometimes.

15   Q.   You said that on what occasions would that   02:23:09

16   happen. I'm trying to tackle your use of the word,

17   sometimes.

18   A.   There are occasions where it would not

19   increment the field.

20   Q.   What occasions?   02:23:22

21   A.   If, depending on server availability, and

22   the race conditions we previously mentioned, so, if

23   multiple people are sharing the same thing at the

24   same time, which is pretty common, and there is any

25   latency in the system, it's possible we write an old   02:23:38

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1   value, or not at all.   02:23:42

2   Q.   Are there any other circumstances, other

3   than race conditions, that a global share would not

4   be created following the creation of a user-specific

5   share object?   02:23:55

6   A.   So, you mentioned that the global share

7   was created. The global share is not always

8   created. It's just updated.

9   Q.   Oh.

10   A.   It can be created.   02:24:07

11   Q.   In what circumstances is it updated?

12   A.   In the general case, if the URL object

13 already exists, it would be updated.

14   Q.   And you testified a moment ago that a

15 certain field would be populated, correct?   02:24:31

16   A.   Updated.

17   Q.   Updated. Which field?

18   A.   This is the tracking info field.

19   Q.   And what document are you looking at?

20   A.   I'm looking at Exhibit 14.   02:24:47

21   Q.   And the, I'm sorry, the tracking info

22 field; is that what you said?

23   A.   Yes. If you look from, on the left, it's

24 maybe the, halfway down the page.

25   Q.   I see it. And there is a string of 17   02:25:04

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1   Q.   And what are the circumstances that may   03:33:06

2   have caused -- strike that question.

3   If the user did not have JavaScript

4   enabled, would a global share have been created?

5   A.   No.   03:33:30

6   Q.   Does that mean that no ENT share would

7   have been created?

8   A.   Yes.

9   Q.   Does a global share have to come before

10   the ENT share?   03:33:44

11   MR. CHORBA: Objection. Vague as to time.

12   THE WITNESS: Do you mean a global share would

13   never have, would not have to exist for a ENT share

14   to exist?

15   BY MR. CARNEY: 03:34:09

16   Q.   In the context of URLs embedded in private

17   messages between 2010 and 2012, would a global ENT,

18   would an ENTGlobalShare have to exist prior to the

19   creation of an ENT share?

20   A.   If, are we still under the premise that   03:34:26

21   the user has JavaScript enabled?

22   Q.   JavaScript is enabled.

23   A.   Okay. There must be an ENTGlobalShare

24   before there is an ENT share, at any stage.

25   Q.   At any stage.   03:34:41

1   A.   Yes.   05:56:21

2   Q.   What is it?

3   A.   It is the logging that happens when a user

4   visits a third party link on Facebook, link shim.

5   Q.   What is in the tracking info field on a   05:56:43

6   share object? And I'm looking at the second line

7   there of the second paragraph.

8   MR. CHORBA: Objection. Vague as to time.

9   THE WITNESS: It does depend on time.

10   BY MR. CARNEY: 05:57:02

11   Q.   Let's start with January 24, 2012.

12   A.   The tracking info on a share object here

13   refers to the global share object, and that was the

14   set of comma delimited numbers we previously talked

15   about, so, Exhibit 14?   05:57:17

16   Q.   Uh-huh. Who is the best person to talk to

17   about the creation of source code for taste?

18   MR. CHORBA: Objection. Vague as to, best.

19   BY MR. CARNEY:

20   Q.   Most knowledgeable.   05:58:14

21   MR. CHORBA: Answer, if you know.

22   THE WITNESS: It depends on the time period in

23   question.

24   BY MR. CARNEY:

25   Q.   How about 2010 through 2012?   05:58:21

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1   I, the undersigned, a Certified Shorthand

2   Reporter of the State of California, do hereby

3   certify:

4   That the foregoing proceedings were taken

5   before me at the time and place herein set forth;

6   that any witnesses in the foregoing proceedings,

7   prior to testifying, were duly sworn; that a record

8   of the proceedings was made by me using machine

9   shorthand which was thereafter transcribed under my

10 direction; that the foregoing transcript is a true

11 record of the testimony given.

12   Further, that if the foregoing pertains to the

13 original transcript of a deposition in a Federal

14 Case, before completion of the proceedings, review

15 of the transcript [X] was [ ] was not requested.

16   I further certify I am neither financially

17 interested in the action nor a relative or employee

18 of any attorney or party to this action.

19   IN WITNESS WHEREOF, I have this date subscribed

20 my name.

21

22 Dated:10/9/15

23

24   <%signature>

                      CHRIS TE SELLE

25   CSR No. 10836

In the Matter of: *Campbell et al. v. Facebook, Inc.*
Case No. 13-CV-05996-PJH

Date of deposition: September 25, 2015

Witness: Ray He

Reason codes:

1.   To clarify the record.
2.   To conform to the facts.
3.   To correct transcription errors.

Page	Line	Reads	Should Read	Reason Code
13	1	A. Master of engineering, and computer science and electrical engineering.	A. Master of Engineering of Computer Science and Electrical Engineering.	3
28	12	Q. Is Facebook wiki in the Facebook repository? A. No.	Q. Is Facebook wiki in the Facebook repository? A. The Facebook wiki code was part of the repository, but the Facebook wiki content was not.	1
29	5	Q. And is the DEX system part of the Facebook repository? A. I don't know for sure.	Q. And is the DEX system part of the Facebook repository? A. The Dex code was part of the repository, but the Dex content was not.	1
30	7	Facebook messager repository	Facebook messenger repository	3
32	7	A. A synonym for Facebook repository.	A. A browser for the Facebook repository.	1
39	22	I don't believe I worked directly on messages product ever.	I don't believe I worked directly on the messages product ever.	3
42	13	A. Is either a, I think he may have been an interim product manager. Q. Do you know what project he was the interim product manager for?	A. Is either a, I think he may have been an Intern Product manager. Q. Do you know what project he was the Intern Product manager for?	3
52	25	A. I think, I believe I referred to it as i_data, with a space.	A. I think, I believe I referred to it as i data, with a space.	3

