

Page 1		Page 3	
1	UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE PATENT TRIAL AND APPEAL BOARD	1	INDEX OF EXAMINATION
2		2	WITNESS: PAGE
3		3	EXAMINATION
4	ACTIVISION BLIZZARD, INC., TAKE-TWO INTERACTIVE	4	By Mr. Lee 5
5	SOFTWARE, INC., 2K SPORTS INC. AND ROCKSTAR GAMES,	5	
6	INC.,	6	
7	Petitioners,	7	INDEX TO EXHIBITS
8	vs	8	
9	ACCELERATION BAY, LLC,	9	EXHIBIT DESCRIPTION PAGE
10	Patent Owner.	10	Exhibit-1 Declaration 17
11	Case IPR2015-01964	11	Exhibit-2 Declaration 17
12	US Patent No. 6,829,634	12	Exhibit-3 Hybrid Routing in Dynamic 40
13		13	Networks
14	VIDEOTAPED DEPOSITION OF	14	Exhibit-4 Declaration 111
15		15	Exhibit-5 Activision Exhibit 1001 161
16	DR. DAVID R. KARGER	16	Page 00001-55
17	July 6, 2016	17	
18	9:51 A.M.	18	
19		19	
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23	Gena M. Nardone, RPR	23	
24		24	

Page 2		Page 4	
1	APPEARANCES OF COUNSEL	1	VIDEO TECHNICIAN: This is media
2	On behalf of the Petitioners	2	number one to the videotaped deposition of Dr.
3	JAMES L. DAVIS, ESQ.	3	David Karger, in the matter of Activision
4	ROPES & GRAY	4	Blizzard, et al., petitioners versus
5	1900 University Avenue - 6th Floor	5	Acceleration Bay, LLC, patent owner.
6	East Palo Alto, CA 94303	6	Being heard before the United States Patent
7	650-617-4000	7	and Trademark Office. Case numbers are IPR
8	james.l.davis@ropesgray.com	8	2015-01964 and IPR 2015-01996.
9		9	This deposition is being held at the law
10	MICHAEL TOMASULO, ESQ.	10	offices of Ropes & Gray, 800 Boylston Street,
11	DAVID K. LIN, ESQ.	11	Boston, Massachusetts.
12	WINSTON & STRAWN	12	Today's date is July 6, 2016. The time is
13	333 Grand Avenue - 38th floor	13	9:51 a.m. My name is Ara Hollisian and I am the
14	Los Angeles, CA 90071	14	videographer. The court reporter is Gena Nardone
15	213-615-1973	15	of Esquire Deposition Solutions.
16	dlin@winston.com	16	Counsel, will you please introduce yourselves
17	mtomasullo@winston.com	17	and affiliations and the witness will be sworn.
18	On behalf of the Patent Owner	18	MR. LEE: Michael Lee, from Kramer
19	MICHAEL LEE, ESQ.	19	Levin, representing the patent owner.
20	JAMES HANNAH, ESQ.	20	MR. HANNAH: James Hannah, from Kramer
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24	650-752-1712	24	Blizzard, Electronic Arts, Take-Two Interactive
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	Also Present: Linda Zabriskie		
	Ara Hollisian, Videographer		

Page 5 1 Software, 2K Sports and Rockstar Games. And 2 with me is Linda Zabriskie of Take-Two 3 Interactive Software, 2K Sports and Rockstar 4 Games. 5 Also present are Michael Tomasulo and David 6 Lin of Winston & Strawn. 7 THE WITNESS: I'm David Karger, 8 serving as the expert witness. 9 MR. DAVIS: As we -- as we begin, 10 Michael, as I understand it, you've noticed up 11 the 634 patent depositions for today, a 12 separate deposition for tomorrow on the 344 13 patent, and then a separate deposition on the 14 966 patent for Friday, is that correct? 15 MR. LEE: That's correct. 16 MR. DAVIS: Nothing further. 17 **** 18 DR. DAVID R. KARGER, 19 having been satisfactorily identified by the 20 production of his driver's license, and duly sworn 21 was examined and testified as follows: 22 EXAMINATION BY MR. LEE: 23 Q. Please state your full name and address 24 for the record.	Page 7 1 I'm hunting. Sorry. Can you repeat the question? 2 I'm set now. You were asking about the IPR numbers. 3 Q. Yeah, IPR numbers 2015-01964 -- 4 A. Yes. 5 Q. -- and IPR 2015-01996. 6 A. Yes, that's the two. 7 Q. Did you offer any opinions in these two 8 proceedings? 9 A. Did I offer any opinions in these two 10 proceedings? Yes, I opined on the issues on which I 11 was requested to opine. 12 Q. What issues were you asked to opine upon? 13 A. On these two patents and whether they 14 were -- on whether they were anticipated or obvious 15 in light of prior art and knowledge of a person of 16 ordinary skill in the art. 17 Q. And what was your opinion in these two 18 proceedings? 19 A. So I -- my opinions were that for various 20 reasons this -- this patent, the 634 that we're 21 discussing today, was invalid. 22 Q. Invalid due to both obviousness and 23 anticipation; is that right? 24 A. I have some obviousness grounds and some
Page 6 1 A. My full name is David Ron Karger, and I 2 live at 21 Craigie Street, Cambridge, Massachusetts 3 02138. 4 Q. Do you understand why you're here today, 5 Dr. Karger? 6 A. Yes, I do. 7 Q. Why are you here today? 8 A. I'm serving as an expert on this case. 9 And I've been asked to come to be deposed regarding 10 the declarations that I've given on it. 11 Q. What case are you referring to? 12 A. It's the case of Acceleration Bay versus a 13 number of game companies regarding six distinct 14 patents or three for this deposition. 15 Q. Are you referring to patent number 16 6,829,634? 17 A. Yes, that's the first of the -- of the 18 three and the one we're discussing today. 19 Q. And the proceedings you're referring to is 20 IPR 2015-01964 and IPR 2015-01996; is that correct? 21 A. I haven't actually checked the numbers. 22 So I should verify that in some of this 23 documentation. I'm having trouble finding the IPR 24 number that you're asking about in my documents.	Page 8 1 anticipation grounds, that is correct. 2 Q. What are the obviousness grounds that 3 you're referring to? 4 A. So I submitted three grounds, gave 5 opinions on three grounds that the claims in this 6 patent were first obvious given DirectPlay and Lin 7 to pieces of prior art, that some of the claims, and 8 I can enumerate them if you wish, were anticipated 9 by Lin. And, finally, that claims 1 to 18 were 10 obvious under Lin in view of knowledge of a person 11 of ordinary skill in the art. 12 In a second declaration -- in a second 13 declaration I argued that the claims were -- that claims 14 1 to 18 were obvious under a DirectPlay and Shoubridge 15 combination. I also argued that some of the claims, 16 which I can enumerate, were anticipated by Shoubridge. 17 And, finally, I argued that claims 1 to 18 were obvious 18 by Shoubridge in view of knowledge of a person of 19 ordinary skill in the art. 20 Q. Are you aware of what a routing algorithm 21 is? 22 A. Yes, I am aware of what a routing 23 algorithm is. 24 Q. What is a routing algorithm?

Page 9 1 A. A routing algorithm is an algorithm for 2 delivering, usually information, but it could be 3 other things, from a source to a destination. 4 Q. What do you mean by algorithm? 5 A. An algorithm is a well-defined series of 6 steps aimed at carrying out a particular -- 7 achieving a particular goal or carrying out a 8 particular procedure. 9 Q. And the particular goal of a routing 10 algorithm is delivery of information from the source 11 to the destination? 12 A. I mean, you can also apply it to a 13 package, for example, but information is the primary 14 focus for today. 15 Q. What do you mean by package? 16 A. Something you bought at Amazon needs to be 17 routed to your house. 18 Q. So in terms of networking, how would you 19 describe a routing algorithm? 20 A. So in networking I would characterize a 21 routing algorithm as a well-defined procedure for -- 22 for -- for finding a route to deliver information 23 from a source to a destination or there's a little 24 bit of room for actually delivering the information	Page 11 1 network? 2 A. Imagine if every computer on the Internet 3 was off and you suddenly turned them all on. So at 4 that point the computers hardware would be able to 5 recognize which wires, which computers it is 6 direct -- to which it is directly connected, but if 7 it had no stored information, it might not know what 8 other computers are out there on the Internet and 9 how to reach them. 10 Q. Can you elaborate what you mean by 11 directly connected? 12 A. Yes, so there are a number of different 13 notions of connectivity when it comes to networks. 14 And I used the term direct connection to refer to -- 15 well, in graph theory the existence of an edge 16 connecting a pair of nodes in the network. The 17 analogue for a physical network, a direct connection 18 might be a wire running between two computers. 19 Q. You mentioned a graph theory. What is 20 graph theory? 21 A. Graph theory is a branch of computer 22 science, the study of these mathematical objects 23 called graphs. 24 Q. Can you give me an example of a
Page 10 1 from the source to the destination. 2 Q. Can you elaborate what you mean by finding 3 a route? 4 A. Certainly. In many situations a -- you're 5 given a network and when that network starts up, it 6 isn't clear how to deliver information from a source 7 to a destination. You might not know what sequence 8 of -- what -- what -- what sequence of steps 9 provides a route that will actually get you to your 10 destination. And so a preliminary step for a 11 routing algorithm can be to seek a path versus 12 some -- some route that will take you from the 13 source to the destination. Alternatively, you could 14 -- there are routing algorithms that will get the 15 information from the source to the destination 16 without -- without explicitly finding that path in 17 advance. If you just manage to get the information 18 from the source to the destination, you can say that 19 that information had been routed. 20 Q. You mentioned that when you start up an 21 algorithm, it's not that clear? 22 A. When you start up a network. 23 Q. When you start up a network it's not that 24 clear. Why is it not so clear when you start up a	Page 12 1 mathematical object that's a graph? 2 A. Sure. A graph is defined by specifying a 3 collection of nodes and a collection of edges. Each 4 edge is specified to connect two of the nodes in the 5 graph. These graphs are generally used to model 6 real world objects such as computer networks, road 7 networks, biological networks. They often can be 8 very well modeled as graphs. 9 Q. Did you mention biological network? 10 A. Yes. 11 Q. What is a biological network? 12 A. A biological network is sort of a network 13 of interactions between different proteins in a -- 14 in a living organism, in a cell. 15 Q. What would be an edge in a biological 16 network? 17 A. That would be an edge representing a -- an 18 interaction. For example, you might have an edge 19 that indicate that this protein inhibits this other 20 protein. So it's a -- it's a binary relation. 21 Q. So an edge in a biological network would 22 be an interaction between two different proteins? 23 A. Yes, a representation of -- or an 24 indication of an interaction between two different

Page 13 1 proteins. 2 Q. Can you elaborate what you mean by its 3 interaction? 4 A. Well, now we're getting to the biology 5 part which I am less of an expert than on graph 6 theory, but in biological networks a lot of -- a lot 7 of the way they operate is that certain proteins, 8 when present, will either encourage or inhibit the 9 actions of certain other proteins. And so 10 introducing some proteins into an environment will 11 then cause other proteins to have their effects or 12 prevent those proteins from having those effects and 13 cause changes in the state of the biological 14 particle. 15 Q. Does -- as a professor does your work ever 16 entail researching biological networks? 17 A. I have published one, I think one, 18 possibly two papers on that topic. 19 Q. Do you remember what they are called? 20 A. Unfortunately, it's in my vitae. So it 21 appears that it's not in the copy of the vitae that 22 I submitted here. I can easily look it up for you, 23 if you wish. That's up to you. That was coauthored 24 with Ernest Frankel, S.T. Yager, Lotum (phonetic)	Page 15 1 it currently reads that, for example in figure two 2 below there are eight nodes numbered one to eight, 3 which are connected by seven links. And to make 4 that accurate the correction is, for example, in 5 figure two below, there are seven nodes numbered one 6 to five and seven to eight, which are connected by 7 six links. So I accidentally left -- left number six 8 out of the network. 9 Q. Any other corrections? 10 A. Yes, two more in this declaration. In 11 paragraph number 149, line four. 12 Q. Line four. 13 A. I asserted that a person of ordinary skill 14 in the art would recognize the number of 15 participants disclosed in Lin Figure 18-3-A was 16 exemplary. And that should read disclosed in 17 DirectPlay, figure 18-3-A. The only change is from 18 Lin to DirectPlay. It's a one word change. And, 19 finally, in this declaration, paragraph 225, line 20 three. 21 Q. 225, line three? 22 A. Yes. Which currently reads that claims 1 23 to 7 10, 11, 16 and 17 are anticipated. The 24 correction is that claims 10 to 11, 15 and 18 are
Page 14 1 and I think Laura Davilla (phonetic) may have been 2 her last name. It was studying the use of a 3 particular graph algorithmic technique in order to 4 identify some of these interaction networks in the 5 biological system, yeast I believe. 6 I intended to do something at the 7 beginning, if now is a good time. As I was preparing, I 8 noticed a couple of typos in my deposition. And I'd 9 like to sort of enter into the record corrections of 10 those typos. I got them tabbed. 11 Q. What's in front of you that you're 12 referring to? 13 A. So here I have copies of my depositions on 14 the 634 patent, both the Lin/DirectPlay 15 deposition -- sorry, declaration -- and also the 16 Shoubridge/DirectPlay declaration. And in each of 17 them I found a few typos that I'd like to correct. 18 Q. Go ahead. 19 A. All right. 20 So in paragraph 39 of the Lin deposition 21 is -- this is for IPR 2015-01964. 22 Q. Paragraph 39 you said? 23 A. Yes. This is describing figure two. 24 Simply sort of a numbering error in the figure. So	Page 16 1 anticipated. And then later on in this sentence 2 where it reads that claims 6 to 10 and 17 are 3 obvious, the correction is that claims 1 to 18 are 4 obvious. So those are three typos in that first 5 declaration. 6 In the second declaration, IPR 2015-1996, 7 there's a similar correction regarding the same figure, 8 figure two, paragraph 39. Rather than reading that 9 there are eight nodes numbered one to eight, which are 10 connected by seven links, the correction is that there 11 are seven nodes numbered one to five and seven to eight, 12 which are connected by six links. 13 The second typo is in paragraph 162, line 14 four. I mention participants disclosed in Shoubridge 15 figure 18-3A, and the correction is participants 16 disclosed in DirectPlay figure 18-3A. So, again, one 17 word change from Shoubridge to DirectPlay. 18 And finally, paragraph 240, line four and 19 five currently reads that claims 1, 7, 10, 11, 16 and 17 20 are anticipated. And the correction is that claims 1 to 21 5, 8 to 11, 15 and 18 are anticipated. And -- and it 22 then asserts here that they were anticipated under 102 23 by Lin, but it should be that they were anticipated 24 under 102 by Shoubridge. And, finally, continuing, it

Page 17 1 currently reads that claims 4 to 8, 10 to 11 and 13 to 2 18 are obvious, but the correction is that claims 1 to 3 18 are obvious. And those are the typos that I found in 4 this -- in this read through. 5 Q. Are there any other typographical errors 6 or corrections? 7 A. There aren't any that I have found yet. 8 Q. But are there any other typos or 9 corrections that -- that you're aware of at this 10 time? 11 A. There are no others that I am aware of at 12 this time. 13 (Whereupon documents were marked as 14 Exhibit-1 and 2 for Identification.) 15 Q. So, you've been handed Exhibit-1 and 2. 16 Are these the declarations that you're referring to 17 that's in front of you, namely the -- the 18 declarations for the 634 patent? 19 A. Yes, these do appear to be the 20 declarations. 21 Q. And that's what's in front of you right 22 now? 23 A. Yes. This is the same two declarations 24 but with those typo corrections incorporated.	Page 19 1 we've discussed, routing is something that can 2 be discussed much more broadly than in networks 3 and the description you just gave is 4 nonsensical if you're talking about packages or 5 airplane travelers. Even within networks, I 6 would say that that's too narrow a description 7 of what a routing algorithm is. 8 Q. And can you elaborate why it would be too 9 narrow? 10 A. Again, a routing algorithm needs to 11 cover the -- a routing algorithm can be used to 12 describe more of the process of getting information 13 from a source to a destination. It can include 14 determining suitable paths through the network or 15 sort of thinking at the -- at the more abstract 16 level of deciding which -- which neighbor to send 17 information to for a next step. 18 Q. So one of the purposes of a routing al -- 19 routing algorithm can be deciding suitable paths, 20 but that's too narrow, there could be a much broader 21 definition of routing algorithm? 22 A. So a routing algorithm is about finding or 23 applying a route, right? And so it's about a lot 24 more than just picking the next wire that you want
Page 18 1 Q. Getting back to the routing algorithm 2 that -- we were speaking about that. 3 A. Uh-huh. 4 Q. What's the purpose of a routing algorithm? 5 A. Well, the purpose of a routing algorithm 6 is to get information delivered from its source to 7 its destination or as we -- there is a broader use 8 of routing for packages and travelers and airplanes 9 and things like that. 10 Q. Would it be fair to say that a routing -- 11 routing algorithm is the part of the network layer 12 that's responsible for deciding which output line an 13 incoming a packet should be transmitted on? 14 MR. DAVIS: Objection to form. 15 THE WITNESS: Could you reask the 16 question? 17 Q. Sure. 18 Would it be fair to say that a routing 19 algorithm -- routing algorithm is the part of the 20 network layer software for deciding which -- which 21 output line an incoming packet should be 22 transmitted? 23 MR. DAVIS: Same objection. 24 THE WITNESS: Well, so, again, as	Page 20 1 to use at this moment. It -- it may be occasionally 2 used in that narrower meaning, if you're focused on 3 a hardware device, for example, then from that 4 perspective the focus might be on the decision about 5 the next outgoing port to put your message onto, but 6 in other contexts it can be used more broadly. 7 Q. I believe you mentioned finding or 8 applying a route. What's the difference between 9 finding and applying a route? 10 A. Well, so if, for example, you think about 11 the way the Internet works, in general there's a 12 routing layer for the Internet protocol and that has 13 two common parts -- two commonly used parts. One of 14 them is a part which determines in advance the 15 routes that need -- that should be taken when 16 delivering information from a given source to a 17 destination and stores information about that in -- 18 in the machines and routers that are in the network. 19 Then there's the step -- that can all be done, and 20 usually is done in advance. Then there's the step, 21 I have a packet and I want to deliver that packet to 22 a destination. I may now use the previously 23 computed state in order to quickly route that 24 package to its destination.

