

EXHIBIT 4

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UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA

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MATTHEW CAMPBELL, MICHAEL	HURLEY, and DAVID SHADPOUR, on)
behalf of themselves and all)
others similarly situated,)
Plaintiffs,)
vs.) Case No.
) C 13-05996 PJH
FACEBOOK, INC.,)
Defendant.)
<hr/>)

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VIDEOTAPED DEPOSITION OF RAY HE
Palo Alto, California
Friday, September 25, 2015
Volume I

Reported by:
CHRIS TE SELLE
CSR No. 10836
Job No. 2144894

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<p>1 it, which is an association type and user next to 02:56:42 2 it. 3 Q. What does no props mean? 4 A. That just means that this tool was not 5 able to find properties on the association type. 02:57:06 6 Q. And what association type was it looking 7 for there? 8 A. 37619379530. 9 Q. Do you know why it was looking for that? 10 A. This tool just displays any raw 02:57:25 11 associations we can find. 12 Q. And then how about the, above that, the 13 top line there which says props, and then OBJ 14 greater than user, do you see that? 15 A. Yes. 02:57:41 16 Q. What does that mean? 17 A. I wouldn't be able to tell without loading 18 the association type. 19 Q. And how would you go about loading the 20 association type? 02:57:53 21 A. I would load the association type into our 22 association type tool, and also scanning it through, 23 looking for the association type within our code 24 base. 25 Q. And what's your association tool, what's 02:58:10 Page 170</p>	<p>1 anything, because they were prototyped products, and 03:00:24 2 any engineer can build a system to add any 3 associations between any objects. 4 Q. If you had access to, to your Facebook 5 terminal today, could you, would you have the means 03:00:55 6 to identify what those associations were? 7 A. I'm not sure I could do this for 8 everything. 9 Q. Could you do it for some things? 10 A. Yes. 03:01:13 11 Q. Which ones do you think you would be able 12 to identify? 13 A. For instance, I think I know the last 14 association. 15 Q. So what page are you looking at? 03:01:27 16 A. Looking at page 11, 6019. 17 Q. Uh-huh. 18 A. I believe those, the object marker 19 association, I could identify that. 20 Q. How so? 03:01:42 21 A. I believe I've seen the association 22 before. 23 Q. You mean that exact number? 24 A. No. The type -- 25 Q. Okay. 03:01:54 Page 172</p>
<p>1 the name of it? 02:58:13 2 A. That would be the, I believe that would be 3 the TAO schema tool. 4 Q. What is an association, as that term is 5 used at the top of page 6014, Bates 6014? 02:58:44 6 A. It is a entry within TAO linking this 7 global share to a user ID, sorry, to any ID. 8 Q. So an object ID, a user ID, any ID, any 9 identification number created by Facebook. 10 A. Yes, depending on the type. 02:59:21 11 Q. What types are included, what types of IDs 12 are included in this list of associations? 13 A. I wouldn't be able to give you an 14 exhaustive list, but the ones listed for this object 15 are on the left, left-hand column. 02:59:37 16 Q. Can, in the left-hand column under the 17 props, colon, OBJ greater than user line or column? 18 A. Yes. 19 Q. And can you tell what type of ID the 20 2540961 number is? 02:59:58 21 A. No. 22 Q. Is there any way to ascertain what any of 23 these associations are on the left-hand column 24 because of, for example, the number of digits? 25 A. There is not. Some of them may not mean 03:00:20 Page 171</p>	<p>1 A. -- used in our code base. 03:01:55 2 Q. And what type is that? 3 A. It's a type which indicates who has marked 4 this as spam, or abusive. 5 Q. And are there particular digits there that 03:02:06 6 allow you to make that conclusion? 7 A. I think it's the name of the type. 8 Q. The OBJ to marker? 9 A. Yes, OBJ to marker. 10 Q. So, what has been marked as spam or 03:02:29 11 abusive in, on page 11 of 29? 12 MR. CHORBA: Objection. Lacks foundation. 13 THE WITNESS: What do you mean, what? 14 BY MR. CARNEY: 15 Q. Is, looking at the OBJ to marker entry 03:02:56 16 there, and that looks like maybe 12 or 16 digit 17 number? 18 A. Yes. 19 Q. What is that number? Is that number an 20 object? 03:03:11 21 A. To the right, or right underneath OBJ -- 22 Q. Right underneath, which begins 101501. 23 A. I believe that is the number indicating 24 the type of OBJ to marker. 25 Q. I see. 03:03:28 Page 173</p>