53	1	Q. And does i_data or some successor to that product exist today? A. Yes.	Q. And does i data or some successor to that product exist today? A. Yes.	3
53	9	Q. And is demographic information reflected in the i_data dashboard today? A. I don't believe so.	Q. And is demographic information reflected in the i data dashboard today? A. I don't believe so.	3
65	19	A: An internal page, i_data, and an internal page, which was kind of like domain insights.	A: An internal page, i data, and an internal 20 page, which was kind of like domain insights.	3
70	25	A. If I said Mark Kinsey was an engineer, I believe he was the interim product manager.	A. If I said Mark Kinsey was an engineer, I believe he was the Intern Product manager.	3
72	1	A. It's -- acronym?	A. It's an acronym.	3
79	19	Q. And then you said, within the context of an FQL query, it meant total number of share object created, correct? A. Yes.	Q. And then you said, within the context of an FQL query, it meant total number of share object created, correct? A. It meant the total number of feed-posted share objects created.	1
92	16	Q. What different branches existed in 2009, under sort of the umbrella concept of API? A. I would not be able to make a list of those from memory.	Q. What different branches existed in 2009, under sort of the umbrella concept of API? A. I would not be able to make a list of those from memory. Branches don't mean code branches, but rather API methods or "branches" in the graph.	1
93	21	Q. Is M. Kinsey, Mark Kinsey? A. Yes.	Q. Is mkinsey, Mark Kinsey? A. Yes.	3
97	17	although we may have had an interim name of interaction total.	although we may have had an internal name of interaction total.	3
101	8	A. It is not a tool in the same sense that it is not an interim tool.	A. It is not a tool in the same sense that it is not an Intern tool.	3
102	2	deprecated interim system that we have been talking about for the last five minutes?	deprecated Intern system that we have been talking about for the last five minutes?	3
120	25	to avoid risk of identifiable information per, I think, I. Shepard or M. Vernal.	to avoid risk of identifiable information per, I think, lShepard or mvernal.	3
128	21	Q. What is get_stats?	Q. What is getstats?	3
129	11	A. That would be the aggregate counts we discussed about the total, interaction, the	A. That would be the aggregate counts we discussed about the total interaction, the	3

		like_count, the comment_count, share_count.	like_count, the comment_count, share_count.	
throughout		ENT share	EntShare	3
throughout		ENTGlobalShare	EntGlobalShare	3
163	4	A. Permalink refers to a link where an object would hypothetically be a render, would render then if you click on it.	A. Permalink refers to a link where an object would hypothetically be rendered if you click on it.	3
174	24	A. If, for instance, this was posted by a page on behalf of a page, I believe it would be different.	A. If, for instance, this was posted on behalf of a page, I believe it would be different.	3
178	23	Q. Is it FBI type shares that relate exclusively to the message product? A. No.	Q. Is it FB type shares that relate exclusively to the message product? A. No.	3
179	12	A. Facebook has, with the introduction of schema, automatically generated documentation, which would show up if you were to click see more details about ENT share schema.	A. Facebook has, with the introduction of EntSchema, automatically generated documentation, which would show up if you were to click see more details about EntShare schema.	3
197	14	Q. And what if the user never hits send? Does the URL attachment ever become an object? A. No.	Q. And what if the user never hits send? Does the URL attachment ever become an object? A. No, it never becomes a FB share object.	1
212	3	A. It's just a, I believe, literally, in the code, it's, is, underscore, posted.	A. It's just a, I believe, literally, in the code, it is $posted.	3
221	12	A. Appears to be a copy of an e-mail sent from C. Mishra to myself.	A. Appears to be a copy of an e-mail sent from cmishra to myself.	3
223	9	Q. In June of 2010, was there a unique ID associated with every shared URL? And I'm just reading that next bullet point there. A. That is, if you and I shared the same URL, the ID would be the same.	Q. In June of 2010, was there a unique ID associated with every shared URL? And I'm just reading that next bullet point there. A. That is, if you and I successfully shared the same URL, the ID for that canonical URL would be the same.	1
241	13	I believe he worked on it or he had input on the project leading up to FA 2011.	I believe he worked on it or he had input on the project leading up to F8 2011.	3
247	8	A. Without checking the code that this pulled it's information out of.	A. Without checking the code that this pulled its information out of.	3
251	2, 4	Q. And what is ████████ It's on the second line of the middle paragraph.	Q. And what is ████████? It's on the second line of the middle paragraph.	3

		A. I believe ████████ is one of the class methods on ENT share that we previously discussed.	A. I believe ████████ is one of the class methods on EntShare that we previously discussed.	
262	23	Q. And are you familiar with the term, ENT feedback target with tokens? A. Yes.	Q. And are you familiar with the term, EntFeedbackTarget with tokens? A. Yes.	3

Date: November __11___, 2015

_____
Ray He