Page 21 1 Q. You mentioned this is a routing layer. 2 What is the name of this routing layer? 3 A. Oh, sorry, I mentioned the Internet 4 protocol. IP, so it's the IP part of TCP/IP. 5 Q. So the IP part of the TCP/IP that's for 6 finding and applying the route? 7 A. Actually, the finding is -- well, there 8 are many -- there are many layers in the Internet. 9 Finding those routes also involves something known 10 as the Border Gateway Protocol, for example, which 11 is a protocol to allow different nodes on the 12 network to exchange information about their state. 13 And it's that information that's used to create 14 routing tables in different devices that are then 15 used for actually routing the packets. IP is more 16 precisely the part that does the routing of the 17 packets using that routing information. 18 Q. You mentioned routing tables, correct? 19 A. Yes. 20 Q. What are routing tables? 21 A. So routing tables are state that are kept 22 in computers and routers that provide information to 23 assist in routing. In particular the standard way 24 of doing this is that you have a sort of a	Page 23 1 IP and -- and BGP, one of the measures of distance 2 which is frequently used, is a kind of -- what's 3 known as hop count, just the number of intermediate 4 machines that the packet will have to traverse on 5 its way to its destination. In the language of 6 graph theory, if you have a graph, which is a model 7 of a network which is just counting the number of 8 edges that a path through the network will traverse. 9 Q. So would it be fair to say that a routing 10 table would typically include a next hop and a hop 11 count? 12 MR. DAVIS: Objection. Form. 13 THE WITNESS: So, again, this would 14 need to be -- this needs to be sort of specific 15 to a protocol, right? It would be natural for 16 a specific -- so at the time of routing, all 17 you really need is the next hop. If you're 18 trying to manage your routing tables and update 19 them, then you may need additional information, 20 such as hop counts or latencies, distances. 21 There are many things that you could put in to 22 help you decide on choosing a route. 23 Q. You mentioned it depends on the protocol. 24 Are you referring to any particular protocols when
Page 22 1 dictionary where for a given destination you can 2 look up in your routing table what is the next hop 3 for the packet. If you receive a packet that is -- 4 has a particular destination address, you look in 5 your routing table, and in there there will be some 6 information about who should you hand that packet 7 off to in order to move it to its ultimate 8 destination. 9 Q. Do routing tables store more than the next 10 hop, for example, the next next hop or just the next 11 hop? 12 A. That depends on the particular protocol, 13 right, there -- there are different ways that you 14 can implement this. The information that's 15 exchanged between routers includes not only the sort 16 of hop information but distances to various 17 destinations which can be used to optimize routes or 18 to decide which -- which route to select for a 19 particular destination. 20 Q. Can you elaborate, what do you mean by 21 distances? 22 A. Well, there are several interpretations of 23 distance. There's, of course, the standard 24 definition, but within networking, again, looking at	Page 24 1 you -- when you were discussing next hop and hop 2 counts? 3 A. Well, those are things that -- those are 4 used in TCP/IP and BGP. 5 Q. So would it be fair to say TCIP (sic) 6 typically uses routing tables? 7 MR. DAVIS: Objection to form. 8 THE WITNESS: Typically uses -- yes, I 9 think it would be fair to say that. 10 Q. You mentioned protocol. What's a 11 protocol? 12 A. So roughly speaking a protocol is a 13 description of how things should work. And it 14 includes instructions for how information should be 15 described and is therefore important in 16 communications. So, for example, the Internet 17 protocol includes a specification of how addresses 18 and other information should be recorded in an 19 information packet. This is important because when 20 you hand that packet off to another machine, it 21 needs to understand how to -- how to read that 22 packet in order to make sense of it. And so a 23 protocol is sort of an agreed on format for how that 24 information will be represented and what it will

Page 25 1 cause to happen. 2 Q. Would it be fair to say that a protocol is 3 a set of rules? 4 MR. DAVIS: Objection. Form. 5 THE WITNESS: Yes, a protocol 6 certainly includes a set of rules. I mean 7 protocol is used in, you know, standard 8 English, diplomatic protocol, which is a set of 9 rules for how diplomats should interact, but we 10 tend -- we are perhaps here focusing on 11 protocols in the computer science sense, right? 12 So there's -- as I said, there's -- there's the 13 Internet protocol, there's the Border Gateway 14 Protocol. These are sets of rules for, in both 15 cases, exchanging information, how it shall be 16 represented and how it shall be interpreted. 17 Q. Who creates these sets of rules, for 18 example, in networking? 19 A. So they emerged, of course, from various 20 academic efforts. And I believe that the academic 21 community was the original creator of things like 22 the Internet protocol and the Border Gateway 23 Protocol. They are now under the supervision of 24 certain bodies. I believe, that the Internet	Page 27 1 Q. Is -- the protocol itself is not a 2 software application or is it? 3 A. No, it's not, the protocol is a 4 specification, not -- not a piece of software. 5 Q. Have you heard of a constraint table? 6 A. A constraint table. I -- I believe I've 7 run into that term before, but the context doesn't 8 come to mind. 9 Q. In the context of routing -- 10 A. I'm sorry, that's what I mean. I believe 11 I've run into it in the context of routing but the 12 specific -- the specific meaning of it doesn't come 13 to mind. 14 Q. How about flood search routing, have you 15 ever heard of -- do you know what flood search 16 routing -- 17 A. I have heard of flood search routing and I 18 have a general sense of what it means. 19 Q. What does flood -- flood search routing 20 mean? 21 A. So flood search routing is one way to find 22 a route and possibly to deliver information from a 23 source to a destination, which is to flood the 24 network. You essentially take -- you could either
Page 26 1 Engineering Task Force is one of them that is 2 responsible for these sorts of things. And there's 3 a process for proposing changes to the protocols and 4 adopting those changes. 5 Q. What's the purpose of a protocol? 6 A. Well, as I said, a protocol is a kind of 7 agreement on how information will be represented and 8 what you'll do with it, so that, you know, I sitting 9 in one computer can create an IP protocol packet and 10 send it out on the network and know what's going to 11 happen to it because I know that everybody else 12 who's following the Internet protocol is going to 13 read it and respond to it in a certain way. 14 Q. Would it be fair to say that these 15 protocols are for allowing developers to create 16 applications that use a standard set of rules? 17 MR. DAVIS: Objection to form. 18 THE WITNESS: I wouldn't necessarily 19 say that that is what the protocols are for as 20 in that's their only purpose, but it's 21 certainly necessary to know those protocols in 22 order to create algorithms or to develop 23 software that will make use of those layers of 24 the network.	Page 28 1 flood the network with some kind of route request or 2 you could flood the network with the information 3 that you actually want to deliver. In either case, 4 the thing that you're -- the -- the request for a 5 route or the information itself floods through the 6 network until it arrives at the destination. If 7 you -- if what you were flooding was the packet 8 itself -- the information itself, then you're done. 9 If what it was you were flooding was the request for 10 a route, then some kind of a response needs to come 11 back and that will most likely give you information 12 about the route along which you can then send 13 information. 14 Q. What is the difference between the request 15 for a route and then the -- the actual packet being 16 sent? 17 A. Sure. So let me describe one -- one 18 algorithm -- one implementation of this idea which 19 was in a mobile network setting. And I'm afraid the 20 name escapes me at the moment, but a source that 21 wished to deliver some information to a destination 22 would send these route requests -- would -- would 23 flood a route request, which would go out on the 24 network, and it would eventually arrive at the

Page 29 1 destination. And as this route request was flooding 2 through the network, it would be sort of tagged -- 3 any particular one of these packets would be tagged 4 with a list of the machines that it had passed 5 through during the flood. And so when that copy of 6 that request arrives at the destination, it includes 7 a complete list of the machines that that particular 8 packet went through on the way from the source to 9 the destination. And that series of machines is now 10 an identified route from the source to the 11 destination. So the destination can now turn around 12 and send that path, that described path back to the 13 source, using its own route or using its own flood. 14 When the source receives that information now, it 15 knows what route can be used to send that 16 information and it uses something called source 17 routing, which is where the -- the source actually 18 specifies the route and the packet is then delivered 19 along that route. 20 Q. Is there a name for such a route request? 21 A. I don't think there's a canonical name for 22 it. It's the kind of thing you would name as you're 23 defining your protocol. 24 Q. Is there a specific type of data structure	Page 31 1 packet? 2 A. Well, I'm not sure there's a -- I don't 3 know if normal packet is a fair term. 4 Q. How is that different from another -- 5 other packets? 6 A. Well, so it is a kind of packet, right? 7 Packet is the general -- the general concept for -- 8 for packet networks. So control packets are 9 characterizing one kind of packet. They might be 10 differentiated from data packets or -- which are 11 carrying, say, the information that a user wants to 12 have delivered from one place to another, but these 13 are all packets. They are all information. And 14 they tend to be routed in similar ways. 15 Q. Just to be clear, a control packet is used 16 for finding a route to a destination and a data 17 packet is something carrying user information? 18 MR. DAVIS: Objection to form. 19 THE WITNESS: So I would say that a 20 packet used to define -- you -- you asked if a 21 control packet is used to find a route to a 22 destination. I think it needs to be described 23 the other way, that the packet that you use to 24 find a route to a destination would be called a
Page 30 1 that a route request is -- is sent in? Does that 2 make sense? 3 A. Again, that would be part of the 4 specification of the protocol. All right. So 5 abstractly in -- I described the algorithm, I said 6 you need to have -- you need to have a route request 7 packet and you need someplace in that route request 8 packet to store the destination and the path that 9 you're finding. The protocol would specify that, 10 well, the first byte of the packet contains an 11 identifier of the packet type which is a route 12 request and the second through fifth bytes contain 13 the identifier of the destination, and so on and so 14 forth. 15 Q. Are these route request packets also 16 referred to as control packets? 17 A. They would be a kind of control packet. 18 Q. Can you elaborate? 19 A. Sure. A control packet is one which is -- 20 whose purpose is to control the operation of this 21 network to -- to determine routes, to pass reports 22 of relevant information between routers that need to 23 be aware of something from each other. 24 Q. How is that different from a normal	Page 32 1 control packet, but there are other types of 2 control packets. 3 Q. And a data packet would -- is different in 4 that it has user information rather than being used 5 to find a route, is that -- 6 MR. DAVIS: Same objection. 7 Q. Is that correct? 8 A. So, again, to get away from the idea that 9 control packets are only for finding routes, right, 10 so TCP/IP, for example, there are various packets 11 that are used to establish a connection, to 12 acknowledge receipt of information and so forth. 13 And I would also characterize these as control 14 packets. 15 Q. What is a data packet? 16 A. So I'd be cautious about using data packet 17 with no context, but if I was talking about control 18 packets versus data packets, then I would use that 19 to distinguish, again, the sort of acknowledgment, 20 synchronization packets and so forth versus the 21 packets that actually contain the information that 22 the higher level application or user is trying to 23 deliver from a source to a destination. 24 Q. What's a packet?

Page 33 1 A. So one of the real innovations of the 2 Internet was the idea of packet switched networks. 3 The earliest networks were circuit switched, when 4 you wanted to deliver information from a source to a 5 destination. And this is how telephones worked 6 until relatively recently, when you wanted to set 7 up -- to deliver information from a source to a 8 destination, you would in advance set up a complete 9 circuit, a full connection of wires and switches 10 that got you from the source to the destination. 11 And you would sort of hold that fixed and push all 12 of your information through that one circuit. In a 13 packet switched network, such as the Internet, you 14 take the information you want to deliver. You break 15 it up into packets and you send each packet out on 16 its own. And different packets may arrive via 17 completely different routes as the Internet changes 18 underneath them in the middle of the sending 19 process. It doesn't matter. They arrive in pieces. 20 The destination receives them all, puts them all 21 back together in the complete message. And so that 22 allows for a lot more flexibility and robustness in 23 the delivery of information. 24 Q. Have you heard of network layer?	Page 35 1 e-mail to the -- to the intended recipient. 2 Q. So how is the -- how is the information 3 that an application layer looks at different from 4 the network layer? 5 MR. DAVIS: Objection. Form. 6 THE WITNESS: Well -- well, so, again, 7 an application might be something like an 8 e-mail application. I compose an e-mail 9 message and now I want to send it. And so the 10 e-mail application is responsible for 11 identifying the machine that should receive 12 that -- that e-mail. It then needs to send -- 13 to cause that e-mail to move to the -- the 14 intended recipient. The way it does that is it 15 talks to its own network layer. It says, 16 here's this e-mail message, please deliver this 17 on the network layer to the network end point 18 of the recipient. The network layer takes that 19 message, chops it up into packets and is 20 then -- and then takes care of sending all 21 those packets to the recipient machine. The 22 recipient machines network layer gets all of 23 those packets, reassembles them into an e-mail 24 message, which it then hands up to the appli --
Page 34 1 A. Sure. 2 Q. Is a network layer responsible for packet 3 forwarding? 4 A. Yes, that is one of the things that I 5 would characterize at the network layer. 6 Q. What else would you characterize as the -- 7 part of the network layer? 8 A. I think I would put the -- the 9 construction of routes as part of the network layer 10 as well. Although other people might disagree with 11 me. There's a -- there's a formal, you know, seven 12 layer model somewhere, which I don't bother to 13 remember, but roughly speaking, the network layer is 14 about the packet forwarding. 15 Q. Have you heard -- 16 A. It's above the link layer and below the 17 application layer. 18 Q. What is the application layer for? 19 A. The application layer is for actual 20 applications that think about sending information 21 from -- between each other and sort of hand it down 22 to the network layer to be broken down into packets 23 and delivered. So the applications can just say, 24 I'm sending an e-mail, right, put -- move this	Page 36 1 e-mail application at the other end. 2 Q. So would it be fair to say that an 3 application layer, the type of information that it 4 looks at is -- is application data, while a network 5 layer is -- the type of information that it looks at 6 is packets? 7 MR. DAVIS: Objection. Form. 8 THE WITNESS: Well, the network layer 9 is looking at the application data because it 10 has to deliver it, right, but it is treating it 11 sort of opaquely as a blob of data that needs 12 to be delivered to another destination in the 13 network, right? The network layer does not try 14 to interpret the -- that this is an e-mail 15 message and that that has some kind of 16 significance. 17 Q. It just treats it as packets, not like an 18 e-mail then? 19 A. Well, it treats it -- it treats it as a 20 sequence of bits. It then breaks that sequence up 21 into packets and sends them off. 22 Q. I believe you mentioned that application 23 layer is considered a higher -- higher layer -- 24 higher end to end protocol, is that -- is that fair?

Page 37 1 A. It is considered a higher layer. 2 MR. DAVIS: Objection to form. 3 Q. And what's meant by a higher layer? 4 A. So, again, this is just -- what's the word 5 -- not colloquial, it's the sort of the language 6 that has been agreed upon in the network community, 7 is that higher layers tend to depend on lower 8 layers, whereas lower layers don't tend to have a 9 dependence or awareness of higher layers. So you 10 can talk about the operation of the network layer, 11 the delivery of packets and so forth without any 12 concern for what's in those packets. There doesn't 13 have to be any particular application. The network 14 layer just delivers packets. The application layer, 15 it needs a network layer, right, without -- without 16 the network layer, it can't operate because it has 17 no way to cause its information to be delivered. So 18 it -- it sort of reflects a dependency or the sort 19 of -- a direction of dependency and similarly the 20 network layer tends to depend on the link layer. 21 Q. Can you give me an example of a -- a 22 network layer protocol? 23 A. TCP/IP or at least IP. Again, when you're 24 talking about the seven layers, they may have	Page 39 1 Q. Why would there be a difference in opinion 2 of what TC/IP (sic) protocol is? 3 A. Well, so there is an important difference 4 between TCP and IP. And people who are trying to be 5 very nit-picky might decide to give them separate 6 layers or give them separate names. Okay. So IP is 7 responsible for the delivery of individual packets 8 and it's not really aware of the fact that there may 9 be a whole stream of packets that are coming from 10 one source to a destination. TCP is responsible for 11 managing that stream of packets, making sure they 12 are not sent too fast or too slowly, making sure 13 that any that are lost are sent again and so forth. 14 So IP just delivers packets, one at a time, forwards 15 them. It doesn't guarantee their delivery. Those 16 packets might get lost midway. TCP provides a 17 reliable stream layer on top of IP. 18 Q. Previously you were referring to -- you 19 were talking about routers. Do you remember that? 20 A. Yes. 21 Q. What's a router? 22 A. A router is a device whose purpose is to 23 route. Sometimes that device is a special purpose 24 piece of hardware. Many times it's just a computer
Page 38 1 separated TCP and IP and said that there's like a 2 session protocol, but if we're not trying to be way 3 too precise, then TCP/IP would be the typical 4 network layer protocol. 5 Q. How about an application layer protocol? 6 A. An application -- 7 MR. DAVIS: Objection to form. 8 THE WITNESS: I would probably 9 describe SMPT the e-mail protocol as an 10 application layer protocol. 11 Q. How about HTTP, is that an application 12 layer protocol? 13 A. Yes, I would think of that as an 14 application layer protocol. 15 Q. And just to be clear, the TC/IP (sic) 16 protocol, you're saying that's -- that's not an 17 application layer, that's a network layer? 18 A. I would characterize TCP/IP as a network 19 layer protocol. 20 Q. Did you say that other people would 21 characterize it differently, is that -- 22 A. I didn't say that others would, but I want 23 to be a little cautious in overgeneralizing on what 24 everybody else would say.	Page 40 1 that's been told to -- that's been told to route. 2 Q. Can you give me an example of a computer 3 that's been told to -- to route? 4 A. Oh, this is something that you can just 5 enable. Well, I don't know if you can do it under 6 Windows, but under -- under most Unix operating 7 systems you just need to configure them a certain 8 way, enable certain processes and they will route, 9 which means that they will be listening for the 10 arrival of packets, looking for destinations in 11 those packets and handing them off to another 12 machine. 13 Q. Have you heard -- have you heard of the 14 term constrained flooding? 15 A. Yes, I have. 16 Q. What is constrained flooding? 17 A. So constrained flooding is used, I 18 believe, in Shoubridge to specify that -- sorry, I'm 19 going to -- I'm going to look before I talk, just to 20 make sure that I'm accurate. Although, if you have 21 a copy of Shoubridge, I could actually find it 22 faster. 23 (Whereupon a document was marked as 24 Exhibit-3 for Identification.)

Page 41 1 Q. Sure. I'll get you -- you've been handed 2 an exhibit marked as Exhibit Number 3. It's 3 entitled hybrid routing in dynamic networks by Peter 4 Shoubridge. Is this the Shoubridge reference you're 5 referring to? 6 A. Yes, it is. 7 Q. So just to be clear, you're looking for -- 8 A. I want to confirm that the phrase 9 constrained flooding actually appears in the 10 document. Flooding appears, but I've been going 11 through a lot of references and I want to make 12 sure -- and some of them do use the term constrained 13 flooding. 14 Q. If I direct your attention to page three, 15 it says performance of the constrained flooding, is 16 that -- under simulation result. 17 A. Yes, thank you. 18 Q. So what did you say constrained flooding 19 is? 20 A. So constrained flooding is referring to 21 the fact that there are different ways to flood and 22 there are some things that you might do that are a 23 bad idea. So what's generally recognized as a good 24 idea in flooding is making sure that there are	Page 43 1 of packets, you can number each packet in increasing 2 order. And this means that instead of hanging onto 3 an entire packet in order to know that you have 4 received it before, you can just hang onto the 5 sequence number of that packet. The -- the sender 6 makes sure that each packet gets a different -- 7 different sequence number. The sequence number is 8 much smaller. So you can keep of a list of sequence 9 numbers that you've received, instead of whole 10 packets. Even better, since the sequence numbers 11 are these sort of incrementing numbers, you can -- 12 you don't have to keep track of all of the sequence 13 numbers you've received. You can simply keep track 14 of the last sequence number that you've received in 15 order. This really minimizes the amount of state 16 you have to preserve in order to constrain your 17 flooding in an appropriate way. 18 Q. Does Shoubridge use the TCP/IP sequence 19 numbers you're referring to? Just to be clear, I 20 believe on Page 3 Shoubridge does refer to sequence 21 numbering. I'm asking if that's the same as the 22 TC/IP (sic). It says, constrained flooding uniquely 23 identifies packets associated with a particular 24 flood search using a -- using sequence numbering.
Page 42 1 limits to the flood. And so, in particular, most 2 flooding algorithms, or at least many, will try to 3 avoid duplicate -- duplicate transmission of 4 packets. So if a particular node receives a packet, 5 then the flooding algorithm sort of says that it 6 should pass it onto its neighbors, but there's no 7 point passing it onto its neighbor it just received 8 it from because it knows that it already has it. 9 And if it has already received that particular 10 packet previously then, again, there's no point in 11 passing it onto the neighbors because those 12 neighbors have already received it from it. So 13 constrained flooding is this idea that you -- you're 14 flooding but not -- you don't just automatically 15 turn around and send everything you receive to every 16 neighbor, but you put some -- you put some 17 constraints on it. 18 Q. How does a node keep track of whether its 19 received a packet already or not? 20 A. Well, so the most common mechanism and the 21 one that's used in TCP/IP is with sequence numbers. 22 So frequently packets are part of a stream of 23 packets, as I was mentioning, this is sort of the 24 purpose of TCP/IP. And if you're sending a stream	Page 44 1 A. So this is not the same as TCP/IP because 2 this is not using TCP, but it's using the same idea. 3 Q. So how is this sequence numbering 4 different from TC/IP (sic)? 5 A. I'm sorry, I'm simply saying it's not TCP, 6 right? So TCP is a particular protocol which is not 7 a flooding protocol, but this protocol uses sequence 8 numbering in the same way as TCP -- as TCP is using 9 sequence numbering. 10 Q. Do you see where it says node store 11 sequence numbers of packets already flooded? 12 A. Yes, I do. 13 Q. So what exactly is stored? Is it the list 14 of sequence numbers or is it the last sequence 15 number? 16 A. I haven't looked at Shoubridge's code 17 implementation. You could do it in different ways. 18 You could exhaustively store all of the sequence 19 numbers of the packets that had been received or you 20 could perform the optimization that I just 21 mentioned. If you know that you have received 22 packets one to one hundred, you can represent that 23 by storing only one hundred. And saying that I've 24 also received everything before.

Page 45 1 Q. How is it typically implemented? When you 2 read Shoubridge, how would you think it would be 3 typically implemented? 4 A. Well, I would assume -- sorry, there is an 5 efficiency appeal to storing only a recent sequence 6 number instead of all sequence numbers because it 7 allows you to represent your state in a smaller 8 amount of space. However, somebody implementing in 9 a hurry might, for some reason, choose to store all 10 of the sequence numbers. 11 Q. You described an efficiency. Can you 12 elaborate? 13 A. Yes, storing -- storing one number, the 14 last number received in sequence takes only a fixed 15 amount of space. If you're going to store every 16 sequence number that you've received, then as you 17 receive a longer and longer stream, it's going to be 18 taking up more and more space to store those 19 sequence numbers. It's -- one of the appeals of 20 sequence numbers is they have a sequence and so you 21 can represent the whole set by the last one. 22 Q. When you say a fixed amount of space, 23 what -- what type of data structure actually stores 24 these sequence numbers?	Page 47 1 then you just check if the new number is 2 smaller. 3 Q. Do you see where the next sentence says, 4 if any packets revisit a node with the same sequence 5 number, they are discarded instead of being further 6 broadcast to neighbors? 7 A. Yes. 8 Q. What does that mean, they are discarded? 9 A. It means the -- the plain meaning. They 10 are thrown away, right? So, in a -- in flooding, 11 the sort of base rule is that when you receive a 12 packet, you forward it onto your neighbors, but this 13 is saying that if you received it a second time, you 14 don't forward it to your neighbors, instead you 15 discard it. If there was an application running on 16 top of this, you also would not send this duplicate 17 to the application level. 18 Q. So the packet is discarded or is it -- 19 A. Uh-huh. 20 Q. And by thrown away -- thrown away, do you 21 mean deleted or -- 22 A. Yes, yes. 23 Q. And the -- the next sentence talks about 24 this technique ensures that all nodes are visited at
Page 46 1 A. That's up to the implementation, right? 2 At the software level I would have, you know, 3 probably defined some variable for -- or a field in 4 a structure. There's going to need to be one of 5 these for each stream that's being delivered and 6 there's some state associated with that stream 7 and/or -- sorry, this isn't a stream, but with 8 that -- with that pile of information, there would 9 be a structure associated. And in that structure I 10 would have a field which can hold the sequence 11 number, or as I said, an array or link list of all 12 the sequence numbers would be alternatives. 13 Q. Are there any other advantages other than 14 efficiency for storing just the last sequence 15 number? 16 MR. DAVIS: Objection to form. 17 THE WITNESS: Well, there are other 18 efficiencies. So when you receive a packet, 19 you generally need to check whether you've 20 received it before. If you're storing an 21 exhaustive list, then you have to search 22 through the list in order to decide if that 23 number was previously present. If instead you 24 just store the last received sequence number,	Page 48 1 least once and duplicated traffic is kept at a 2 minimum throughout the network? 3 A. Yes. 4 Q. This is where you're referring to about 5 removing duplication or duplicative transmission, 6 right? 7 A. Yes. 8 Q. Can you elaborate? What do you mean by 9 duplicative transmission? 10 A. Well, again, if I don't have this kind of 11 duplicate detection and elimination, then each time 12 I receive a packet, I'll forward it to my neighbors. 13 So A receives a packet. They send it to B, their 14 neighbor B. B has now received that packet. 15 They'll send it to C. C has received that packet. 16 They might send it to A. So now A receives the 17 packet a second time. They'll turn around and send 18 it to B again. B will send it to C. C will send it 19 to A. And each -- each of these receipts leads to 20 possibly more than one sending. So you just are 21 repeatedly amplifying the number of packets in the 22 network for no purpose. 23 Q. Are there any disadvantages to constrained 24 flooding?