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<p>1 line of this e-mail. 04:50:44 2 MR. CHORBA: Objection. Lacks foundation. 3 Calls for speculation. 4 You can answer, if you know. 5 THE WITNESS: I don't know exactly what Mr. Liu 04:50:59 6 meant in the title of this diff. 7 BY MR. CARNEY: 8 Q. Do you recall whether you performed a code 9 review of adding post-processing step to fetch the 10 share and like associations? 04:51:14 11 A. I don't recall. 12 Q. Would the, would a record have been 13 preserved at Facebook which would reveal whether in 14 fact you had performed such a code review? 15 A. Yes. 04:51:30 16 Q. And where would that information reside? 17 A. In the revision detail link. 18 Q. In what system? 19 A. In this document. 20 Q. So, if I clicked on the link there, 04:51:45 21 tools.Facebook.com/D188969, that information would 22 be revealed? 23 A. Yes. 24 Q. What is, taste, as the term is used in 25 this document? 04:52:01</p> <p style="text-align: right;">Page 226</p>	<p>1 able to answer that question. 04:53:58 2 Q. Are there documents that you could review 3 that you know exist that would allow for you to 4 answer the question? 5 A. Yes. 04:54:12 6 Q. What are they? 7 A. Facebook source code. 8 Q. And how would you find the lines of code 9 that would answer that question if you had access to 10 the source code in the room today? 04:54:22 11 A. I would look back to December 3, 2010 and 12 see if that code existed before this revision. 13 Q. I did limit that temporally. Let me ask 14 the question without any temporal limitation. 15 Is there code at Facebook which allows for 04:54:48 16 the fetching of like information for purposes of 17 providing recommendations? 18 MR. CHORBA: Objection. Vague as to time. I 19 know you intended to lift the temporal limitation, 20 but are you talking about today? 04:55:09 21 MR. CARNEY: At any time. 22 THE WITNESS: I'm not sure if there is code at 23 Facebook which allows for the fetching of like 24 information for the purposes of providing 25 recommendations, other than what was introduced or 04:55:26</p> <p style="text-align: right;">Page 228</p>
<p>1 MR. CHORBA: Objection. Lacks foundation. 04:52:02 2 You can answer, if you know. 3 THE WITNESS: Taste is a back end for providing 4 recommendations. 5 BY MR. CARNEY: 04:52:12 6 Q. And what does, back end, mean in that 7 answer you just gave? 8 A. It is a server that a, a web server would 9 communicate with to fetch information. 10 Q. And what is a recommendation? 04:52:31 11 A. A recommendation is a link, typically, a 12 link that we think a user would find relevant. 13 Q. And how is that information presented to 14 the user? 15 A. For this particular diff, it would have 04:52:55 16 been presented in a social plugin called the 17 recommendations plugin. 18 Q. Subsequent to December 2010, was there 19 code which allowed for the fetching of like 20 information for purposes of providing 04:53:38 21 recommendations? 22 A. I'm not sure. 23 Q. Who would best be able to answer that 24 question? 25 A. I'm probably the person who would best be 04:53:56</p> <p style="text-align: right;">Page 227</p>	<p>1 supposedly introduced in this. 04:55:29 2 BY MR. CARNEY: 3 Q. What types of things are recommended by 4 the taste back end? 5 MR. CHORBA: Objection. Vague. 04:56:04 6 THE WITNESS: What do you mean by, types of 7 things? Just -- 8 BY MR. CARNEY: 9 Q. Is it consumer goods? Is it restaurants? 10 Is it trips? I have no idea. 04:56:28 11 A. It depends on the time period in question. 12 Q. Okay. How about in 2011? 13 A. In 2011, I believe it was only URLs. 14 Q. And would they be URLs that included 15 commercial URLs, that is, commercial companies 04:56:47 16 selling products to consumers? 17 A. I don't think it differentiated between 18 URLs. 19 Q. And how, were you involved in drafting 20 source code for purposes of identifying 04:57:01 21 recommendations? 22 A. Not directly. 23 Q. Indirectly? 24 A. Well, we've previously established that I 25 wrote the code to add a counter, and I believe that 04:57:27</p> <p style="text-align: right;">Page 229</p>