Page 49 1 A. Compared to what? 2 Q. Compared to other protocols. 3 MR. DAVIS: Objection. Form. 4 THE WITNESS: So there are cases where 5 flooding is a great idea. And there are cases 6 where flooding has disadvantages compared to 7 other protocols. And Shoubridge actually 8 explores this in -- in their writing. 9 Flooding, by nature, delivers information to 10 every node in the network, which means that it 11 uses capacity and processing at every node in 12 the network. If you have information that you 13 only want to deliver to a single node, then 14 under certain circumstances there might be 15 better things to do than flooding. 16 Q. Did you say Shoubridge discusses these 17 disadvantages? 18 A. No, what I said was that Shoubridge 19 discusses -- can I ask you to read back exactly what 20 I said, just for clarity? 21 (Reporter reads back.) 22 Q. Can you explain what you mean by explores 23 this in its writing? 24 A. So, yes, Shoubridge explores a spectrum of	Page 51 1 THE WITNESS: So, again, I think I'd 2 asked disadvantages compared to what? 3 Q. Compared to shortest paths. 4 MR. DAVIS: Same objection. 5 THE WITNESS: So if you're 6 comparing -- Shoubridge actually outlines this 7 reasonably well. Situations in which flooding 8 would be dis -- situations in which shortest 9 path algorithms would be advantageous would be 10 situations where you have a very stable 11 network. Shoubridge first described it as a 12 static or quasi-static network where changes 13 are happening very slowly. And because these 14 changes are happening slowly, you can compute 15 shortest paths not too frequently you can -- 16 which means your state will be up-to-date. 17 Once you have that state delivering information 18 along the shortest path means you used less 19 network resources overall than you would in 20 flooding. So that is a situation in which you 21 might look to shortest paths rather than 22 flooding but, of course, there's -- in any -- 23 in any design scenario like this, you need to 24 look at all of the -- all of the considerations
Page 50 1 ways to route, including constrained flooding, and 2 also including sort of a more direct path based 3 routing, where you use information that you have to 4 send the information that you want only from the 5 source, along a single path to the destination, and 6 other nodes in the network don't receive it at all. 7 Q. Can you point to where in Shoubridge 8 there's this discussion? 9 A. So -- sorry, can you just reask your 10 question? 11 Q. This question that you're referring to, 12 where Shoubridge discusses different types of 13 routing. 14 A. Yes. So in the introduction, Shoubridge 15 discusses the fact that there are -- it's a class of 16 algorithms that determines shortest paths between 17 source and destination and then deliver packets 18 along those shortest paths. And he also mentions 19 that there are flooding algorithms that are used in 20 other settings where they are advantageous to 21 deliver information. 22 Q. In what situations would it be 23 disadvantage to use flooding? 24 MR. DAVIS: Objection. Form.	Page 52 1 and decide what's going to work better. 2 Q. Do you see on page one, the last sentence 3 of the first paragraph says, no routing tables or 4 routing information exchanges required when using 5 flooding algorithms but flooding is rather wasteful 6 of network resources? 7 A. Yes. 8 Q. Can you explain why flooding is very 9 wasteful of network resources? 10 A. Yeah, I -- so what he's referring to is 11 the fact that, as I mentioned before -- sorry, let 12 me make my phone quiet -- what I was referring to 13 before, that flooding by nature involves every 14 single node in the network and possibly every link 15 as well. A shortest path route involves only the 16 nodes on the shortest path. So in comparison, if 17 the -- if the shortest path is short, it will 18 generally involve less network resources than 19 flooding would. 20 Q. Do you agree that flooding is very 21 wasteful of network resources? 22 A. So I might take issue with the term 23 wasteful because it implies that there is a better 24 alternative. And in some circumstances there isn't,

Page 53 1 but it certainly consumes a substantial amount of 2 network resources. 3 Q. Are you aware of whether a disadvantage of 4 flooding is high bandwidth consumption? 5 MR. DAVIS: Objection to form. 6 THE WITNESS: So as I said, it 7 consumes a significant amount of network 8 resources. And by that I was referring to sort 9 of processing work at the nodes, possibly 10 storage at the nodes and linked bandwidth. 11 Q. Have you ever heard that a disadvantage of 12 flooding is a hefty memory requirement? 13 A. Hefty memory requirement? 14 MR. DAVIS: Same objection. 15 THE WITNESS: Do you have some context 16 memory requirement of -- of what? 17 Q. A memory requirement for maintaining, for 18 example, the -- the packets that have went 19 through -- 20 MR. DAVIS: Objection. Form. 21 Q. -- or to log packets? 22 MR. DAVIS: Same objection. 23 THE WITNESS: So sort of thinking of a 24 single flooding process in isolation, as we	Page 55 1 days is probably, you know, I don't know if I 2 would call that hefty, but it starts -- it 3 starts to become significant. 4 Q. Do routers have some type of storage for 5 storing sequence numbers? 6 A. So as I said before -- 7 MR. DAVIS: Sorry. I'll object to 8 form. 9 THE WITNESS: As I said before, 10 routers can be either specialized devices or 11 computers. When you have a computer acting as 12 a router, then, yes, it has mechanisms for 13 storing sequence numbers because that's part of 14 its -- part of its functionality. I'm not sure 15 with regard to the sort of backbone routers, 16 the big machines that are devoted entirely to 17 routing, whether they bother with sequence 18 numbers or whether they allocate all of their 19 energy to just forwarding packets. They may 20 leave it to the higher levels to -- to do 21 duplicate elimination, for example. And 22 actually -- actually, now that I think about 23 it, duplicate elimination is done at the TCP 24 layer. Routers, these big routers are just
Page 54 1 discussed, with the sequence numbers you can 2 really keep the amount of memory needed quite 3 small per machine. On the other hand, you 4 know, if we -- if we looked at the Internet, 5 we're using that small amount of memory on, 6 say, a billion machines. So one -- you know, 7 if we try to flood the Internet, we would be 8 using gigabits of memory just to store sequence 9 numbers. So you could call that a hefty memory 10 requirement, although on no one machine would 11 it be particularly noticeable. 12 Q. It would be a hefty memory requirement if 13 they had to store a link list of an array of all the 14 sequence numbers, right? 15 MR. DAVIS: Objection. Form. 16 THE WITNESS: Well, that would 17 increase the -- the memory requirement. Again, 18 on a single machine, it's not clear that it 19 would be hefty, given that your -- your 20 sequence number is perhaps four bytes and you 21 only need one of them for each packet, which is 22 four kilobytes. So even if you were sending a 23 gigabyte of information, you would -- you would 24 need a megabyte of sequence numbers which these	Page 56 1 doing IP packet routing. So they would have no 2 reason to store sequence numbers. 3 Q. What do you mean by the higher level? 4 A. Well, again, TCP is being a higher layer 5 than IP. IP forwards packets. TCP is responsible 6 for creating a stream of information but, again, on 7 the flip side, nowadays a lot of routers are just 8 plain computers and they do store sequence numbers 9 as part of their work. 10 Q. What do you mean by nowadays they are just 11 plain computers? Was it different before? 12 A. Well, I don't think it was different at 13 the time under consideration, the -- the nineties, 14 right, but I -- I wasn't alive in the sixties, but I 15 would bet that general purpose computers were not 16 used as routers back then, just because of need for 17 specialized fast functionality. 18 Q. So that sort of router would be only for 19 specialized routing as opposed to a general purpose 20 computer can be used for routing and other 21 functionalities? 22 A. Again, in the sixties I would probably -- 23 I would assume that it was like that, but as 24 computers became more efficient and -- and powerful,

Page 57 1 I think that the difference has started to lessen. 2 Q. What type of general purpose computers are 3 you aware of that are used for routing during the 4 nineties? 5 A. Well, again, there's a difference between 6 were and could be, right? And I would have to go 7 back and think and see if I was, myself, making use 8 of a computer as a router, but anytime you -- you 9 set up a home network you might choose to make 10 your -- you might choose to have an interesting 11 structure of home network where -- and use one of 12 your computers as a router in that interesting 13 structure. One of the advantages of using a general 14 purpose computer is you can put quite sophisticated 15 processing rules into the router. You can actually 16 tell it to locate each packet and do special things. 17 Q. Can you give me an example? 18 A. So I think a firewall would be a good 19 example. You might want to have very -- very 20 sophisticated rules for inspecting packets and 21 deciding which ones to let through. You might want 22 to use a general purpose computer to be able to have 23 complete flexibility in specifying those rules. 24 Q. So a firewall would be an example of a	Page 59 1 Poisson process model. It is a description of 2 certain routing algorithms that they tend to 3 evaluate through this simulation model. A 4 description of sort of a behavior. So, for example, 5 they talk about, they are going to try and model 6 real systems which do retransmissions when packets 7 are lost, and so their simulation model incorporates 8 that. If the packet does not reach the destination 9 within a certain time, then the packet is 10 retransmitted. It's the dedication of the total 11 amount of load that's arriving onto the network. 12 And there's a bit of a description of the protocol 13 itself, like the fact that a node that receives a 14 packet returns an acknowledgment on a packet which, 15 of course, that acknowledgment is another packet, 16 which adds more -- which consumes more of the -- of 17 the network resources. It's also a description of 18 sort of the -- the changing -- the -- the evolution 19 of the network, the -- the failure and recovery of 20 links. 21 Q. Why does Shoubridge use a simulation 22 model? 23 A. Why does Shoubridge use a simulation? 24 Well, simulation is a widely adopted scientific
Page 58 1 general purpose computer for routing? 2 A. A firewall -- 3 MR. DAVIS: Objection to form. 4 THE WITNESS: A firewall would be one 5 place where you might choose to use a general 6 purpose computer as a router. 7 Q. All right. Let's take a break. 8 A. Sounds good to me. 9 VIDEO TECHNICIAN: Time now is 11:19 10 a.m. Off the record. 11 (Recess taken.) 12 VIDEO TECHNICIAN: Time is 11:38 a.m. 13 On the record. 14 Q. Can you go to page two of the Shoubridge 15 reference? Do you see where there's a heading, a 16 simulation model? 17 A. Yes. 18 Q. What does the simulation model refer to 19 here? 20 A. All right. Can you reask the question? 21 Q. What is the Shoubridge simulation model? 22 A. So Shoubridge's simulation model is a 23 description of their model of traffic demand 24 arriving in a network. They've chosen to use a	Page 60 1 technique, which allows you to gain insight about 2 systems hopefully at lower effort than actual 3 deployment of what you're studying in the real 4 world. It's frequently used as sort of a precursor 5 to an actual deployment but lets you, you know, 6 catch problems, make improvements before you invest 7 all of that effort in -- in working in the real 8 world. 9 Q. Do you know why -- do you know what the 10 purpose of Shoubridge's paper is? 11 A. So the purpose of Shoubridge's -- 12 MR. DAVIS: Objection to form. 13 THE WITNESS: According to the 14 abstract, Shoubridge is aiming to assess a 15 routing -- a routing strategy that they claim 16 to be new, which tries to combine some of the 17 ideas of shortest path routing and control 18 flooding. 19 Q. So is the simulation model used to assess 20 this routing strategy? 21 A. I believe it's used to assess several 22 routing strat -- I mean, as I said, Shoubridge 23 outlines at least three routing strategies. There's 24 sort of traditional shortest path routing. There's

Page 61 1 traditional constrained flooding and there's his 2 hybrid model and, I believe, he looks at all of 3 them. 4 Q. So the simulation model is used for 5 shortest path, constrained flooding and hybrid 6 routing, correct? 7 A. Yes. 8 Q. And what was Shoubridge's conclusion from 9 the simulation? 10 MR. DAVIS: Objection to form. 11 THE WITNESS: So Shoubridge's article 12 concludes with a conclusion section, which 13 outlines his conclusions. Some of which were 14 around the -- sort of what it was that 15 contributed to network load. He was making an 16 argument that in addition to the network 17 capacity that's needed to maintain routing 18 tables, there was a noticeable contribution of 19 load from the need to retransmit packets that 20 aren't arriving at their destinations, 21 especially as the rates have changed in the 22 network increase, you get more -- more 23 retransmissions due to -- due to routing, due 24 to paths getting broken. And he also concludes	Page 63 1 level when packets are received, they are 2 acknowledged by the recipient. That tells the 3 sender that that packet has been received and they 4 don't need to worry about it any more, but if they 5 don't receive an acknowledgment, then after some 6 timeout usually they will send another copy of the 7 same packet in the hope that this time it will get 8 through. And they'll just keep on sending that 9 packet until they get the acknowledgment that they 10 were looking for. 11 Q. In Shoubridge is there a component that 12 performs these retransmissions? 13 A. Well, it's part of the simulation model. 14 Q. So the simulator would -- would perform 15 the retransmissions? 16 A. Yes. And, of course, what the simulator 17 is doing is simulating some network protocols 18 performing these transmissions -- these 19 retransmissions. 20 Q. What network protocol is the simulator 21 simulating? 22 MR. DAVIS: Objection. Form. 23 THE WITNESS: So I would be careful 24 saying that it is simulating a network protocol
Page 62 1 that his hybrid routing strategy, which mixes 2 shortest path routing with flooding, can help 3 mitigate some of the problems that emerge in 4 these dynamic networks while still using -- 5 using less overall network capacity than -- 6 than a standard controlled flooding. 7 Q. What do you mean by retransmissions? 8 A. So as I was discussing before, the sort of 9 lower level network layer protocols are just 10 concerned with taking a packet and getting it to its 11 destination, but there are all things -- all sorts 12 of things that might happen to that packet leading 13 to its not getting to its destination. So you talk 14 about best effort delivery, which is what the 15 Internet protocol offers. That's not -- that's not 16 what you want to use -- that's not what you want to 17 think about when you're writing an application. So 18 on top of this, you'll generally build a -- another 19 layer that instead provides you with a guaranteed 20 delivery of packets. And how does it do that? 21 Well, it takes the information you want to send, 22 breaks it into packets. It sends those packets to 23 the destination using the network layer protocol and 24 it awaits an acknowledgment. So at this higher	Page 64 1 because as we discussed, protocols are these 2 sort of specifications of exactly how you 3 should store the information in packets and so 4 forth. And that's not important in the 5 simulation, right? The simulation is only 6 talking to itself. It knows what the packets 7 mean. So it's probably not a protocol defined 8 there, but it is simulating a protocol which 9 has -- which is sort of characteristic of 10 TCP/IP, the sort of sending along a shortest 11 path with retransmissions after a short 12 timeout. It appears to be ignoring some other 13 aspects of TCP/IP like window sizing to control 14 rates. It also simulates a constrained 15 flooding protocol, and it also simulates 16 Shoubridge's proposed hybrid routing protocol. 17 Q. Do you see under -- the first sentence 18 says, an initial network model has been developed -- 19 under simulation model on page two. 20 A. Yes. 21 Q. An initial network model has been 22 developed based on stationary stochastic processes 23 evenly distributed across the network? 24 A. Yes.

Page 65 1 Q. What does the network refer to there? 2 A. The network refers sort of generically to 3 whatever network Shoubridge is going to be 4 simulating over. 5 Q. Is this the TCP/IP network that you're 6 referring to? 7 A. TCP/IP isn't a network. It's a protocol, 8 right. So, again, the network is this specification 9 of what are the -- the nodes in the network and what 10 are the connections, the communication links in the 11 network. 12 Q. Is there a particular type of network that 13 Shoubridge is referring to? 14 A. Particular type of network? Well, so on 15 page three, second paragraph, Shoubridge describes a 16 64 node network with connectivity of degree four, 17 that is a Manhattan grid network that has been 18 wrapped around itself to form a torus. 19 Q. In that first sentence you refer to evenly 20 distributed across the network. Can you explain 21 what evenly distributed across the network means? 22 A. Sorry, restate the question. 23 Q. The first sentence that we were -- we had 24 been talking about under simulation model, it refers	Page 67 1 in the end to make them all the same. 2 Q. Can you explain -- can you elaborate what 3 you mean by all the same? 4 A. Sure. Sure. That is speaking 5 colloquially for a second. I might want to say 6 things like, you know, this node sends packets five 7 per second. This node sends packets seven per 8 second. This node sends packets three per second; 9 it's not literally every third of the second. 10 There's going to be random -- it's going to be 11 random but since he says evenly distributed, from 12 that I would parse that he has decided for this 13 simulation to actually make the rates the same at 14 all of the different nodes. 15 Q. When -- 16 A. But it's also -- it's also clear from his 17 description that you could make them different, if 18 you wanted to, to sort of have a more general 19 simulation. 20 Q. What impact would it be -- how would it 21 impact the -- the simulation if -- if the arrival 22 rate was different? 23 A. Well, this -- this torus is quite uniform, 24 right? And so if you have the -- sort of things
Page 66 1 to evenly distributed across the network. I'm just 2 wondering what your opinion of evenly distributed 3 across the network means? 4 A. Yeah, so that's a sort of a summary of 5 what he says on paragraph three of page three, where 6 he uses a Poisson process model, which essentially 7 says that the packets arrive at random times on the 8 different nodes of the network and are then assigned 9 a random destination node. So that specifies a 10 source and a destination. And what he is implying 11 here when he talks about evenly distributed load is, 12 I mean the way I would parse it is that he's putting 13 the same rate of arrival on packets at every node in 14 the network. Certainly he's got the same rate of 15 reception -- destination, all the destinations are 16 getting packets at the same rate because the 17 destinations are being and randomly chosen. I sort 18 of might, if I was trying to figure this out really 19 precisely, I might sort of wonder about the fact 20 that he specifies a -- an arrival rate at each node. 21 Sort of saying -- saying that there's an arrival 22 rate at each node suggests that you could make them 23 different, but he then says that they are evenly 24 distributed, which implies, to me, that he decided	Page 68 1 arriving at the same rate everywhere, it's going to 2 be sort of isotropic, every -- sort of every part of 3 the network is going to look like every other part 4 of the network. All of the links will probably have 5 about the same congestion and so forth. You could 6 go to the other extreme and say I'm going to have 7 all of the packets originate from this node. And if 8 that happens, then you're probably going to get a 9 lot more congested edges right near that node 10 because all of the packets are trying to get out of 11 that part of the network and the rest of the network 12 would not be as heavily utilized. 13 Q. Would that be better for a simulation 14 rather than having everything arrive at the same 15 rate? 16 A. I wouldn't characterize that as better or 17 worse for the simulation. It's a question of what 18 do you want to simulate. Do you want to simulate a 19 network where traffic is originating everywhere 20 uniformly or do you want to simulate a network where 21 there's one broadcaster and everyone is just 22 listening. 23 Q. Why does Shoubridge want to have a 24 simulation where all the nodes -- I mean all the

Page 69 1 packets arrive at the same rate? 2 MR. DAVIS: Objection to form. 3 THE WITNESS: I can't look inside of 4 Shoubridge's head to know why he chose to do 5 that. It seems like a perfectly reasonable 6 thing to do. 7 Q. Why is it a perfectly reasonable thing to 8 do? 9 A. It's sort of the most neutral choice, 10 right? I'm -- I'm not going to prefer any 11 particular node. Again, I can sort of understand 12 what's going on, if all of the parts of the network 13 are being exercised, right? You know, if you need 14 to -- let's see, what would be a good example -- 15 just sort of evenly dividing things up seems like a 16 very natural default decision. And the point is you 17 have to make some sort of decision in order to 18 decide what simulation to run. You can't run every 19 imaginable, you know, infinitely many possible 20 starting conditions for your simulation, that seems 21 like a fine one. If I were really trying to explore 22 every angle, every aspect, I might sort of -- I 23 might choose to also try the single origin as sort 24 of the opposite extreme from uniform distribution,	Page 71 1 sort of say that one -- you know, again, it 2 seems natural to -- to posit that all of the 3 soldiers are generating traffic. 4 Q. What's the -- the military network that 5 you're referring to? 6 A. Oh, sorry, there's been a lot of -- no, 7 no, no, no. I was just drawing other examples of 8 networks to answer your question about whether it 9 would be reasonable to have a uniform arrival rate 10 everywhere. 11 Q. So, just to be clear, in a game network 12 packets arrive on a -- at the exact same rate? 13 A. No. 14 MR. DAVIS: Objection to form. 15 THE WITNESS: What I said was that if 16 I wanted to simulate a gaming network, then it 17 would be plausible as a modeling decision to -- 18 to run a simulation where things were arriving 19 at the same rate because it seems plausible 20 that, you know, roughly speaking, all the 21 players would be generating the same amount of 22 traffic. I'm not saying that that would have 23 to happen or -- or even that I'm right because 24 I haven't sort of done a careful study of
Page 70 1 but this is just sort of a research decision. 2 Q. In real life situations are -- is this 3 ever the case where packets arrive at the same 4 arrival rate at each node? 5 MR. DAVIS: Objection to form. 6 THE WITNESS: So if you were -- there 7 are many different network settings, right? If 8 you consider the Internet as a whole, you know, 9 you probably don't have packets originating 10 from own users networks as much as you have 11 them going to, right? Most users download more 12 than they upload. So that wouldn't be entirely 13 uniform. On the other hand, if you created 14 a -- a gaming network, which is sort of what 15 we're looking at today, you know, I think it 16 would be natural to posit by default that all 17 the players are kind of generating the same 18 amount of activity. And so a uniform arrival 19 rate would be a reasonable place to start for 20 sort of simulating that sort of network. 21 Similarly, a mobile ad hoc wireless network, 22 you know, the kind of thing that they model for 23 military applications where a bunch of soldiers 24 are dropping into the battlefield. I wouldn't	Page 72 1 gaming patterns, but it would seem to be a 2 plausible starting point. 3 Q. You've done simulation models for 4 networking before, right? 5 A. Yes, I have. 6 Q. What's the purpose of -- of creating such 7 simulation models in your -- in your experience? 8 A. Well, so, as I mentioned before, the 9 advantage of a simulation is that it's not real, 10 which means that it's often less expensive to 11 implement and execute, right? When we were studying 12 around 1998 or so web server load balancing 13 networks, it was kind of nice to, you know, to have 14 all of our clients simulated on one machine, instead 15 of finding thousands of machines and asking clients 16 on them to all make requests to our web server, 17 right? So it's -- it's generally much easier to run 18 a simulation than it is to run a real world test. 19 Q. You're were referring to this user packets 20 entering the network arrive with a Poisson arrival 21 rate at each node. What is the -- the network that 22 these user packets are entering? 23 A. Well, as described in the previous 24 paragraph, Shoubridge has chosen to run his

Page 73 1 simulation over a Manhattan grid. 2 Q. And what is a Poisson arrival rate? 3 A. So a Poisson arrival rate means that the 4 distribution of arrival times -- let's see, how 5 would I say this? Can I throw in some math or -- 6 Q. Sure. Whatever you think is -- 7 A. So a -- a Poisson waiting time is a random 8 value, a random time value, which is determined by 9 saying that the probability that you wait for longer 10 than T is E to the minus Lambda -- or E to the minus 11 Gamma T, all right. And so a Poisson process says, 12 pick a waiting time and at the end of that waiting 13 time, an arrival happens. Now start over. Pick a 14 new waiting time and at the end of that waiting 15 time, the next arrival happens. And each of those 16 waiting times is chosen independently using this E 17 to the minus Gamma T probability distribution. 18 Q. So I'm getting confused. I thought the 19 Poisson arrival rate was always standard, the same 20 arrival rate -- 21 A. Well, but see that's -- that's my point, 22 is that the rate in -- when you're talking about 23 Poisson arrival rates is the average arrival rate. 24 So when I say an average arrival rate of three per	Page 75 1 The next arrival only depends on the time of the 2 last arrival. So it's very easy to calculate. And 3 it has lots of beautiful mathematical properties and 4 it often is reasonably accurate for describing 5 what's going on in the real world. 6 Q. And just to be clear, the Poisson arrival 7 rate is the -- is what is meant by the evenly 8 distributed across the network, right? 9 A. I want to be cautious because this 10 question of the exact arrival rate was not critical 11 for my forming my opinions in this declaration. 12 Looking at it at the moment, my interpretation of 13 even distribution is that he set all of these Gamma 14 N parameters to be the same. So here Gamma -- 15 you'll notice that he's given a subscript to the -- 16 to the arrival rates, right, which implies that each 17 node can have a different arrival rate, right? But 18 when he then says evenly distributed, the way I 19 interpret that right now, not having carefully 20 looked through the document to be sure, is that he's 21 decided to make all of those Gamma Ns have the same 22 value, even though you could choose to have them 23 different. It's -- again, it's a natural 24 simplifying starting point for his simulation.
Page 74 1 second, I'm saying on average there will be three 2 per second. I'm not saying that every third of a 3 second one will arrive. 4 Q. So it's an average of the random times? 5 A. Exactly. 6 Q. Based upon the Poisson calculation? 7 A. That's right. And so essentially when you 8 set the rate -- as I said, this E to the minus Gamma 9 T arrival rate, that turns into an average arrival 10 rate of -- of Gamma per second. 11 Q. This Poisson calculation is -- is this 12 typically used in network chain modeling? 13 A. Yes, the Poisson process is very popular. 14 It's a very natural distribution. 15 Q. And why is it a very natural distribution? 16 A. Well, one of the major appeals of the 17 Poisson process is that it's sort of stationary and 18 memory-less. You don't have to remember any state. 19 Sort of as soon as one arrival happens, the next 20 arrival just has this uniform distribution. There's 21 no notion of sort of bunching up, right? So you 22 don't sort of say, well, I have to remember when the 23 last six packets arrived so that -- because that 24 influences when the next packet is going to arrive.	Page 76 1 Q. What does the Gamma and the N stand for? 2 A. It's a variable. It's the variable 3 associated with node N. It's the rate that node N 4 is going to see arrivals at. 5 Q. You also mentioned a Manhattan grid 6 network, correct? 7 A. Yes, I did. 8 Q. What's a Manhattan grid network? 9 A. So as we see in the previous paragraph, 10 he's talking about this Manhattan grid and also 11 about wrapping around -- wrapping it around. 12 Manhattan grid is a network which looks like a map 13 of Manhattan. You've got these nodes in a -- in a 14 sort of regular rows and columns. And each node has 15 an edge down to the node directly below it, in the 16 row below, there's a node directly above it, in the 17 row above and the nodes to its left and right in 18 neighboring columns. And then the wrap around -- if 19 you just talk about a Manhattan grid network, you 20 can sort of imagine stopping at the boundaries of 21 this rectangle, but wrapping around says that you -- 22 you take the node at the right most column and you 23 connect it to the same row on the left most column. 24 Q. Have you seen Manhattan grid networks used

Page 77 1 in real life situations before? 2 MR. DAVIS: Objection to form. 3 THE WITNESS: Well, Manhattan. 4 Q. Can you explain that? 5 A. I mean the city streets of Manhattan are 6 the canonical Manhattan grid. 7 Q. How about real life networking situations? 8 A. Sure. 9 MR. DAVIS: Same objection. 10 THE WITNESS: Sure. Manhattan grids 11 are very popular. If you're building a -- a 12 parallel computer, for example, many different 13 computers acting as processors. The nice thing 14 about the Manhattan grid is that it's a very 15 natural layout. You put all of your processes 16 on a table. And you then run wires to the 17 processors right next to your wire. 18 Q. Why was the Manhattan grid network used 19 for the parallel computing? 20 MR. DAVIS: Objection to form. 21 THE WITNESS: Well, like I said, it's 22 very natural. It gives you sort of a 23 mutant-able amount of connectivity and 24 reliability. And so -- so if you think about	Page 79 1 you're trying to deal with fault tolerance, but 2 there's an obvious route where you just sort of 3 go to right until your upper column and then go 4 down until you're at the proper node. So that 5 gives you simple routing procedure. So there's 6 a lot of appeal to these Manhattan grids. 7 Q. I believe you mentioned a straight line. 8 How is the Manhattan grid network different from a 9 straight line? 10 A. So a linear network is where you just line 11 up all the nodes in a row. And you might do the 12 same thing of wrapping a wire around from the last 13 node to the first node. That's just another network 14 shape. 15 Q. You also mentioned a -- a ring. 16 A. Same thing. A ring is this line with the 17 wrap around. 18 Q. Just -- I thought you mentioned that the 19 Manhattan grid network is a -- is a form of a ring 20 or something? 21 A. No, I said it's a generalization of a 22 ring. So the -- the line and the wrapped around 23 version of the ring is kind of the one dimensional 24 version of this. The Manhattan grid is the two
Page 78 1 it, the Manhattan grid is kind of a generation 2 of a ring. And so a ring is sort of a one 3 dimensional version of all the nodes in a line. 4 The problem with a line is that you have a 5 limited amount of network, right? All of them 6 have to share that one line. If you spread 7 things out into a grid, you have sort of 8 more -- more links to carry your traffic. You 9 also go from connectivity two to connectivity 10 four. So you can tolerate the failure of more 11 components before your network becomes 12 partitioned. You also decrease the diameter of 13 the network. The Manhattan grid only has a 14 square root end diameter, instead of an end 15 diameter. So it's a way of sort of having 16 better connectivity than a straight line. At 17 the same time, it's very nicely regular, you 18 know, there's -- there's sort of a natural 19 coordinate system. You can talk about the 20 processor at position 35 and the processor at 21 position at 7,3. You can route very easily if 22 you -- if you know the destination of the -- of 23 the nodes. You actually don't need routing 24 tables in a Manhattan grid network unless	Page 80 1 dimensional version of the same idea where you have 2 sort of two coordinates now instead of one. You can 3 also go to a three dimensional grid or -- or mesh 4 where you -- you have a cube now instead of a -- a 5 square and higher dimensions as well. 6 Q. Have you heard of a ring network? 7 A. Yes. 8 Q. Is a Manhattan grid network a ring 9 network? 10 A. No. As I said, the ring network that I 11 was describing was just this -- this one dimensional 12 version of it. This sort of line with a wrap 13 around. 14 Q. So a Manhattan grid network is different 15 from a ring network because it's in multi-dimensions 16 rather than just one? 17 A. Yeah, that's right. 18 Q. Ever hear of a -- a token ring network? 19 A. Yes. 20 Q. What is a token ring network? 21 A. The token ring refers to a particular 22 protocol for deciding how nodes are going to use 23 that network. How they are going to sort of share 24 the capacity on that network. It's -- it's used in

Page 81 1 situations where only one node is supposed to be 2 transmitting at a time because if multiple nodes 3 transmit, they'll talk on top of each other and you 4 won't be able to hear anything. And so this token 5 is passed around from node to node to say -- it's 6 like who has the conch in Lord of the Flies. It's 7 who's allowed to talk right now. 8 Q. Is -- in a Manhattan grid network are 9 nodes -- in a Manhattan grid network is -- is only 10 one node allowed to transmit at one time or is it 11 multiple nodes? 12 A. Those are sort of separate questions. A 13 Manhattan grid sort of refers to the structure of 14 the network and to the physics or the protocols of 15 the network. All right. So, again, the point of 16 this token ring is that it's a -- it's a protocol 17 for a -- a structure where having more than one node 18 talking at the same time is a problem, right? If 19 you had a mesh where having more than one node 20 talking at the same time is a problem, you might 21 choose to make use of some kind of token to deal 22 with that. 23 Q. Are you aware of -- what kind of protocol 24 does Shoubridge use for the Manhattan grid network?	Page 83 1 A. Well, a grid is a kind of a graph. 2 Q. Is a mesh also a type of graph? 3 A. Yes. And I should say that there are sort 4 of, in different communities, different 5 vocabularies. Some people will talk about a mesh 6 and they'll just mean sort of any kind of graph 7 that's not a tree. That's in one of our -- in one 8 of our references they talk about certain kinds of 9 network structures. And they say, well, there's 10 star networks and there's tree networks and there's 11 mesh networks but, again, there's this more specific 12 notion of mesh which -- which refers to a grid-like 13 structure. 14 Q. You mentioned a torus and a -- I believe 15 Shoubridge it says -- talks about a Manhattan grid 16 network that has been wrapped around itself as a 17 torus to avoid edge effects? 18 A. Yes. 19 Q. What are edge effects? 20 A. Well, so again, if I imagine the 21 non-wrapped grid, that would have a boundary of the 22 Hudson River, and I forget the other, but that 23 boundary is unusual, right? Nodes on that boundary 24 only have three neighbors and the corners only have
Page 82 1 A. Well, again, as I said before, I wouldn't 2 say that Shoubridge is defining a protocol, right? 3 He's -- because the protocol covers the -- a level 4 of specification that you don't need when you're 5 doing a simulation, right? 6 Q. Why -- why is that? 7 A. Well, again, the protocol tends to include 8 specifications of how information is represented in 9 the packet, right? So that other systems that 10 receive your packets can read them properly. 11 Shoubridge is just running a simulation. So he 12 doesn't need to create that specification. 13 Q. You also mentioned mesh. What do you mean 14 by mesh? 15 A. Mesh is another term that is used -- I 16 don't know if it's always interchangeable with grid 17 but it -- it tends to mean a similar -- a similar 18 concept that you can talk about a two dimensional 19 mesh which is -- I would generally interpret as a -- 20 a Manhattan grid or a three dimensional mesh, which 21 would be the cube version or a one dimensional mesh 22 which would be the ring. 23 Q. Is there any difference between a -- a 24 graph and a grid?	Page 84 1 two neighbors. Packets can only go in one direction 2 from those nodes. And so the behavior of the 3 network near those nodes would be different from the 4 behavior of the network in the center where 5 everything has four directions. And so those 6 different behaviors are what he's referring to as 7 edge effects. The reasons he's calling it a torus 8 is that one way to -- if you're actually going to 9 build this and you wanted nodes to be near their 10 neighbors, the structure that you would pick is 11 essentially a doughnut. If you think about a 12 doughnut and the sort of long way around the 13 doughnut as the rows and going around the edges of 14 the doughnut as the columns, you can create one of 15 these four dimensional grids without any edges. 16 Q. Do you see the next line, it says, 17 transmission links function as a single server 18 queuing system with service rate defined by packet 19 size and link capacity? 20 A. Yes. 21 Q. What is meant by transmission links? 22 A. So what he is simulating here is the -- 23 the real world process of getting packets from one 24 node to another node across the wire, right? So in

Page 85 1 order to do that you need a piece of hardware on 2 each end and that hardware takes the packet of 3 information and translates it into electrical 4 signals and delivers it across the wire to a 5 receiver on the other end, which takes those 6 electrical signals and translates them back into a 7 packet. And so what he's saying here is that these 8 transmission links -- he's describing how they work, 9 which is that they have -- they have some queue of 10 packets that need to be transmitted. Any time you 11 want to send another packet on that edge, that 12 packet goes into the queue, the -- the transmitter 13 is continually grabbing a packet off of that queue, 14 performing the transmission and then going on to the 15 next packet in the queue. 16 Q. This transmitter, is this -- is this part 17 of the simulator or -- 18 A. Well, you wouldn't actually build the 19 transmitter in the simulator, but you are simulating 20 such a transmitter. 21 Q. Where -- where does this transmitter -- 22 sorry. So is the transmitter functionality part of 23 the simulator? 24 MR. DAVIS: Objection.	Page 87 1 work. So a queue is essentially just a line of 2 things that need to be done. And you talk about a 3 server, its job is to take things off of the front 4 of the line, do them and then move on to the next 5 thing. There are very general notions of queuing. 6 So you might have several servers that are all 7 handling the same -- the same queue, right? But 8 what he's saying is, no, I'm going to use sort of 9 the simple model where there is one server for this 10 queue. It does one thing at a time and then it 11 moves on to the next thing. 12 Q. So for each of the 64 nodes in this 13 Manhattan grid network, there's only one single 14 server that does the queuing? 15 MR. DAVIS: Objection to form. 16 Q. Or is it something different? 17 MR. DAVIS: Same objection. 18 THE WITNESS: So there are at least 19 two natural models that I could simulate. If 20 you would like me to take the time to read, I 21 can try and verify that these -- which one he's 22 using or I could tell you about both of them. 23 Q. I'm sorry. I'm confused. What -- what do 24 you mean by natural models? I guess I'm trying to
Page 86 1 Q. I'm kind of confused. 2 MR. DAVIS: Objection to form. 3 THE WITNESS: Yeah, again, the 4 transmitter functionality is being simulated by 5 this, right? There's probably some code that 6 says, okay, time for this transmitter to send 7 another packet. 8 Q. So, again, the transmission links 9 functionality is simulated by the transmitter? 10 A. No. The transmitter and the links are 11 simulated by the simulator. 12 Q. The transmission and the links are 13 simulated by the trans -- by the simulator? 14 A. Yes. 15 Q. This single server queuing system, that's 16 also simulated by the transmitter -- I mean, 17 simulated by the simulator? 18 A. It's part of the simulation, yes. 19 Q. What is a single server queuing system? 20 A. Yeah, so queuing theory is another very 21 rich area of study, which is extremely relevant 22 to -- to networking. Queuing is this -- just like a 23 graph is a mathematic model of a -- of a network, 24 you can talk about queues as the model of doing	Page 88 1 see like how is this single server queuing system 2 being used in the 64 node? 3 MR. DAVIS: Objection. Form. 4 THE WITNESS: So there are at least 5 two possible ways that one could simulate that 6 one would be plausible. One is that you have a 7 single server per node and that server is 8 responsible for a queue of packets that want to 9 leave the node. And each time that server 10 goes, it takes a packet, sees that it wants to 11 leave the node, at which of the four links it 12 should travel on and it sends it on that link. 13 And then it goes on to the next packet. 14 Another option is that you would have a 15 queue/server per transmission link. And all 16 four of the transmission links, each of them 17 has a server, a single server running and 18 pushing packets out onto that transmission 19 link. Those reflect different types of 20 hardware that you might want to simulate. And 21 I would need to hunt in order to see if he's 22 clear on which of those he is choosing to use. 23 Q. Yeah, if you can tell me which one that 24 Shoubridge uses, that would be great.

Page 89 1 A. All right. So he's not a hundred percent 2 firm on this, but from my reading I would infer, 3 with reasonably strong confidence, that he placed a 4 different server -- a different queue on each of the 5 outgoing transmission links. 6 Q. And can you point to how you arrived at 7 that conclusion? 8 A. So I include that from the fact that he 9 talks about, in the -- in the first line of this 10 page, about a user packet transmitted from the node 11 is copied and broadcast on all outgoing links. 12 Q. Where -- 13 A. This is on the first line of page three. 14 And then I combine that with the fact that he says 15 that transmission links function as a single server 16 queue. All right. So these transmission links to 17 me mean the -- the individual links, four of which 18 are coming out of each node. And so from that, 19 again, I infer that he's put a separate queue on 20 each of the outgoing transmission links. 21 Q. So each node has a separate server -- has 22 a separate single server queuing system, would you 23 agree? 24 A. Each -- actually, each node would have	Page 91 1 grid networks to have four server queuing systems? 2 MR. DAVIS: Objection to form. 3 Q. For each node? 4 MR. DAVIS: Objection to form. 5 THE WITNESS: So, again, the -- the 6 Manhattan network is a -- is it typical for 7 Manhattan networks? So I'll back up to what I 8 was saying before, that there are sort of two 9 natural models of your network. One is that 10 you kind of have one transmitter that uses all 11 of the outgoing links. Another is that you 12 have one transmitter per outgoing link. So in 13 the case of a Manhattan network where you have 14 four outgoing links, it is quite natural to 15 model each of those outgoing links as its own 16 queue of outgoing packets. 17 Q. And just to be clear, the purpose of the 18 single server queuing system is to -- is for 19 transmission? 20 MR. DAVIS: Objection to form. 21 THE WITNESS: The purpose of this 22 single server queuing system is to hold the 23 packets that need to be transmitted. 24 Q. Has --
Page 90 1 four. One for each outgoing link. 2 Q. So each node of the 64 node network has 3 four single server queuing systems? 4 A. Is modeled as four single server queuing 5 systems, yes. Of course, clearly they are -- they 6 are a piece of the node, right? So it is the node 7 that has these four neighbors and this -- is the -- 8 the origin of traffic and is deciding to copy 9 packets and send them out and so forth. It's kind 10 of like its hands, extensions of the node. 11 Q. And just to be clear, each node, when it 12 models four single server queuing systems, it's -- 13 those single server systems are completely different 14 for each node in a -- in a 64 node network, right? 15 MR. DAVIS: Objection to form. 16 THE WITNESS: If I understand 17 correctly what you're saying, yes, that's 18 correct. 19 Q. So they are completely independent of each 20 other? 21 MR. DAVIS: Same objection. 22 Q. Is that what you're saying or -- 23 A. Yes, that's what I'm saying. 24 Q. Okay. Is that typical for Manhattan	Page 92 1 A. And then to transmit them one at a time. 2 Q. Is there any other functionality for the 3 single server queuing system? 4 A. Well, as I said, queuing theory is an 5 incredibly broad area of study and there are all 6 sorts of things that are modeled as single server 7 queuing systems, but in this particular article 8 that's what he's using the server queuing system 9 for. 10 Q. Queuing packets for transmission? 11 A. Yes. If I could take another short break. 12 Just -- just take two minutes. 13 VIDEO TECHNICIAN: The time now is 14 12:25 p.m. Off the record. 15 (Recess taken.) 16 VIDEO TECHNICIAN: The time is 17 12:31 p.m. On the record. 18 Q. Can I direct your attention to page three, 19 right above the -- the sentence of describing the 20 Poisson arrival rate. It says that infinite link 21 queues are modeled to ensure that packet discard 22 results solely from routing table uncertainty, loop 23 formation and link failure. 24 A. Yes.