<p>1 code was indirectly used to provide recommendations. 04:57:35 2 Q. How? 3 A. The counts were taken into account to 4 assess the relative engagement or popularity of a 5 given URL. More popular URLs are more likely to be 04:57:51 6 recommended. 7 Q. You -- I limited that question temporally 8 to 2011. 9 Did it change in 2012? 10 A. I don't know. 04:58:06 11 Q. Turning your attention to 17, the document 12 that we've been talking about -- 13 A. Yes. 14 Q. -- has the, can you tell by looking at 15 this e-mail whether the code to accomplish these 04:59:17 16 tasks had been written and was complete, and your 17 role was to review it, or had it not been written 18 yet? 19 A. I can't tell from this document. I'm also 20 not sure what you meant by -- 04:59:45 21 Q. Okay. And, I understand the confusion, I 22 think. Do you know whether Mr. Liu ever wrote code 23 that provided for adding a post-processing step to 24 fetch the share and like associations? 25 A. I don't know. 05:00:15</p> <p style="text-align: right;">Page 230</p>	<p>1 Q. How about 6386? 05:02:19 2 A. No. 3 Q. 6387. 4 A. No. 5 Q. Okay. If you'd look at the text that's 05:02:43 6 drafted by Mr. Liu at 6:16 p.m, they are sort of in 7 the middle of 6387, do you see that? 8 A. Yes. 9 Q. Do you know what previous bug number 10 444663 relates to? 05:02:57 11 MR. CHORBA: Objection. Lacks foundation. 12 THE WITNESS: No, I don't know. 13 BY MR. CARNEY: 14 Q. In February of 2011, was [REDACTED] 15 logging all shares, that is, including posts and 05:03:37 16 nonposts? I'm just reading on here. 17 MR. CHORBA: Objection. Lacks foundation. 18 THE WITNESS: I don't know for sure. 19 BY MR. CARNEY: 20 Q. Who would know the answer to that 05:04:00 21 question? 22 A. I would best know the answer to that 23 question. I believe, in a timeline that counsel has 24 provided, it would have delineated the time periods. 25 I'm unable to recall, given a time, what the state 05:04:17</p> <p style="text-align: right;">Page 232</p>
<p>1 Q. We talked earlier and you just mentioned 05:00:27 2 about the code to add a counter. 3 A. Yes. 4 Q. Remind me, what did you add a counter to? 5 A. This is the ENTGlobalShare. 05:00:39 6 Q. And are URLs embedded in private messages, 7 do they give rise to global shares? 8 MR. CHORBA: Objection as to form. 9 THE WITNESS: Not necessarily. 10 BY MR. CARNEY: 05:01:04 11 Q. In some instances? 12 A. Based on the instances we previously 13 discussed, and, under all those conditions, yes, 14 they can. 15 Q. Okay. 05:01:12 16 (Exhibit 18 was marked for identification 17 by the court reporter and is attached hereto.) 18 BY MR. CARNEY: 19 Q. Mr. He, if you'd look at that document and 20 identify it, if you can. 05:01:48 21 A. This appears to be a printout of a 22 automatically created task e-mail. 23 Q. Can you tell by looking what information 24 is redacted there on page 16385? 25 A. No. 05:02:16</p> <p style="text-align: right;">Page 231</p>	<p>1 of the world was. 05:04:20 2 Q. What do you mean by, timeline? 3 A. I mean, a document listing a sequence of 4 events and dates. 5 Q. And who prepared the timeline? 05:04:43 6 A. I believe, counsel. 7 MR. CHORBA: Can we have a second to confer. I 8 think we might be able to cut through this. 9 MR. CARNEY: Yeah. 10 MR. CHORBA: Take your mike off for a second. 05:04:56 11 We don't have to go off. Just give me one second. 12 (Counsel conferred with the witness.) 13 MR. CHORBA: I think, I think he's talking 14 about the Alex Himel declaration that had the diffs. 15 MR. CARNEY: Okay. 05:05:12 16 MR. CHORBA: He's referring to it as a 17 timeline. 18 MR. CARNEY: Great. Okay. 19 BY MR. CARNEY: 20 Q. Let me see if we can pull that document, 05:05:23 21 and then we won't force you into a crushing 22 memory -- 23 A. Exercise. 24 Q. Yes. 25 (Exhibit 19 was marked for identification 05:06:03</p> <p style="text-align: right;">Page 233</p>