Page 93 1 Q. What is meant by routing table 2 uncertainty? 3 A. Shoubridge is studying a situation where 4 networks are changing. Each time a network changes, 5 some of the routes that were originally appropriate 6 for that network become inappropriate. In those 7 situations you need a process for updating your 8 routing tables to correct to the -- to the proper 9 routes but those updates take time, which means that 10 the routing tables that you have at any given time 11 might be out of date. And so they may end up 12 sending your packet somewhere that can't actually 13 get to the destination. You know, one example of 14 this might be routing tables where, for some reason, 15 you've got two nodes pointing at each other. So 16 they just ping-pong the packet back and forth and it 17 never actually gets to where it's supposed to go. 18 In the real world there are -- there are other 19 things that can go wrong which will create sort a of 20 black hole on the Internet where packets go in and 21 they -- they never come out. So it's just one of 22 the things that can prevent a packet from arriving 23 at its intended destination. 24 Q. What type of routing table does Shoubridge	Page 95 1 And you say your distance to that node is one 2 greater than that neighbor because you can 3 reach that node by sending a packet to that 4 neighbor and then having them follow their 5 distance to that node. So that is the sort of 6 procedure for computing distances based on 7 talking to your neighbors. The routing tables 8 contain that information about which node is it 9 that is one closer to the given destination. 10 So, again, you look up by destination, that 11 will give you your -- your next hop in the 12 route. 13 Q. Where are these routing -- routing tables 14 maintained, is it in each node or somewhere else? 15 MR. DAVIS: Objection to form. 16 THE WITNESS: So this is a -- the 17 purpose of this, in general, is to serve as a 18 distributed routing protocol. And so each node 19 is responsible for maintaining its own routing 20 tables. 21 Q. Can you go to the -- the paragraph 22 underneath simulation model on page two, where 23 it's -- it's the next to the last sentence, says 24 routing algorithms are executed within the same
Page 94 1 maintain? 2 MR. DAVIS: Objection to form. 3 THE WITNESS: Sorry, can you repeat 4 your question? 5 Q. What type of routing tables does 6 Shoubridge maintain? 7 MR. DAVIS: Objection to form. 8 THE WITNESS: So Shoubridge focuses on 9 -- for his routing table -- for his routing 10 based algorithms he focuses on what's known as 11 minimum hop routing, which says that the 12 desired path for a particular packet is the 13 shortest path, the fewest hops from the source 14 to the destination. And there are several 15 well-known procedures for computing what those 16 paths should be. This is actually what is 17 also, roughly speaking, used in the Border 18 Gateway Protocol that I discussed earlier. 19 Essentially, in order to find -- well, for 20 starters, if you want to compute your distance 21 from a given node, what you do is you talk to 22 all of your neighbors and you ask them what 23 their distance to that node is. And your -- 24 you find the one that's closest to that node.	Page 96 1 nodes and update control messages are exchanged 2 between neighboring nodes for the purpose of 3 maintaining routing tables. 4 A. Yes. 5 Q. Can you explain what that sentence means? 6 A. Sure. So the first part of the sentence 7 is referring back to the previous sentence, which 8 says that each node functions as a sort of user 9 traffic. So these packets have to originate 10 somewhere. Notionally they are coming from outside 11 of the network or are being created and then they 12 have to be delivered. So you could have a 13 simulation where some of the nodes are responsible 14 for originating the traffic and other nodes are 15 responsible for routing the traffic. He is drawing 16 the distinction that in his model the same nodes are 17 both the origins of their own traffic and the nodes 18 that route other traffic. The second half, which 19 says that update control messages are exchanged 20 between neighboring nodes, is exactly what I was 21 just describing, it's sort of in this minimum hop 22 count, or shortest path routing, the way you figure 23 out what those shortest paths are is by asking your 24 neighbors what their distances are and then sort of

Page 97 1 computing over that to figure out what your distance 2 is. 3 Q. What are these control messages that are 4 updated? Do you see where it says update control 5 messages? 6 A. Yeah, it's not that the control messages 7 are updated. These are control messages for 8 updating your routing tables. 9 Q. Can you explain what the control messages 10 for updating routing tables are? 11 A. So, again, notionally, at a high level, 12 what you do is you send your neighbors a list of 13 your distances to all of the destinations. That's 14 the information that they need in order to 15 receive -- in order to compute their distances. 16 Q. Can you go to the second column of page 17 two where it describes -- starts with, since the 18 routing procedures are triggered by link cost change 19 events, G has essentially fixed topology. Do you 20 see that? 21 A. Yes. 22 Q. What does it mean by an essentially fixed 23 topology? 24 A. So, again, if we focus down on the -- the	Page 99 1 Q. So the solid lines would be the part 2 that's fixed in the Manhattan grid? 3 A. No, the solid and dashed lines would be 4 the fixed part and what's changing is whether a line 5 is solid or dashed. 6 Q. Do you see on the last sentence of that 7 paragraph it says, this simplified approached 8 requires no topology control as a particular 9 neighbor -- a particular nodes' neighbor at any 10 given time always belong to the same subset of nodes 11 as originally defined in G? 12 A. Yes. 13 Q. Can you explain what that sentence means? 14 A. So he's saying that, since I know that 15 there are exactly four nodes who I could ever be 16 connected to, it's very easy for me to sort of 17 represent my state. I don't need to have some 18 arbitrarily large, long list of nodes that might be 19 my neighbors. I just have to say for these four 20 nodes, which of the -- which of those four links are 21 currently working or not working. 22 Q. And it's always going to be the same 23 subset of nodes? 24 A. In -- again, in this grid network that
Page 98 1 point that he's making here is -- can be true about 2 any graph, but just in order to make it specific 3 let's talk about the -- the Manhattan grid that he 4 ultimately chooses to simulate. What he's saying is 5 he's not going to sort of arbitrarily add other 6 edges and sort of change the -- the shape of the 7 network. Instead he's going to think of there being 8 this one network, the grid but that some of the 9 edges fail and recover. So it's a single fixed grid 10 structure where you now make some of the edges 11 disappear temporarily and then come back, but 12 under -- but they are all -- all the edges you're 13 talking about are the edges of this underlying grid 14 topology. 15 Q. What do you mean by underlying grid 16 topology? 17 A. Again, what he's saying is, I'm going to 18 start with grid and now I'm going to make some of 19 the edges of the grid disappear and come back. So, 20 you know, it's like, I'll use solid lines for the 21 edges that are currently alive and dashed lines for 22 the edges that are currently dead, but it will be -- 23 you'll see a grid made of solid and dashed lines at 24 any time.	Page 100 1 he's choosing to simulate, yes, there will be this 2 set of four neighbors that will -- is all the 3 neighbors that you'll ever have. 4 Q. And that's regardless of link failures, 5 correct? 6 A. Well, no, I mean, the way we generally 7 talk about links, when a link has failed, that node 8 stops being your neighbor temporarily, but he's 9 still your potential neighbor. And when the link 10 recovers, that node would become your neighbor 11 again. 12 Q. Do you see where it says, there's only two 13 possible states, a link is either up, providing good 14 error free transmission or the link has failed, 15 providing no useful transmission at all? 16 A. Yes. 17 Q. What is -- where are these two states 18 stored or is there like a -- how is the topology 19 maintained in these states? 20 A. So, again, you're simulating something 21 that's happening in the real word. In the real 22 world, these states are stored in the real world, 23 even if the link is up or not. In the simulator, 24 depends how you chose to implement the simulator.

Page 101 1 The state has to be represented in the simulator. 2 Q. The simulator -- okay. The state of up or 3 down is represented in the simulator? 4 A. He may have chosen to represent the 5 individual nodes tracking this information or he may 6 have just sort of decided to keep it in the 7 simulator and make use of it at the appropriate 8 time. 9 Q. Is it fair to say that the Manhattan grid 10 network topology described in Shoubridge is 11 essentially a fixed network topology? 12 MR. DAVIS: Objection to form. 13 THE WITNESS: So with the proper 14 interpretation of fixed, right, and that is why 15 Shoubridge is saying it. So he's not saying 16 that the network is completely unchanging 17 because he is modeling edges coming and going 18 but he is modeling that there is this 19 underlying grid that -- that doesn't change and 20 that -- that edges of that grid fail and 21 recover. 22 Q. Is there an overlay grid as well? Are you 23 familiar with that term? 24 A. I'm familiar with the term overlay, yes.	Page 103 1 THE WITNESS: Shoubridge is not 2 specifying whether the network he's simulating 3 is a real network or an overlay network, and it 4 doesn't matter. 5 Q. Why is -- doesn't it matter? 6 A. Because what he's studying is this 7 network, right? I mean, what he's simulating is a 8 network and he talks about it having, you know, 9 radios and such, which suggests he's simulating a -- 10 a physical network, but what he's studying is a 11 grid. And you could create a grid shaped overlay if 12 you wished and make use of Shoubridge's simulations 13 in order to understand what the behavior of that 14 grid shaped overlay would be. 15 Q. I believe you referred to Shoubridge 16 simulating a packet radio network, is that right? 17 Referring to page three where it talks about X 25 18 packet layer protocol. 19 A. Well, that's used not only in radio 20 networks but, yes, that -- that sentence mentions 21 packet radio. 22 Q. What are packet radio networks? 23 A. Well, so I talked before about packet 24 networks. And packet radio networks are packet
Page 102 1 Q. Okay. So what does overlay mean? 2 A. I presume you're referring to overlay 3 network? 4 Q. Correct. 5 A. Yeah, so an overlay network is a powerful 6 and broadly adopted strategy for leveraging some of 7 these layering ideas that -- that I spoke about 8 before. In many circumstances you need a network 9 with certain properties and you can think about 10 simulating that network on top of a different 11 network. So, you know, in a video conference 12 situation you might -- or an audio distribution 13 situation, you might want to act as if all of the 14 nodes are directly connected to each other and able 15 to send information directly to each other. That 16 may not be physically true. So you will create a 17 layer, an overlay layer, where you can just say send 18 a message to this node. So from your perspective, 19 it's as if that node is connected to you. That 20 connection is simulated somewhere in the lower 21 network layers. 22 Q. So does Shoubridge have an overlay 23 network? 24 MR. DAVIS: Objection to form.	Page 104 1 networks that use radio for their link layer to move 2 information between adjacent -- between neighbors. 3 Q. And is X 25 an example of a packet radio 4 network? 5 A. No, X 25 is a protocol, but as he says, 6 modified versions have been proposed for packet 7 radio -- modified versions of that protocol have 8 been proposed for packet radio networks. 9 Q. Are you familiar with the X 25 packet 10 layer protocol? 11 A. No. 12 Q. Do you have any understanding of what the 13 X 25 packet layer protocol is? 14 A. Only from what is said here, right, that 15 it is a packet layer protocol. That it has a packet 16 size. That it includes, right, that the -- that the 17 packet length is fixed at 128 octets. I can infer 18 that there is some sort of representation of the 19 destination and possibility the source of the packet 20 included in the -- the protocol. 21 Q. Are you familiar with what X 25 packet 22 layer protocol is used in other than packet radio 23 network? 24 A. Well, it says here that it's also used in

Page 105 1 wide area networks. 2 Q. What -- can you explain what a wide area 3 network is? 4 A. Wide area network is usually -- the term 5 is used to draw a distinction from local area 6 network. A local area network is what you might 7 have in your office to connect all your computers in 8 your office. Wide area network is like the 9 Internet, something that is intended to deliver 10 packets to remote destinations through many 11 different authorities, many different -- different 12 pieces of -- of management. 13 Q. Previously we were talking about TCIP 14 (sic) protocol. 15 A. PCP/IP. 16 Q. Are you familiar with whether X 25 is a 17 TCP/IP protocol? 18 A. No, I'm not. 19 Q. Just to be clear, the packet radio network 20 is the underlying network described in Shoubridge? 21 MR. DAVIS: Objection to form. 22 THE WITNESS: No, Shoubridge mentions 23 packet radio networks as one place where the X 24 25 protocol has been used and says that he's	Page 107 1 Q. Have you heard of the term adaptive 2 routing? 3 A. Adaptive routing. I don't think I've 4 encountered it frequently. Have I heard it? I -- I 5 don't recall whether I've heard those two words put 6 together. 7 Q. Do you have any understanding of what 8 adaptive routing is? 9 A. I have an inference, which I would, of 10 course, use context to -- to be sure that I was 11 correct but, you know, if I'm qualifying routing as 12 being adaptive, I would say that that is to 13 differentiate it from static routing, where you just 14 specify the route once and, you know, whatever 15 happens you're going to keep using those routes. 16 So, adaptive routing would adapt to, for example, 17 changes in the network. It would find different 18 routes if the ones you started with didn't work. 19 Q. Is Shoubridge describing an adaptive 20 routing? 21 MR. DAVIS: Objection form. 22 THE WITNESS: Yes, the -- the 23 protocols that Shoubridge describes are 24 adaptive in that they do adapt to changes in
Page 106 1 basing some of his -- some of the parameters of 2 the system on those -- of the X 25 protocol. 3 Q. Previously -- previously we were talking 4 about links as used in Shoubridge. What is a link? 5 A. So a link generally refers to the layer 6 below the network layer. It's often a piece of 7 hardware or refers to a piece of hardware that is -- 8 that provides a direct physical connection between 9 nodes. Those correspond to the edges of the graph 10 or rather generally when you draw a graph to model a 11 network, you make an edge for each link. These are 12 the -- the -- the links connect you to machines that 13 you can talk to directly. You don't need to have -- 14 you don't need to learn routes to them because 15 you -- you know they are there by the fact that they 16 are talking to you from the other side of the -- of 17 the link. 18 Q. Is it fair to say that a link is a direct 19 connection between two nodes? 20 MR. DAVIS: Objection to form. 21 THE WITNESS: I think that that's a 22 fair -- a fair statement. I would perhaps 23 invert it and say that you -- you generally 24 refer to the direct connections as links.	Page 108 1 the network. 2 Q. Do you know how to analyze the performance 3 of an adaptive routing algorithm? 4 MR. DAVIS: Objection to form. 5 THE WITNESS: I'm afraid that that's 6 too broad a question for me to answer. 7 Q. Are you aware of performance being 8 analyzed in the context of adaptive routing 9 algorithms? 10 MR. DAVIS: Same objection. 11 THE WITNESS: Yes. 12 Q. What is your understanding of the 13 performance being analyzed? 14 MR. DAVIS: Same objection. 15 THE WITNESS: Yeah, so I'd like to 16 sort of pin down what you're asking. I said 17 yes, I'm aware of performance being analyzed 18 because I am aware of various papers, 19 researchers who have studied the performance of 20 various algorithms, but what are you -- what 21 did you want to ask about that? 22 Q. How -- how to analyze the performance of a 23 routing algorithm -- or adaptive routing algorithm? 24 MR. DAVIS: Objection to form.

Page 109

1 THE WITNESS: So there are a number of
2 metrics that I would use in studying routing --
3 sorry, that I have seen researchers use, in
4 studying routing algorithms. These include
5 things like the latency, the delay that those
6 algorithms provide in -- in delivery, the way
7 they handle congestion, the -- the amount of
8 bandwidth they consume, the amount of state
9 that needs to be maintained at individual nodes
10 in order for those routing algorithms to
11 operate, how fault tolerant those routing
12 algorithms are, what kinds of failures they can
13 handle, how frequent those failures can be
14 without disrupting the behavior of the routing,
15 whether they are safe stabilizing, whether if
16 the network settles down, those routing
17 algorithms reach sort of a good operating
18 state. So there -- there are many different
19 dimensions which I have seen and would choose
20 to evaluate routing algorithms.
21 Q. Would you agree that it's not possible to
22 analyze an adaptive routing algorithm performance
23 for typical networks used in real life?
24 MR. DAVIS: Objection. Form.

Page 110

1 THE WITNESS: No, I wouldn't agree
2 with that at all. Again, this is something
3 that networking researchers do a lot. They try
4 to analyze the performance of their routing
5 algorithms.
6 Q. And how would -- how would -- would that
7 analysis take place?
8 A. Through experimentation, simulation,
9 sometimes mathematical modeling can be used. There
10 are many -- many ways to evaluate a routing
11 algorithm.
12 Q. Can I direct your attention to the
13 introduction of Shoubridge where it talks about, in
14 addition to successfully forwarding user traffic
15 between source and destination nodes in a
16 communication network, the routing function
17 generally seeks to optimize performance criteria
18 such as network utilization or throughput or perhaps
19 average delay. Do you see that sentence?
20 A. Yes.
21 Q. What is referred to here as a
22 communications network, what is that?
23 A. What is a communications network?
24 Q. Correct.

Page 111

1 A. I mean, to me, it just has the plain
2 meaning, right? It is a networking supporting
3 communication.
4 Q. Is there any difference between a
5 communications network and a network?
6 A. Well, again, networks can include road
7 networks, social networks, biological networks.
8 It's a very broad concept.
9 Q. So communications network is one form of a
10 network?
11 A. Yes.
12 Q. So when Shoubridge mentions networks in
13 his paper, he's always referring to a communications
14 network?
15 A. I think that can be taken from the
16 context, yes.
17 (Whereupon a document was marked as
18 Exhibit-4 for Identification.)
19 Q. You've been handed a document marked as
20 Exhibit Number 4. Do you recognize Exhibit Number
21 4?
22 A. Yes, I do recognize this exhibit.
23 Q. What is Exhibit Number 4?
24 A. So Exhibit Number 4 is an article by Lin

Page 112

1 et al., studying gossip and deterministic flooding
2 protocols.
3 Actually, so -- I don't need to stop now
4 but if we're going to switch to Lin, would people like
5 to use this time for lunch?
6 MR. DAVIS: It's up to you.
7 Q. Yeah. I'm okay.
8 A. I don't know what the plan is. If we're
9 going to make this sort of shift to a completely
10 different document, it might make it -- what time is
11 it?
12 THE COURT REPORTER: It's one o'clock.
13 THE WITNESS: So it would be a
14 plausible breaking time. If we're still going
15 to be going back and forth, I'm happy to
16 continue until there's a good stopping point.
17 Q. Well, we're still going to be going back
18 and forth, yeah, but if you want to take a break.
19 A. All right, yeah. If you see a good
20 stopping point within a half an hour, I'd be okay
21 with that, but if it's all going to be the same, I'm
22 happy to break now.
23 Q. Let's just break now. That's fine.
24 A. Okay.

Page 113 1 VIDEO TECHNICIAN: Time now is 2 1:02 p.m. Off the record. 3 (Recess taken.) 4 VIDEO TECHNICIAN: Time is 1:45 p.m. 5 On the record. 6 Q. Please direct your attention to Exhibit 7 Number 4. We were just talking about that before 8 the break. 9 A. Yes. 10 Q. What did you say Exhibit Number 4 was? 11 A. Exhibit Number 4 is an article by Lin et 12 al., studying certain kinds of broadcasting 13 protocols and their performance. 14 Q. What page are you on of Exhibit Number 4? 15 A. Oh, I'm sorry, I'm on page five of the 16 exhibit. 17 Q. Page five. Okay. So -- 18 A. It begins with a declaration. 19 Q. So what portion of Exhibit Number 4 are 20 you saying is the Lin reference? 21 A. That's starting at page five. 22 Q. So you're saying the Lin reference is page 23 5 to page 28 of Exhibit Number 4? 24 A. Yes.	Page 115 1 DirectPlay. Let me find the matching -- I'm sorry, 2 paragraph 78. I understand that Lin is prior art. 3 Q. So what date exactly is your understanding 4 that Lin was first published? 5 A. If you turn to page three of the -- of 6 Exhibit-1004. 7 Q. Yes. 8 A. You can see the declaration of Glenn 9 Little, that this article was submitted on 10 November 18 and -- and modified on November 23, 1999 11 and became available to the public no later than 12 November 23, 1999. 13 Q. So your only understanding of the 14 publication date of Lin is based upon the Glenn 15 Little declaration; is that correct? 16 A. That's correct. 17 Q. You're not relying on any other type of 18 information for the publication date of Lin, 19 correct? 20 A. Correct. 21 Q. And the publication date is -- that Glenn 22 Little says is November 23, 1999? 23 A. Yes. 24 Q. Previously you were talking about page
Page 114 1 MR. DAVIS: Objection to form. 2 Q. What is page five of Exhibit Number 4? 3 What does it show? 4 A. What does page five -- oh, I'm sorry, page 5 five shows sort of -- of a title page, sort of 6 access page for -- for this article. The article 7 itself actually begins on page eight. 8 Q. Okay. So just to clarify, the Lin 9 reference is pages 8 to 28 of Exhibit Number 4, 10 correct? 11 A. Yes. 12 Q. Do pages 8 through 28 of Exhibit Number 4 13 indicate what date Lin was first published? 14 A. I see no such indication. 15 Q. Do you have any understanding of when Lin 16 was first published? 17 A. So if you turn to page 36 of my 18 declaration regarding the 634 patent, which is the 19 1964 IPR. 20 Q. Page 36 you said? 21 A. Yes, paragraph 74. 22 Q. Okay. 23 A. You'll see that I understand that -- that 24 the Lin reference is prior art -- I'm sorry, that's	Page 116 1 five of Exhibit Number 4. Did you print page five? 2 A. I haven't printed anything that's here. 3 Q. Did you ever speak to Glenn Little? 4 A. No. 5 Q. Have you ever spoke to Peter Shoubridge? 6 A. Not to my recollection. 7 Q. How about the author of Lin, meaning John 8 Lin? 9 A. Not that I recall. 10 Q. Do you see where -- if you go to page 11 eight of Exhibit Number 4, under the introduction, 12 it says, consider the problem of designing a 13 protocol that broadcasts all -- to all -- broadcasts 14 messages to all processors in a network. 15 A. Yes. 16 Q. What's your understanding of what Lin 17 means by protocol? 18 A. So as we discussed earlier, my 19 interpretation for a protocol is that it is a 20 description of a way of doing things which often 21 incorporates a description of how parts of 22 information should be laid out so that different 23 participants can interpret it properly. 24 Q. Would it be fair to say that Lin is

Page 117 1 concerning the problem of designing a set of rules 2 for broadcasting messages to all processors in a 3 network? 4 MR. DAVIS: Objection. Form. 5 THE WITNESS: What do you mean by -- 6 sorry, is it my understanding -- sorry, could 7 you repeat the question? 8 Q. Is it fair to say that Lin is regarding 9 the problem of designing a set of rules regarding 10 broadcasting messages to all processors in a 11 network? 12 MR. DAVIS: Objection. Form. 13 THE WITNESS: So I don't think that 14 rules necessarily covers it because there's 15 also, you know, we're talking about rules and 16 procedures, right? Rules is not -- it's not 17 only about what you are allowed, not allowed to 18 do but also, you know, there's an -- there's an 19 algorithmic component. When this happens, do 20 this. When this happens, do that. 21 Q. So what's the difference between a rule 22 and -- and procedures? 23 A. So I'd be cautious about trying to be -- 24 about ascribing too much weight to an exact	Page 119 1 Q. You mentioned a deterministic flooding 2 algorithm -- 3 A. Uh-huh. 4 Q. -- is that correct? 5 What is a deterministic flooding 6 algorithm? 7 A. Well, this is a term that Lin uses to 8 distinguish the particular flooding procedure that 9 he is studying from gossip protocols, which are 10 often randomized. 11 Q. Can you point to where you're referring to 12 in Lin -- 13 A. Sure. 14 Q. -- deterministic flooding and gossip 15 protocols? 16 A. Sure. Section three of Lin, page three, 17 discusses gossip protocols. And I think his first 18 mention of deterministic flooding is in the fourth 19 paragraph of page three. 20 Q. Fourth paragraph of page three. Can you 21 describe which -- how does the paragraph start? 22 A. Oh, I'm sorry, page two -- or -- sorry, 23 exhibit number nine -- exhibit number page nine. 24 It's page two of the article. It says that -- on --
Page 118 1 definition of rule or procedure, but if we talk 2 about, you know, plain English, I think it's 3 reasonable to say, you know, that it's a -- it's 4 a -- a rule that you -- that you get -- that you -- 5 that's actually a bad example. It's a rule that you 6 don't cut in line, right? So it's -- it's saying 7 something that you should not do. And procedures -- 8 I mean, rules can also be things that you should do. 9 Like you should look both ways before you cross the 10 street. A procedure, I would generally interpret it 11 as, you know, here is -- here is how you should do 12 this. Here is -- here are the steps that you should 13 take. A rule can be a constraint. A procedure is 14 generally sort of algorithmic. 15 Q. What is the algorithmic aspect of Lin? 16 A. So there are a number of different 17 algorithmic aspects in Lin. One is the flooding 18 algorithm, the deterministic flooding algorithm that 19 he describes. There's also, you know, the gossip 20 algorithm that he describes, and there's also the 21 algorithmic aspect of constructing a Harary graph, 22 overlaying that Harary graph on some other network 23 and using it to then carry the deterministic 24 broadcast.	Page 120 1 on line four of the fourth paragraph it says that 2 unlike gossip the protocol is deterministic. 3 Q. How is gossip not deterministic? Is it 4 because it's random, is that what you said? 5 A. So the gossip protocols that he discusses 6 here are probabilistic protocols. You choose random 7 partners to communicate with in the network. 8 Q. And the flooding -- the deterministic 9 flooding is -- is deterministic because it's not 10 random, correct? 11 A. Yes, those are -- those are held as 12 complimentary to each other. 13 Q. You also mentioned Harary graphs? 14 A. Yes. 15 Q. That's used with the deterministic 16 flooding, correct? 17 A. Yes. 18 Q. Harary graphs are not used with gossip 19 protocols, correct? 20 A. Well, they could be. I don't think that 21 they do. 22 Q. To be clear, does Lin describe using 23 Harary graphs with gossip protocols? 24 A. I don't see a discussion of gossip over

Page 121 1 the Harary graph. 2 Q. Can you describe what Lin's gossip 3 protocol is? 4 A. Well, it's not Lin's gossip protocol. 5 He's referring to well known gossip protocols. The 6 general idea of the gossip protocol is that each 7 node in a round will randomly identify some other 8 node to communicate with and send it information. 9 And the next round it will pick a different random 10 node. As the nodes sort of randomly mingle and pass 11 information back and forth, that information 12 eventually spreads throughout the entire network. 13 Q. Do you see on the first paragraph, page 14 nine of Exhibit Number 4, the second to last 15 sentence of the first paragraph says, no processor 16 has a specific role to play and so a failed 17 processor will not prevent other processors from 18 continuing sending messages? 19 A. Yes. 20 Q. Can you explain what that sentence means? 21 A. So in these gossip protocols every 22 processor is executing the same algorithm for 23 disseminating information. None of them is doing 24 anything different from any of the others. In	Page 123 1 links, pretending they are not there, we may be 2 inventing links that aren't really there and just 3 pretending that they are there, and sending 4 information between nodes that are not directly 5 connected. So they are -- they are choosing a 6 particular graph structure and using that to define 7 which nodes are going to be declared to be 8 neighbors, declared to be linked and sending 9 messages only along those links. That is -- sorry, 10 sending -- sending direct messages only along those 11 links. The flooding protocol will mean that those 12 messages will ultimately spread to the rest of the 13 network. 14 Q. So using deterministic flooding, the 15 messages are not sent to every link that a processor 16 has, but only the -- the edge links? 17 MR. DAVIS: Objection to form. 18 Q. Is that fair? 19 A. So, again, to be clear about this notion 20 of overlays and links, sometimes when you talk about 21 links, you're talking about physical links in a -- 22 in a network and protocols and such. The overlay 23 concept, which is also being used here, could -- 24 could work equally well in Shoubridge, is that it's
Page 122 1 this -- in -- in doing this work, obviously, they 2 might be doing other things at the same time, but -- 3 but the specification of this -- of this algorithm 4 describes what every processor should be doing. 5 Every processor should be randomly connecting to a 6 random node and -- and exchanging information with 7 it. 8 Q. Regarding the deterministic flooding, do 9 you see the fourth paragraph talks about the 10 protocol effectively superimposes a communications 11 graph on top of the processors and sends messages 12 only along the edges of this graph? 13 A. Yes. 14 Q. What is meant to send messages only along 15 the edges of this graph? 16 A. This gets towards the overlay network 17 concept that we were previously discussing. Instead 18 of looking at the physical topology of the network, 19 the algorithm itself is making up its mind about 20 what -- what nodes it should be -- it will choose to 21 consider as connected by a link. These are the 22 nodes that can actually -- will -- will actually 23 communicate with one another. Even though other 24 nodes could -- we may be ignoring certain actual	Page 124 1 not about which nodes are physically connected. 2 It's about which nodes you are declaring to be 3 connected. And so some of the links that you're 4 using might not really exist at all. They might 5 need to be implemented by sending messages along 6 some path in the network. Some links that do exist, 7 some -- some physical links that do exist might be 8 ignored. You may pretend that they are not there. 9 So there is no required consistency between the 10 overlay network and the underlying network. 11 Q. What do you mean ignored? Do you mean 12 that messages are not sent on those links? 13 MR. DAVIS: Objection. Form. 14 THE WITNESS: It's a little bit more 15 complicated than that because, for example, I 16 might pretend that that link is not there as an 17 edge, but I might simulate some other link 18 using a path that actually traverses that edge. 19 So I would then be sending messages along the 20 physical link, but I would not be thinking of 21 it as a link in the overlay network. 22 Q. So is it fair to say there are some links 23 that a processor has that messages are not sent on 24 using deterministic flooding?

Page 125 1 MR. DAVIS: Objection to form. 2 THE WITNESS: It's not clear -- sorry, 3 it's -- that's not inherent. That is, it could 4 be that there are links that are not used for 5 messages or it could be that all the links are 6 used for messages, depending on what overlay 7 network you've chosen to use and how you've 8 chosen to overlay it. 9 Q. How about for Lin, in Lin are there some 10 links that are not -- that messages are not sent 11 along? 12 MR. DAVIS: Objection. Form. 13 Q. For a processor? 14 MR. DAVIS: Objection. Form. 15 THE WITNESS: So Lin does not impose a 16 decision about that, right? Again, Lin says, 17 use this overlay network and send messages on 18 this overlay network. Depending on how you 19 choose to do that overlay, there might be 20 underlying links that are not used or all the 21 underlying links might be used. 22 Q. But Lin doesn't say either way, correct? 23 MR. DAVIS: Objection to form. 24 THE WITNESS: What Lin is describing	Page 127 1 MR. DAVIS: Objection. Form. 2 THE WITNESS: So we again have to be 3 careful about link, because we have two 4 different networks that we're talking about, 5 right? So -- 6 Q. What's a better terminology? 7 A. So the -- the whole idea of Lin is that he 8 only sends messages along edges of the overlay 9 graph, right? These edges of the overlay network 10 might correspond to links, might correspond to paths 11 and are mapped onto the underlying network in a 12 variety of ways. 13 Q. So edges are not necessarily links? 14 A. That is correct. 15 MR. DAVIS: Objection. Form. 16 THE WITNESS: So the edges in one 17 layer are not necessarily links or edges of the 18 other layer. 19 Q. And what's the difference between an edge 20 and a link? 21 A. The difference is primarily vocabulary. 22 That if I'm talking in the language of graph -- 23 graph theory, I'll generally use the word edge. If 24 I'm talking about a network, I'll generally use the
Page 126 1 is the rules for sending messages over the 2 overlay network and does not specify that you 3 must do one thing or another in terms of 4 placing that overlay network on top of the 5 underlying network. 6 Q. Does Lin specify sending messages along 7 every link of the overlay network? 8 MR. DAVIS: Objection. Form. 9 THE WITNESS: So if you look on page 10 15 of the exhibit, section 42. 11 Q. Go ahead. 12 A. It there observes that the overhead 13 flooding Harary graph is -- most emphasis is on the 14 swan. The processor that starts the broadcast, 15 sends t messages and then all the other processors 16 send no more than t minus one messages. This 17 reflects the fact that each processor, aside from 18 the originator, sends the message everywhere except 19 to the node where it received the message. And so 20 this -- this calculation is based on the idea that 21 each link in the Harary is carrying a message. 22 Q. So every link that a processor has, has 23 messages sent along it? 24 A. Every link --	Page 128 1 term link. And, again, it's important to -- to 2 remember that these might not be physical. 3 Q. You mentioned an overlay network. Is -- 4 is the Harary graph an overlay network? 5 A. The Harary is a graph. It's a 6 mathematical object. So what Lin is proposing is to 7 use its structure to define an overlay network. 8 Q. So the -- so Lin doesn't actually 9 implement an overlay network but proposes a Harary 10 graph for implementing a overlay network; is that 11 correct? 12 MR. DAVIS: Objection to form. 13 THE WITNESS: Well, Lin does implement 14 it in order to study its performance. 15 Q. So would it be fair to say that Lin's 16 Harary graph is an overlay network? 17 A. Again, the Harary graph is a graph. Lin 18 is using that graph as an overlay network or is 19 proposing to use that graph as an overlay network. 20 Q. Is there an underlying network disclosed 21 by Lin? 22 A. So if you look at page 24 of the exhibit, 23 they described a simulation that they used in order 24 to assess the performance of their idea. One of

Page 129 1 those networks was a single Ethernet network, 2 bearing 32 processors. And the other was wide area 3 network with three Ethernets connected by a router. 4 Q. Which portion of page 24 are you referring 5 to? 6 A. Sorry, this is the last paragraph of page 7 24, spilling over to page 25. 8 Q. So the simulated Ethernet based networks, 9 is that what you're saying is an underlying network, 10 correct? 11 A. Correct. 12 Q. Can you go -- I'm sorry, can you go to 13 page ten of Exhibit Number 4? Do you see where -- 14 A. Sorry, do you mean exhibit numbering page 15 ten? 16 Q. Yes. Actually, to make it more clear, Lin 17 at page three. It talks about, one example of the 18 use of a graph more richly connected than a tree is 19 discussed in bracket 11. In this work they show how 20 a hypercube graph can be used instead of a tree to 21 disseminate information for the purposes of garbage 22 collection? 23 A. Yes. 24 Q. What's your understanding of what is meant	Page 131 1 THE WITNESS: Yes, I read that as 2 referring to the citation 11. 3 Q. Are you familiar with what is discussed in 4 citation 11? 5 A. I can't recall it at present. 6 Q. Just to be clear, that's referring to page 7 20, the -- the work of R. Friedman and S. Manor and 8 K. Guo, scalable stability detection using logical 9 hypercube, correct? 10 A. Correct. 11 Q. Do you know what a -- a logical hypercube 12 is? 13 A. So a hypercube is a family of graphs which 14 is defined by a given dimension. A one -- a one 15 dimensional hypercube is a line. A two dimensional 16 hypercube is square. A three dimensional hypercube 17 is a cube, and it has the -- sort of the natural 18 edges. It's related to the grid concept, right? 19 But now instead of having many rows and many 20 columns, you just have two rows and two columns, but 21 as you go up in dimensions, you're able to fit more 22 and more nodes into that. And logical hypercube 23 here again refers to the fact that this not 24 necessarily the physical structure of the network
Page 130 1 by to disseminate information for the purposes of 2 garbage collection? Or -- or first, I should say, 3 what is -- what are these two sentences talking 4 about? 5 A. So they are discussing related work. 6 Somebody else discussed the use of a -- a different 7 structure. So before this they were talking about 8 using a spanning tree as an overlay for spreading 9 information through a network. Again, the edges of 10 the tree may or may not be in correspondence with 11 the underlying network links, but -- so first they 12 covered this idea of sort of flooding that 13 information over the tree. And here they discuss 14 the fact that you could instead flood that 15 information over a -- or strike that -- you could 16 disseminate this information over a hypercube, which 17 is another abstract family of graphs that are 18 frequently used to create networks. 19 Q. When they say in this work they show how a 20 hypercube could be used instead of a tree to 21 disseminate information for the purposes of garbage 22 collection, they are not referring to Lin's work, 23 right? 24 MR. DAVIS: Objection to form.	Page 132 1 that you're using but is instead a -- a logical 2 construct that you use to steer your information 3 dissemination. 4 Q. What type of information is disseminated 5 using the hypercube? 6 A. I don't -- 7 MR. DAVIS: Objection to form. 8 Q. Specifically described here, where it 9 says, disseminate information for the purposes of 10 garbage collection? 11 A. I don't know. I don't recall having read 12 that paper carefully. So I -- I mean I could -- I 13 won't speculate, but it's something having to do 14 with garbage collection, which is deciding when you 15 can reclaim information that's no longer needed by a 16 system. 17 Q. So -- 18 A. And you use that space for something else. 19 Q. Would you happen to know where this 20 garbage collection information is disseminated to? 21 A. No, not -- not just by looking at this. 22 Q. Does Lin describe disseminating 23 information using the deterministic flooding? 24 A. Yes, they do.

Page 133 1 Q. What type of information is disseminated? 2 Sorry. Let me rephrase it, make it more clear. Lin 3 does not use a deterministic flooding to disseminate 4 information for the purposes of garbage collection, 5 right? 6 MR. DAVIS: Objection. Form. 7 THE WITNESS: So Lin is describing a 8 procedure for disseminating information and is 9 staying agnostic as to what type of information 10 you might wish to disseminate. It could work 11 with anything. If you wanted to use it to 12 disseminate garbage collection information, go 13 ahead. 14 Q. What format is this information in, could 15 be any type or something or -- 16 A. So, again, this is something on which Lin 17 is agnostic. They are thinking about disseminating 18 information, presumably through some packet system. 19 Essentially any information can be broken up into 20 packets and -- and disseminated. 21 Q. So is it fair to say when Lin says 22 disseminate information, it's at least in the form 23 of packets? 24 MR. DAVIS: Objection. Form.	Page 135 1 specify parameters in the simulation, just like 2 Shoubridge's ideas could be applied to any 3 network, but when you want to test them, you 4 have to pick one and try it. Lin is doing the 5 same thing here. 6 Q. The one that Lin picks and tries is the 7 1K-byte packet, right? 8 A. Yes. 9 Q. Do you see under scalability -- there's a 10 section on page 16 of Lin, below scalability, it 11 says that both protocols run simple algorithms that 12 are based on slowly changing information. Both 13 require a processor to know the identity of the 14 other processors on its local area or small wide 15 area network and a small amount of constant 16 information, the rule used to identify neighbors 17 versus the constants B and F? 18 A. Yes. 19 Q. How does -- sorry -- in -- in flooding 20 what's the type of knowledge required for a 21 processor to know the identity of the other 22 processors or -- let me rephrase that. In flooding 23 how -- how does a processor know the identity of the 24 other processors on a network?
Page 134 1 THE WITNESS: So to the extent that we 2 take packet to mean sort of a finite blob of 3 information, yes, I think that is what Harary 4 is considering. 5 Q. Can I direct your attention to page 18 of 6 Lin? Do you see where it says each message was 7 contained in a 1K-byte packet? 8 A. Yes. 9 Q. What's a 1K-byte packet? 10 A. So this is Lin's description of their 11 simulation, which they used to study their idea. 12 And 1K-byte packet just refers to the fact that the 13 size of those packets was one kilobyte, which when 14 you combine that with the -- the bandwidth and delay 15 metrics that they specify in the same paragraph, 16 tells you how long it's going to take for packets to 17 get from one node to the next. 18 Q. So is it fair to say that Lin's Harary 19 graph used for deterministic flooding is 20 disseminating 1K pack -- 1K-byte packets? 21 MR. DAVIS: Objection to form. 22 THE WITNESS: So, again, Lin is 23 describing a general idea. They are then using 24 a simulation to test it. And they had to	Page 136 1 A. Well, so flooding posits that -- posits 2 that you know the identity of the processors you 3 need to flood to, the identities of your neighbors. 4 Q. But how does that occur? Is there like 5 some kind of information stored at each node? 6 A. So all that flooding requires is that it 7 happened. That you somehow know who your neighbors 8 are. It could be done in a variety of ways. 9 Q. How does the flooding over a Harary graph 10 described by Lin in that situation, how does a 11 processor know the identity of the other processors? 12 A. Sure. So the implication in Lin is that 13 the processor is aware of its -- of its Harary graph 14 neighbors, right, with which other nodes are to be 15 considered its neighbors with these virtual 16 connections from the Harary graph. 17 Q. Is there some kind of data structure that 18 stores this information in the node? 19 A. That could be a plausible option for doing 20 it. 21 Q. Can you give -- give an example, a 22 specific example? 23 A. I could store in -- I could store with my 24 node a list of the other nodes that are to be taken

Page 137 1 as my Harary graph neighbors. 2 Q. Is that list of other nodes, is that 3 called a routing table? 4 MR. DAVIS: Objection to form. 5 THE WITNESS: I would not think of my 6 list of neighbors as a routing table. 7 Q. How is it different from a routing table? 8 A. Well, the goal of a routing table is to 9 give me information on how to route. And a list of 10 neighbors by itself is not necessarily going to give 11 me enough information to route. 12 Q. What type of information is required to 13 qualify as a routing table? 14 A. So the general use of a routing table is 15 that it gives you a way to determine, for a given 16 destination, where you should next send a packet 17 that has that destination. 18 Q. Can you give me examples of what would 19 qualify? 20 A. The routing tables used in the Internet 21 protocol, right? So, again, every -- every node has 22 a list or is -- is often compressed in various ways 23 but essentially it's a list saying, if this is your 24 destination, send the packet to this neighbor.	Page 139 1 your hardware, for example, right? So if I know I 2 have four outgoing wires, you know, I don't really 3 need to have a list of the names of the neighbors 4 that are on the other ends of those wires. I can 5 sort of see that I have four outgoing wires. In a 6 sense that's all I need for flooding in that 7 environment. Highly regular networks you may also 8 be able to represent the set of neighbors using some 9 sort of function that you can compute instead of 10 having to explicitly list them. 11 Q. In Lin's Harary graph based flooding the 12 processors do explicitly list -- store a list of 13 neighbors, right? 14 A. Well, it's not entirely clear because Lin 15 talks about the rule used to identify neighbors. He 16 doesn't just say the list of neighbors, but 17 certainly giving a list of neighbors would be an 18 easy way to specify that rule. 19 Q. The portion where it talks about 20 adaptability, do you see where it says, flooding 21 protocol requires the processors to use the same 22 Harary graph? 23 A. Yes. 24 Q. What does it mean for processors to use
Page 138 1 Q. When it says the small amount of constant 2 information, what does -- what is the small amount 3 of constant information that flooding uses? 4 A. As they say here, it's the rule used to 5 identify neighbors. That is it could be the -- the 6 explicit list of the neighbors or it might be some 7 function that you could compute in order to 8 determine who the neighbors are. 9 Q. For flooding where -- where is this 10 explicit list of neighbors stored? 11 A. So if you turn back to the previous page, 12 the sentence -- last sentence leads in, right? That 13 both protocols require a processor to know the 14 identity of the other processors on its network and 15 a small amount of information. So the implication 16 is that that information is stored on the 17 processors. 18 Q. So in flooding each processor has a -- an 19 explicit list of neighbors, correct? 20 A. That's common, but is not necessarily 21 true. 22 Q. Can you describe why? 23 A. Well, if you consider, for example, a -- 24 that -- that set of neighbors may be implicit in	Page 140 1 the same Harary graph? 2 A. Lin's protocol is based on this idea of 3 having an overlay network. In the overlay network 4 each node is told or each nodes knows that certain 5 other nodes in the network are its neighbors. If 6 these instructions are inconsistent, then behaviors 7 might not happen as you expect, right? That is 8 if -- if half the nodes are thinking of one Harary 9 graph and the other half of the nodes are thinking 10 of a different Harary graph, then it's possible that 11 they might not talk to each other at all because 12 none of the Harary graph edges in their imagined 13 network connect to the other half of the nodes. 14 Q. Regarding adaptability, is Lin saying that 15 gossip is more adaptable than flooding? 16 A. It's showing in this paragraph, Lin is 17 arguing that from a practical point of view, they 18 are similar. Harary graph flooding does require 19 this common view of what the -- the graph is, which 20 can be a challenge if, for example, nodes are coming 21 back into the network after being disconnected from 22 the network and you have to pick a new Harary graph 23 that includes the node which was temporarily 24 disconnected and -- and brought back, but Lin's