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1 describes a user, a Facebook user. 06:28:07
 2 Q. Can you give me an example.
 3 A. My user ID is [REDACTED]
 4 Q. Truly -- okay. And then what is an object
 5 ID, something in the, what is something in the 06:28:24
 6 object ID range?
 7 A. For example, if you look at Exhibit 14,
 8 the ID listed at the top.
 9 Q. An that's the ENTGlobalShare ID?
 10 A. Yes. 06:28:39
 11 Q. Can you define the term, stored, as you
 12 used it in your answer?
 13 A. In this answer, or --
 14 Q. Uh-huh, yeah.
 15 A. In this answer, I mean a persistent store. 06:28:58
 16 Q. Let's capture the databases that are
 17 involved in holding objects and associations created
 18 from private messages prior to persistent storage.
 19 A. That would be on the web server itself,
 20 within RAM. 06:29:27
 21 Q. Any other places other than -- is web
 22 server a class of database?
 23 A. It's a class of server. A database is a
 24 different class of server.
 25 Q. What's the difference between a server and 06:29:50
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1 a database? 06:29:51
 2 A. One is a subset of the other.
 3 Q. Which is a subset of the other?
 4 A. A server can host a database.
 5 Q. Other than -- I may have asked you this; 06:30:17
 6 if I did, I apologize -- other than the web server,
 7 are there any other databases or servers that are
 8 involved in the storage of objects and associations
 9 with respect to private messages prior to persistent
 10 storage? 06:30:39
 11 MR. CHORBA: Objection. Asked and answered.
 12 THE WITNESS: No.
 13 MR. CARNEY: Okay. Thank you.
 14 MR. CHORBA: Thank you.
 15 THE VIDEOGRAPHER: This marks the end of volume 06:30:50
 16 1, disk 4, and concludes --
 17 MR. CHORBA: Let me make clear, we're
 18 designating this highly confidential, attorneys'
 19 eyes only, subject to review.
 20 MR. CARNEY: Yeah. Thanks. 06:31:00
 21 THE VIDEOGRAPHER: This marks the end of volume
 22 1, disk 4, and concludes the deposition of Ray He.
 23 The time is 4:31 p.m., and we are off the record --
 24 6:31 p.m., and we are off the record.
 25 (Time noted: 6:31 p.m.) 06:31:15
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1 I, RAY HE, do hereby declare under penalty of
 2 perjury that I have read the foregoing transcript,
 3 volume I; that I have made any corrections as appear
 4 noted, in ink, initialed by me; that my testimony as
 5 contained herein, as corrected, is true and correct.
 6 EXECUTED this ____ day of _____,
 7 201____, at _____,
 (City) (State)
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 RAY HE
 VOLUME I
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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>
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