Page 141 1 argument is that this is sort of slowly changing 2 information, and you can manage this process of 3 updating the Harary graph to reflect node -- node 4 joint needs, recoveries and such fast enough that 5 you can think of it as a stable fact and that 6 every -- for a particular broadcast, you can 7 actually use the -- you can actually expect that 8 everybody will know about the same Harary and the 9 broadcast will work. 10 Q. What do you mean by slowly changing 11 information? 12 A. Well, this is a term from Lin. 13 Q. On page 16? 14 A. Yes, second to last line. 15 Q. What does Lin mean by slowly changing 16 information? 17 A. So, of course, slow is a relative term, 18 but Lin is trying to differentiate things like 19 the -- again, a node coming back after having been 20 completely disconnected from the network versus the 21 temporary failure and recovery of a single edge. 22 The whole point of this Harary graph protocol is 23 that -- not the whole point -- but one of the 24 appeals of this Harary graph protocol is that if an	Page 143 1 Q. That would be a permanent change? 2 A. Well, again, permanence is relative, 3 right? In this case it's for the duration of that 4 player being in the game. 5 If I could take a quick break. 6 Q. Sure. Go ahead. 7 VIDEO TECHNICIAN: Time now is 8 2:40 p.m. Off the record. 9 (Recess taken.) 10 VIDEO TECHNICIAN: Time is 2:45 p.m. 11 On the record. 12 THE WITNESS: So would it be okay for 13 me to elaborate a little bit on the answer I 14 just gave? 15 Q. Oh, I was -- I was going to move onto a 16 different topic but if you feel it's necessary. 17 A. I just want to avoid leaving something 18 potentially confusing on the table. 19 Q. What did you want to clarify? 20 A. Well, so I talked about sort of slow 21 change and permanence and so forth, and I really 22 want to emphasize that these are all relative terms 23 and that, you know, at the scale of networking 24 you've got individual packets traveling through the
Page 142 1 edge fails or even if a node fails, there are other 2 paths for the information to take. And so those 3 sorts of short paths, temporary failures, they'll 4 work -- you can continue to use the same Harary 5 graph and you'll route around the failures. You do 6 want, if there is a permanent change to the network, 7 right, a node has become permanently disconnected or 8 permanently added, then you want to update the 9 Harary graph to reflect that, but his argument is 10 that these sort of permanent changes happen 11 relatively slowly compared to brief disappearances 12 or recoveries of nodes. 13 Q. Can you describe an example of a permanent 14 change? 15 A. Sure. I mean Lin is -- Lin discusses 16 their simulation of 32 computers on a LAN, maybe one 17 day I decide to plug-in a 33rd computer. That's a 18 small change, or maybe I just, you know, again, 19 we're talking about the -- sort of the gaming 20 context, if I have, you know, 16 people playing a 21 game on a LAN and a 17th person wants to join the 22 game on their computer, I have to extend the overlay 23 network to incorporate that new computer into the 24 game.	Page 144 1 network which is very fast and you've got evolution 2 of the network, right? So if I talk about, you 3 know, a network being permanent or, you know, even 4 if I talk -- like in Shoubridge, I think we talked 5 about fixed topologies, those are for a given time 6 scale, you think of them as stable, but over a 7 longer time frame, pretty much every imaginable 8 network does change. Nodes come, nodes go. And so 9 as you vary your time scale perspective, you can 10 just talk about different things as being 11 fixed/permanent or as being slow changing or as 12 being rapidly changing. 13 Q. And you said in Shoubridge is a fixed 14 topology, I guess, it's just in a smaller time 15 scale, is that -- 16 A. Like we talked about Shoubridge is running 17 this simulation on a fixed -- on this fixed topology 18 network. We talked about links failing. Now, 19 actually those are changes to the topology, right? 20 That -- that link is -- is not there. There is now 21 a new graph of available connections. That's a 22 different -- it's a different topology, but at a 23 slower time scale you think of that as a temporary 24 failure in a -- in this fixed grid topology. At an

Page 145 1 even larger time scale, everybody will recognize 2 that you're going to be adding, you know, networks 3 grow, all right, so you'll probably be adding nodes 4 to whatever network. So Shoubridge wanted to 5 concentrate on a particular time scale. So he 6 didn't -- he didn't choose to vary the network but 7 it's clear that that is something that will happen. 8 Q. So just to be clear that the Shoubridge is 9 focusing on a slower time scale; is that right? 10 MR. DAVIS: Objection. Form. 11 Q. As you're distinguishing fast and slow? 12 A. Shoubridge -- Shoubridge is studying a 13 particular scale of time, right? In a context where 14 we know that there are many scales and they are all 15 relevant, right? So there's the scale of individual 16 edge sort of packet deliveries. There's the scale 17 of individual edge failures. And there's the scale 18 at which nodes are being added to or removed from a 19 network. All of these things are in mind as we're 20 thinking about networks and their evolutions. 21 Q. How would you characterize adding nodes to 22 a network? Is that considered a fast or slow time 23 scale? 24 A. You know, it depends on the -- on the kind	Page 147 1 to changing networks, then they need to adapt 2 faster than the network actually changes. 3 Q. Anything else that you wanted to clarify? 4 A. No. 5 Q. Have you heard the term peer to peer? 6 A. Yes. 7 Q. What -- what does peer to peer mean? 8 A. So peer to peer reflects a class of 9 networks, of applications where the nodes are peers. 10 We -- we've seen some verbiage about this already 11 where -- where no node has a special role to play. 12 And peer to peer specifically tends to refer to the 13 fact that the peers communicate with one another 14 directly. 15 Q. Is it a type of protocol? Is peer to peer 16 a type of protocol? 17 A. There are protocol -- there are protocols 18 for peer to peer systems. Peer to peer is a design. 19 It's an approach to -- to building networks or 20 solving problems. 21 Q. Is it fair to say that in a peer to peer 22 system -- strike that. 23 Is it fair to say that peer to peer 24 systems are distributed systems without any
Page 146 1 of network, right? Again, it's all relative, right? 2 When the phone company adds -- builds a new base 3 station and connects it to their network, that's 4 kind of slow. It's a physical change, right? When 5 you have a -- a video chat happening and people drop 6 in and drop off, that's a change to the network, 7 which is happening more rapidly, right? Social 8 networks also have a certain pace of change as 9 people become friends and stop being friends. 10 Q. How is the pace of change in Shoubridge 11 and Lin, is it the fast or slow? 12 MR. DAVIS: Objection to form. 13 THE WITNESS: So starting with Lin, 14 Lin makes this point that their protocol is 15 based on slowly changing information. What 16 does that mean? Does it mean a particular 17 clock speed? No. What they are referring to 18 is that the set of nodes participating in this 19 broadcast channel is changing slower than their 20 ability to select and disseminate the choice of 21 Harary graph. And it's similar with -- with 22 Shoubridge, right? They are not specifying a 23 time scale. Everything has to be relative. If 24 you -- if parts of your protocol need to adapt	Page 148 1 centralized control? 2 MR. DAVIS: Objection to form. 3 THE WITNESS: I would say that that is 4 the ideal of a peer to peer system, but that in 5 practice that ideal may not be perfectly met. 6 Q. Why is that? 7 A. There may be things that you need 8 centralized control for in order to do well. 9 Q. So a peer to peer system -- so Lin can 10 qualify as a peer to peer even if it has a 11 centralized control, correct? 12 MR. DAVIS: Objection. Form. 13 THE WITNESS: I think one has to be 14 careful. I would be cautious about following 15 -- about using sort of a black and white label. 16 I'm familiar with various systems that have -- 17 have strong peer to peer aspects but may not be 18 perfectly peer to peer. If the whole system is 19 centrally controlled, that would sort of lean 20 away from my calling it a peer to peer system 21 but it might still have peer to peer aspects. 22 Q. What do you mean by peer to peer aspects? 23 A. Where a lot of the nodes are acting in -- 24 in roughly the same way without need to get involved

Page 149

1 with that centralized controller, talking to each
2 other directly would be an important part of that
3 peer to peer characterization.
4 Q. But just to be clear, having centralized
5 control, you wouldn't consider that being an -- an
6 important part of peer to peer criteria, correct?
7 A. Correct, I would not say that centralized
8 control is a criterion of peer to peer systems.
9 Q. Is it fair to say that in peer to peer
10 systems there are nodes that are constantly joining
11 and leaving the system?
12 MR. DAVIS: Objection to form.
13 THE WITNESS: I would not say that
14 that is a necessary characteristic of peer to
15 peer systems. It is -- there -- there are many
16 peer to peer systems that do have that
17 characteristic.
18 Q. Would having nodes that are constantly --
19 THE COURT REPORTER: I'm sorry, say
20 that again.
21 Q. Would having nodes that are constantly
22 joining and leaving the system, would that be
23 considered a characteristic of a peer to peer
24 system?

Page 150

1 MR. DAVIS: Objection to form.
2 THE WITNESS: So, as I said before, it
3 is not an inherent characteristic of peer to
4 peer systems to have nodes joining and leaving.
5 I do believe that many systems have that
6 characteristic.
7 Q. But just to be clear, I'm not asking
8 whether it's absolutely necessary, but I'm just
9 asking you if having nodes that constantly join and
10 leave, would that be considered a peer to peer
11 characteristic?
12 MR. DAVIS: Objection to form.
13 Q. Does that make sense?
14 MR. DAVIS: Same objection.
15 THE WITNESS: Well, I'm -- I'm not
16 sure how it differs from the previous question.
17 That is, my answer is the same, that there
18 are -- you can -- having a stable system where
19 the nodes are fixed does not preclude it being
20 a peer to peer system. There certainly are
21 peer to peer systems where nodes are constantly
22 joining and leaving.
23 Q. Just to be clear, I believe you're
24 answering something different. I'm not asking about

Page 151

1 whether it's necessary.
2 A. Okay.
3 Q. I'm just asking whether having nodes that
4 are constantly or continuously joining and leaving,
5 is that a characteristic of a peer to peer system?
6 MR. DAVIS: Objection to form.
7 Q. Is that one characteristic of a peer to
8 peer system?
9 MR. DAVIS: Objection to form.
10 THE WITNESS: Again, I think it's --
11 I'm not sure exactly what characteristic means,
12 right? If you're saying it is a defining
13 characteristic, it is necessary, then my answer
14 again is no. Are there peer to peer systems
15 that have that characteristic, yes.
16 Q. Is it fair to say that a peer to peer
17 system is intended to be running continuously
18 forever?
19 MR. DAVIS: Objection to form.
20 THE WITNESS: I certainly don't think
21 of that as a necessary characteristic.
22 Q. Is it fair to say a peer to peer system,
23 the system membership is dynamic?
24 MR. DAVIS: Objection to form.

Page 152

1 THE WITNESS: Again, I would say that
2 that is not -- that is not fundamental to the
3 notion of a peer to peer system, that many
4 systems have that characteristic.
5 Q. Many peer to peer systems --
6 A. Many peer to peer systems have that.
7 Q. What would you say is the core operation
8 of most peer to peer systems?
9 MR. DAVIS: Objection to form.
10 THE WITNESS: I'm afraid I'll need the
11 question clarified.
12 Q. Is it fair to say that the cooperation in
13 most peer to peer systems is the efficient location
14 of data items?
15 MR. DAVIS: Objection to form.
16 THE WITNESS: It's fair to say that
17 that is the cooperation of some peer to peer
18 systems. I think there are plenty of other
19 applications of peer to peer.
20 Q. Just to be clear, my -- my question was --
21 was -- was not some, but whether the cooperation in
22 most peer to peer systems is the efficient location
23 of data items?
24 MR. DAVIS: Objection to form.

Page 153

1 THE WITNESS: That's sort of a
2 quantitative question that I don't feel I could
3 answer effectively, since I haven't done a
4 survey of all of the existing peer to peer
5 systems.
6 Q. Would you say that in a -- sorry -- would
7 you say that the defining characteristic of a peer
8 to peer system is where no node has a specific role
9 to play?
10 A. Again, as an ideal, yes, the ideal of a
11 peer to peer system would be for all nodes to
12 have -- sorry, would be for no node to have a
13 specific role to play. Sometimes you don't get all
14 the way to that ideal, but that is the -- the
15 platonic ideal of a peer to peer system.
16 Q. What's the difference between -- what do
17 you mean by an ideal? Like is that -- you're saying
18 that's not really realistic or --
19 A. No, it depends on the other constraints
20 that you're -- that you're facing, right? So at
21 some point I co-wrote an article sort of arguing
22 that you can't really do -- you can't really do web
23 search efficiently in a peer to peer system. So if
24 you wanted your system to support web search, it

Page 154

1 would have to have a part that was not peer to peer
2 in order to permit you to do web search.
3 Q. And why is that?
4 A. In a peer to peer environment it would
5 require too much -- too much data transmission.
6 Q. Can you -- can you elaborate? What do you
7 mean by having -- requiring too much data
8 transmission?
9 A. So we wrote this article studying the idea
10 of, you know, if you imagine you wanted to run the
11 web on a peer to peer system, one of the things you
12 might want to do is web search. So you've got all
13 of your web documents spread out all over the peer
14 to peer system and now you want to do a search. How
15 do you do it? Well, it turns out that your
16 options are either to sort of send the query to all
17 of the computers and ask each of them to send
18 anything matching back or to send all the documents
19 to a single computer so they can figure which one is
20 matching. Both of those take a lot of communication
21 bandwidth. So it's not just a good choice for a
22 peer to peer system.
23 Q. Do peer to peer systems typically take up
24 a lot of bandwidth?

Page 155

1 MR. DAVIS: Objection to form.
2 THE WITNESS: Again, typically is one
3 of those slippery words. There have been peer
4 to peer systems that took up a lot of
5 bandwidth. And so one of the things that you
6 look at when you're designing a peer to peer
7 system is how much bandwidth it's going to use.
8 It's one of many criteria that you might try to
9 manage.
10 Q. Are you aware of what a client server
11 architecture is?
12 A. Yes.
13 Q. How is that different from peer to peer?
14 A. So the idea behind client server is that
15 there is a server which provides a service and that
16 clients connect to that server in order to receive
17 that service. Again, in the perfect ideal of a
18 client server system the clients only talk to the
19 server. They don't need to be aware of each other
20 at all or at least they don't need to directly
21 communicate with each other at all.
22 Q. Are you aware of -- of what it means
23 for -- sorry -- strike that.
24 Are you aware of what peer to peer

Page 156

1 communications means?
2 A. I mean I read it as peer to peer -- as the
3 communication in a peer to peer system,
4 communication from one peer to another.
5 Q. Can you provide an example of a peer to
6 peer communication?
7 MR. DAVIS: Objection. Form.
8 THE WITNESS: An example of a peer to
9 peer communication. Sure, in -- in Bittorrent,
10 when I sort of contact a computer and ask it to
11 -- ask it to perhaps download a file from it or
12 to get some blocks of a file, that would be a
13 peer to peer communication.
14 Q. But how would that be different from two
15 nodes communicating? How is that different from --
16 A. Well, the qualification is that these two
17 nodes are acting as peers. They are -- they are
18 both performing the same sorts of activity. They
19 are not playing special specific -- actually, this
20 is a good example, right? So when I request a file
21 over Bittorrent and the other computer delivers it
22 to me, well, it's the sender and we're -- and I'm
23 the recipient. It's not -- we're doing slightly
24 different things, but our -- our roles are the same

Page 157 1 because I can turn around and become the sender of 2 that file to somebody else. So the two of us are 3 peers and we're talking to each other. So that's 4 peer to peer communication. 5 Q. So when you say acting as peers, do you 6 mean that the roles can be -- can be reversed for 7 any set of nodes? 8 MR. DAVIS: Objection. Form. 9 THE WITNESS: So, again, I think it's 10 risky to make absolute statements, that 11 reflects the ideal that in peer to peer 12 communication, no special role to play, right? 13 So everybody can do the same thing. There 14 might be an exception where only one computer 15 can do a certain thing in this sort of general 16 approaching the goal of -- of peer to peer 17 perfection. 18 Q. What do you mean by peer to peer 19 perfection? 20 A. Again, peer to peer is -- let me see if I 21 can think of a suitable metaphor. So I guess I'll 22 say that in a -- in a perfect peer to peer system 23 there would be no specialized roles at all, every 24 node would play exactly the same role and would have	Page 159 1 declaration on Lin, page 55, I discuss a 2 disclosed peer to peer topology for a 3 particular game. And I point out that there is 4 a particular node that is serving as a session 5 host. So taken literally, there is one node 6 that is currently playing a different role than 7 the other nodes because the other nodes are not 8 acting as session hosts. However, I still 9 think that this qualifies as a peer to peer 10 system because of everything else that's going 11 on has a peer to peer nature, that the nodes 12 are communicating directly to each other, that 13 all the nodes but the session host are 14 essentially -- that a lot of information is 15 being exchanged that does not involve the 16 session host at all, that's being directly 17 communicated and this data is being managed by 18 the individual nodes. So this to me fulfills 19 the characterization of a peer to peer system, 20 despite the fact that it is not perfectly peer 21 to peer. 22 Q. Well, what criteria would mean that a 23 system would not satisfy a peer to peer? 24 A. I think that's kind of like asking like
Page 158 1 exactly the same capabilities, right? But if the 2 roles are a little bit different, slightly different 3 capabilities, I think it would still often be 4 described as a peer to peer system. 5 Q. So peer to peer would be a -- a very 6 lenient kind of a protocol, is that what you're 7 saying or -- 8 MR. DAVIS: Objection. Form. 9 THE WITNESS: Again, peer to peer is 10 not a protocol. It's a design, right? It's a 11 way of thinking about how your system is going 12 to be -- is going to operate. 13 Q. But I'm trying to understand what the 14 boundaries of what qualifies as a peer to peer or 15 not. And it's -- it's kind of confusing when you're 16 saying that there is certain rules but then they -- 17 they don't necessarily need to be met. I mean, 18 that's what I'm understanding. Is that what you're 19 saying? Like what would you say -- 20 MR. DAVIS: Objection. 21 Q. -- would be the boundary -- would not 22 qualify as a peer to peer system versus what would? 23 MR. DAVIS: Objection. Form. 24 THE WITNESS: So if you look at my	Page 160 1 what criteria would characterize somebody as being 2 not tall, right? I mean, there's taller and less 3 tall. You can certainly say this system is more 4 peer to peer than this system. And there's a 5 certain point at which it's undoubtedly a peer to 6 peer system, but you can sort of mix peer to peer 7 qualities with other -- other kinds of designs. And 8 if they are mixed that way, do you say that it is a 9 peer to peer system or that it's not a peer to peer 10 system, right? It's a little bit of both. 11 Q. And just to be clear, having a centralized 12 control would not disqualify a network from being a 13 peer to peer network? 14 MR. DAVIS: Objection to form. 15 THE WITNESS: If I saw a system where 16 everything was a centralized control, I would 17 need a reason to consider it as a peer to peer 18 system. The centralized control is one of the 19 things that I would -- that would sort of lead 20 me away from thinking of it as a peer to peer 21 system. 22 Q. But it's not necessarily required to be a 23 peer to peer system, right? 24 MR. DAVIS: Objection to form.

Page 161

1 Q. Having a lack of centralized control?
2 MR. DAVIS: Objection to form.
3 THE WITNESS: Sorry -- sorry, could
4 you restate the question?
5 Q. Having no centralized control, is that a
6 necessary requirement of a peer to peer system?
7 MR. DAVIS: Objection. Form.
8 THE WITNESS: So I would say that it
9 is part of the idea of peer to peer systems,
10 that they do not have centralized control but
11 that I might call a system a peer to peer
12 system even if there was some centralized
13 control involved, as long as it weren't many
14 other peer to peer aspects.
15 Q. What are these other aspects?
16 A. As I was discussing the fact that the
17 nodes are, for the most part, operating
18 independently of this centralized control, that they
19 are exchanging information directly with each other,
20 instead of through some server process.
21 (Whereupon a document was marked as
22 Exhibit-5 for Identification.)
23 Q. You've been handed an exhibit marked as
24 Exhibit Number 5. Exhibit Number 5 is entitled U.S.

Page 162

1 Patent Number 6,829,634. Do you recognize Exhibit
2 Number 5?
3 A. Yes, I do.
4 Q. What is Exhibit Number 5?
5 A. This is what we've been referring as the
6 634 patent. The patent on which I've submitted a
7 declaration.
8 Q. Previously we were talking about an
9 overlay network and an underlying network. Do you
10 remember that?
11 A. Yes, I do.
12 Q. Does this 634 patent claim a overlay
13 network?
14 A. Yes, it does.
15 Q. Which claim language refers to or -- yeah,
16 which claim language in the claims is an overlay
17 network?
18 A. So I may have misheard your first question
19 when you asked about whether this patent proposes an
20 overlay network. My answer was referring to the
21 fact that in the detail description, first two
22 lines, it describes a broadcast technique in which a
23 broadcast channel overlays a point to point
24 communication network.

Page 163

1 Q. Let me clarify. Do -- do the claims of
2 the 634 patent require an overlay network?
3 A. So can you repeat your question?
4 Q. Do the claims of the 634 patent require an
5 overlay network?
6 A. So the claims of the -- of the 634 patent
7 do not use the phrase overlay network.
8 Q. Do any claim terms in the 634 patent
9 correspond to an overlay network?
10 MR. DAVIS: Objection. Form.
11 THE WITNESS: So the broadcast -- the
12 634 patent is describing a broadcast channel,
13 right, which is implemented using a
14 communications network that provides peer to
15 peer communications, right? So in a sense that
16 broadcast channel is an overlay on the peer to
17 peer network that you start with.
18 Q. So the peer to peer is the underlying
19 network and the broadcast channel is the overlay
20 network, right?
21 MR. DAVIS: Objection to form.
22 THE WITNESS: Well, to be clear, that
23 peer to peer network might itself be an overlay
24 on yet another network layer. You can have

Page 164

1 overlays on overlays.
2 Q. But in your interpretation, is the peer to
3 peer communications, is that a -- an underlying
4 network or is that another overlay network?
5 MR. DAVIS: Objection. Form.
6 THE WITNESS: So what is clear in the
7 claims is that the peer to peer network
8 underlies the broadcast channel that is being
9 provided in the claims. These claims do not
10 specify whether the peer to peer network is an
11 overlay network or not.
12 Q. How about in claim one, does claim one --
13 are there any claim terms in claim one that
14 corresponds to an overlay network?
15 MR. DAVIS: Objection. Form.
16 THE WITNESS: Can you restate the
17 question?
18 Q. Are there any claim terms in claim one
19 that correspond to an overlay -- an overlay network?
20 MR. DAVIS: Objection. Form.
21 THE WITNESS: Claim one is agnostic
22 about the network that's being used.
23 Q. Does claim one -- are there any claim
24 terms in claim one that correspond to an underlying

Page 165

1 network?

2 MR. DAVIS: Objection to form.

3 THE WITNESS: The question again?

4 Q. Let me rephrase. The -- claim one -- when

5 you said that it's agnostic to an overlay network --

6 requiring an overlay network, does that mean that

7 this computer network described in claim one can be

8 either an overlay network or an underlying network?

9 MR. DAVIS: Objection to form.

10 THE WITNESS: I think that it would be

11 possible for either kind of network to fit this

12 claim, yes.

13 Q. So, just to be clear, the -- the computer

14 network in claim one where it says a non-routing

15 table based computer network, that would be a --

16 that can be an overlay network or it could be an

17 underlying network, correct?

18 MR. DAVIS: Same objection.

19 Q. Did you understand the question?

20 A. I wanted to read a bit and then I'll ask

21 you to restate it. All right. So repeat the

22 question, please.

23 Q. The non-routing table based computer

24 network described in claim one, that can be an

Page 166

1 overlay network or a underlying network; is that

2 correct?

3 MR. DAVIS: Objection to form.

4 THE WITNESS: So, first of all, it

5 makes sense to talk about an overlay network,

6 which implies an underlay network. Are you

7 trying to ask if it could also be an underlay

8 network that it has to have an overlay network

9 or just a network that's not an overlay

10 network?

11 Q. A network -- well, do you understand what

12 we're talking about overlay and underlying networks,

13 right?

14 A. Yes.

15 Q. And I'm just wondering if either an

16 overlay or an underlying qualifies -- can qualify as

17 a non-routing table based computer network?

18 MR. DAVIS: Same objection.

19 THE WITNESS: So, again, based on this

20 claim, the computer network being discussed

21 here could be -- you could fit this claim with

22 a computer network that is an overlay network.

23 Alternatively, you could be using the computer

24 network discussed here as the underlay for some

Page 167

1 other overlay network. Both of those are

2 not -- neither of those is excluded by this

3 claim.

4 Q. Do you see claim 19 discusses a

5 non-routing table based computer readable --

6 actually, strike that.

7 Do you see how claim ten discusses a

8 non-routing table based broadcast channel for

9 participants? Do you see that in claim ten?

10 A. Yes, I do.

11 Q. What's the difference between a

12 non-routing table based computer network and a

13 non-routing table based broadcast channel?

14 MR. DAVIS: Objection. Form.

15 THE WITNESS: What is the difference?

16 So when I talk about a broadcast channel, I'm

17 sort of implicitly describing the intended

18 purpose which is to broadcast, right? What I'm

19 going to use a broadcast channel for is for one

20 entity to broadcast information to other --

21 other entities. When I say that it's

22 non-routing table based, I'm saying that it's

23 not using -- that broadcast channel does not

24 have routing tables. The implementation of

Page 168

1 that broadcast channel does not define routing

2 tables for -- for carrying out that broadcast.

3 When I talk about a non-routing table based

4 computer network, it's not as -- what's the

5 word I'm looking for -- it's not as one hundred

6 percent obvious what the purpose of that

7 network is, right? But if I'm talking about a

8 non-routing table based communication computer

9 network, I can probably draw the inference that

10 the point being made is that information

11 delivery is achieved without use of routing

12 tables.

13 Q. What does it mean to broadcast?

14 A. Broadcast is delivering information from a

15 sender to all recipients of that information.

16 Q. What does the word -- what does channel

17 mean?

18 MR. DAVIS: Objection. Form.

19 THE WITNESS: In this context, I would

20 generally interpret channel as a -- something

21 that carries communications. So I would talk

22 about a communication channel, for example, a

23 television channel or, here, a broadcast

24 channel as a channel that carries broadcasts.

Page 169 1 Q. Is it a -- the channel a software or 2 hardware form? 3 MR. DAVIS: Objection to form. 4 THE WITNESS: A broadcast channel 5 has -- is -- is implemented in a variety of 6 ways, right? If I bring a megaphone into this 7 room, then my broadcast channel is the air. I 8 can also use software to implement a broadcast 9 channel, which is what a lot of these documents 10 are discussing. The channel is the thing which 11 carries the broadcast. 12 Q. So in the context of this 634 patent, what 13 is -- what is the thing that's carrying the 14 broadcast? 15 MR. DAVIS: Objection to form. 16 THE WITNESS: Sorry, your question 17 again? 18 Q. In terms of the 634 patent, what is the 19 thing that carries the broadcast? 20 MR. DAVIS: Objection. Form. 21 THE WITNESS: So as is laid out in 22 claim ten, right? The assertion is that the 23 broadcast channel comprises the communications 24 network that allows the participants to	Page 171 1 talks about participants? 2 A. Yes, I do. 3 Q. What's the difference between a 4 participant and a broadcast component? 5 MR. DAVIS: Objection. Form. 6 THE WITNESS: All right. Sorry, the 7 question again? You want to test the 8 difference between a participant and the 9 broadcast component? 10 Q. Yes. 11 A. So roughly speaking the participant is the 12 entity that wishes to send or receive information. 13 Many of the later claims talk about what the 14 participant might be, a computer, a process, a 15 thread. While the broadcast component is the thing 16 that actually receives that data and hands it off to 17 the participant who wishes to receive it or that 18 takes data that is supposed to be broadcast and 19 actually pushes it out onto the channel. 20 Q. Do you see where in claim ten it says, a 21 broadcast component that receives data from a 22 neighbor participant using the communications 23 network? Do you see that? 24 A. Yes, I do.
Page 170 1 participate -- communicate with each other, 2 various pieces of state information for the 3 participants and the -- in this context -- 4 software that actually implements whatever 5 protocol is being used to carry out the 6 broadcast. 7 Q. Are you referring to the broadcast 8 component? 9 A. Yes. 10 Q. So there would be some sort of software 11 application; is that fair? 12 MR. DAVIS: Objection. Form. 13 Q. Did -- did you understand my question? 14 A. I'm thinking about it. Sorry, can you 15 repeat the question? 16 Q. The broadcast component, is that a type of 17 software application? 18 MR. DAVIS: Objection to form. 19 THE WITNESS: So claim ten doesn't 20 speak to that. It simply says that it's a 21 component. It could have -- it seems 22 conceivable that it could be a hardware 23 component as well as a software component. 24 Q. Do you see where -- that claim ten also	Page 172 1 Q. What do you mean -- what does it mean to 2 use the communications network? 3 MR. DAVIS: Objection to form. 4 THE WITNESS: Sorry, so you asked what 5 it was to use the communications network? 6 Q. Yes. 7 A. So if you refer back to claim a -- part of 8 the -- sorry, part a of claim ten, this part a 9 specifies a communication network that provides peer 10 to peer communications between the participants. 11 And the implication for this final part is that the 12 broadcast information is carried on this peer to 13 peer communications network. 14 Q. So the communications network that's used 15 by the broadcast component has to be a 16 communications network that provides peer to peer 17 communications between the participants connected to 18 the broadcast channel, correct? 19 A. Yes. 20 Q. Previously you mentioned that participants 21 could be a computer or a process or an application 22 program; is that right? 23 A. Actually, I think I said -- 24 MR. DAVIS: Objection to form.

Page 173

1 THE WITNESS: I believe what I said
2 was as a computer or -- a computer or a process
3 or a thread.
4 Q. So any type of computer, process or thread
5 would qualify as a participant for claims one and
6 ten?
7 MR. DAVIS: Objection to form.
8 THE WITNESS: Any type of computer
9 process that would qualify as a participant? I
10 think that's too broad a statement, right?
11 There are all sorts of computer processes. In
12 order to qualify a participant -- as a
13 participant you would have to be doing these
14 things that are described in the claims.
15 Q. Do you have any understanding of what it
16 means to participate?
17 MR. DAVIS: Objection to form.
18 THE WITNESS: So your question again?
19 Q. Do you have any understanding of what it
20 means to participate?
21 MR. DAVIS: Same objection.
22 THE WITNESS: So I would understand
23 participate as to be a participant.
24 Q. And what -- is it fair to say that a

Page 174

1 participant has to participate in a non-routing
2 table based computer network?
3 MR. DAVIS: Objection to form.
4 THE WITNESS: So in the context of
5 this patent where it talks about participants,
6 it is saying in claim one that these
7 participants have to be -- have to be in a
8 non-routing table based computer network.
9 Q. And what does it mean to participate in a
10 non-routing table based computer network?
11 MR. DAVIS: Objection. Form.
12 THE WITNESS: It means that it sends
13 data to the other participants by sending the
14 data to each of its connections through its
15 neighbor participants, that it forwards data
16 that it has received from other participants
17 and the -- the participation is laid out in
18 this -- in this claim.
19 Q. So what it means to participate is laid
20 out in claims one and ten?
21 MR. DAVIS: Objection. Form.
22 THE WITNESS: So in order to fit these
23 claims, the participants need to be doing what
24 these claims say the participants do.

Page 175

1 Q. You mentioned a number of things that just
2 came up here, a participant must send the data
3 through each of its connections to its neighbor
4 participants, right?
5 A. Yes.
6 Q. When you're saying sending data through
7 each of its connections, does that mean that data
8 must be sent to every connection of the originating
9 participant?
10 MR. DAVIS: Objection. Form.
11 THE WITNESS: Sorry, your question
12 again?
13 Q. Sending the data through each of its
14 connections, does that mean that the data must be
15 sent through every connection of the originating
16 participant, meaning all -- all of the participants?
17 MR. DAVIS: Objection to form.
18 THE WITNESS: Yes.
19 Q. So sending to just one neighbor
20 participant of the originating participant wouldn't
21 qualify?
22 MR. DAVIS: Objection to form.
23 Q. Is that correct?
24 A. It does need to send the data to each --

Page 176

1 through each of its connections to its neighbor
2 participants, not just to one.
3 Q. When it says each of them, I'm asking
4 is -- does it mean all or --
5 A. That is how I interpret it, yes.
6 Q. Under claim one, do you see where it
7 cites, wherein the data is numbered sequentially so
8 that data received out of order can be queued and
9 rearranged?
10 A. Yes.
11 Q. What does it mean to rearrange?
12 A. If you're sending a stream of information
13 and you've broken it up into packets, those packets
14 can arrive out of order. If you stick them back
15 together in the same order, your message will be
16 garbled. So you can reorder those packets based on
17 the sequence numbers so that you get back the same
18 messages that were sent.
19 Q. And the queuing functionality described
20 here, what -- can you describe what that means?
21 A. Yeah, that refers to hanging onto a packet
22 that arrived out of order and waiting until the ones
23 that come before it arrive so that they can all be
24 put back into order.

Page 177 1 Q. So the queuing functionality and the 2 rearranging, they are distinct and different 3 functionalities, right? 4 MR. DAVIS: Objection to form. 5 THE WITNESS: What do you mean by 6 separate functionalities? 7 Q. Are they the same or are they different? 8 MR. DAVIS: Same objection. 9 Q. I can give you an example. In order to 10 rearrange, do you have to queue? 11 A. No, in order to rearrange, you don't have 12 to queue. 13 Q. Can you explain why? 14 A. Well, for example, I might choose to drop 15 something that I get out of order instead, wait for 16 it to arrive later in order. 17 Q. Do you see in claim eight it states, 18 wherein a computer hosts more than one participant? 19 A. Yes. 20 Q. What does it mean for a computer to host 21 more than one participant? 22 MR. DAVIS: Objection to form. 23 THE WITNESS: It means that more than 24 one of the participants in this broadcast	Page 179 1 the process or thread is actually executed on 2 that computer. 3 Q. What is this computer referring to here, 4 when it says, wherein a computer, is that another 5 participant or is that something different? 6 MR. DAVIS: Objection to form. 7 THE WITNESS: You mean in claim eight? 8 Q. Yes, correct. 9 MR. DAVIS: Same objection. 10 THE WITNESS: And the question again? 11 Q. Where it says, wherein a computer, what 12 does a computer refer to? 13 MR. DAVIS: Same objection. 14 Q. So you understand, where does it fit into 15 claim one? 16 MR. DAVIS: Same objection. 17 THE WITNESS: So it seems to me that 18 all you can really take away from claim one is 19 that there is a computer that has more than one 20 participant hosted on it -- I'm sorry, from 21 claim eight. 22 Q. So that computer is hosting all three or 23 one or more -- 24 MR. DAVIS: Objection to form.
Page 178 1 channel is on the same computer, with sort of 2 different notions of on, if the participant is 3 a player or a process or a thread, but they are 4 on the same computer. 5 Q. So hosting means on? 6 MR. DAVIS: Objection to form. 7 Q. Or does hosting mean a different -- 8 something different? 9 MR. DAVIS: Same objection. 10 THE WITNESS: Again, I think it means 11 different things depending on what the 12 participants are, right? If you think of 13 participants as people, it would mean having 14 more than one person sitting at the computer. 15 If the participants are computer processes or 16 threads, it would mean that they are executing 17 on the same computer. 18 Q. What does it mean to host? 19 MR. DAVIS: Objection to form. 20 THE WITNESS: What I just said, right? 21 If the participants are a person, then to host 22 would mean that the people are both at that 23 computer using it. If the -- if it's a process 24 or a thread, then I would take it to mean that	Page 180 1 THE WITNESS: It is a computer that 2 has more -- it is a computer that has more than 3 one participant hosted on it, yes. 4 Q. Is it your opinion that the 634 patent 5 claims the use of flooding? 6 MR. DAVIS: Objection to form. 7 THE WITNESS: So claim one asserts 8 that the originating participant sends data to 9 the other participants by sending the data to 10 each of its connections to its neighbor 11 participant, wherein each participant sends 12 data that it receives to its other neighbor 13 participants. That's a pretty good definition 14 of flooding. 15 Q. So just to be clear, claim one claims the 16 use of flooding, correct? 17 A. So I just want to be careful, in case 18 claims means something very specific here. It never 19 uses the word flooding in the claim, but it 20 describes something that is flooding. 21 Q. The same goes for claim ten, it doesn't 22 describe the term flooding but you're saying it 23 claims the use of flooding? 24 MR. DAVIS: Objection to form.

Page 181 1 THE WITNESS: So claim ten is a little 2 bit sloppier or looser because it asserts -- it 3 simply asserts that there is a -- oh, no, there 4 it is. Sorry, strike that. 5 So claim ten does describe a -- that each 6 participant has a broadcast component that receives 7 data from a neighbor participant and sends the 8 received data to its other participants. It 9 doesn't include the language that appears in claim 10 one, saying that the originating participant sends 11 data to the -- to each of its neighbors. 12 Q. But does claim ten also claim the use of 13 flooding? 14 A. Sorry, what was the question? 15 Q. Yes, does claim ten -- 16 A. -- claim the use of flooding. 17 Q. -- claim the use of flooding? 18 A. So flooding would fulfill claim ten. It 19 seems like there might be room for other things that 20 would also fulfill claim ten. 21 Q. So you wouldn't say that claim ten claims 22 the use of flooding, would you? 23 MR. DAVIS: Objection. Form. 24 THE WITNESS: So, again, any use of	Page 183 1 A. Lin or Shoubridge? 2 Q. Either one. Do you see it -- the legal 3 standards section? 4 A. Yes. 5 Q. Just regarding -- are you in the 6 Shoubridge one or the Lin one? 7 A. This is the Lin. 8 Q. Do you see in paragraph 65 you talk 9 about -- this is where you talk about obviousness, 10 correct? 11 A. Yes. 12 Q. And one of the factors is he analyzes the 13 differences, if any, between the prior art and the 14 claimed invention. You agree that proper 15 obviousness analysis requires ascertaining the 16 differences between the prior art and the claimed 17 invention, correct? 18 MR. DAVIS: Objection to form. 19 THE WITNESS: Sorry, the question 20 again? 21 Q. Do you agree that proper obviousness 22 analysis requires ascertaining the differences 23 between the prior art and the claimed invention? 24 MR. DAVIS: Same objection.
Page 182 1 flooding would fit claim ten -- would -- would 2 meet the criteria of claim ten. 3 Q. I understand that, but is -- are you 4 saying the term claim to just be meaning claim 5 language or is it something different? 6 MR. DAVIS: Objection. Form. 7 THE WITNESS: So, again, claim ten 8 never uses the word flooding. What it 9 describes would include any flooding, but if, 10 for example, the originating participant only 11 sent the information to one of its neighbors 12 and then all the other nodes did this sort of 13 broadcast, it would be -- people would still 14 probably be comfortable calling it flooding, 15 but it would not have that first step of the 16 originator sending their information to all of 17 the other nodes. 18 Q. Let's take a break. 19 VIDEO TECHNICIAN: Time now is 20 4:01 p.m. Off the record. 21 (Recess taken.) 22 VIDEO TECHNICIAN: Time is 4:09 p.m. 23 On the record. 24 Q. Can you go to page 30 of your declaration?	Page 184 1 THE WITNESS: Those differences do 2 need to be considered, yes. 3 Q. What are the differences between 4 Shoubridge and the claimed invention of the 634 5 patent? 6 MR. DAVIS: Objection to form and 7 scope, to the extent you're talking about 19 8 onwards. 9 THE WITNESS: Sorry, could you restate 10 the question? 11 Q. What are the differences between 12 Shoubridge and the claimed invention? 13 A. All right. So -- 14 MR. DAVIS: Objection, form and the 15 scope, to the extent that it's about claims 19 16 and beyond. 17 THE WITNESS: So the criterion that 18 you pointed out is the criterion for assessing 19 obviousness. And so if you see in my 20 declaration I've declared that many of the 21 claims are anticipated. And so I won't go into 22 where I think the differences are there because 23 I don't think there are differences. Those are 24 anticipated but the claims for which I assert

Page 185 1 obviousness are 6 and 7, 12 through 14, 16 and 2 17. So if you want to take a look at those, 3 claim six talks about the computer network of 4 claim one wherein the connections are TCP/IP 5 connections. The Shoubridge article discusses 6 a simulation which most likely was run on -- 7 I'm sorry, quite possibly was run on a single 8 computer. And if it was run on a single 9 computer, then they probably didn't bother 10 using TCP/IP in order to handle the 11 communications between the different simulated 12 entities. 13 Claim seven, where each participant is a 14 process executed on a computer, again, in 15 Shoubridge they describe a simulation. It's clear 16 how you could implement that simulation, but there 17 are several ways you could implement that 18 simulation. You might use a single threaded 19 implementation of the simulation or you might use a 20 multi-process implementation of the simulation. 21 All these are plausible. I can't say for sure 22 which one Shoubridge used. So that is another 23 potential difference. 24 Moving on to claim 12. So Shoubridge is	Page 187 1 they may not have bothered to implement the TCP/IP 2 protocol, though it would have been obvious to do 3 so as an alternative way to simulate. 4 And similarly with 17, right, if they were 5 simulating, then their network in the simulation 6 may not have been the Internet, although the 7 obvious intent was to consider a system that was 8 going to run on the Internet. 9 Q. Can you -- direct your attention to 10 paragraph 228 of Exhibit Number 2, page 91. 11 A. Sorry, which is Exhibit-2? 12 Q. That's the Shoubridge declaration. 13 A. All right. Paragraph 98. 14 Q. Paragraph 228. 15 A. Sorry. 16 Q. I want to make sure you have the 17 Shoubridge one because I thought you said this was 18 the Lin. 19 A. I flipped while I was answering this 20 question. 21 Q. Let me know when you're there. 22 A. Yes, go ahead. 23 Q. Paragraph 228 where you state that 24 Shoubridge expressly discloses all the limitations
Page 186 1 simulating a grid network. And it is possible for 2 nodes to join and leave that grid network in a 3 sense by having all of their connections fail. 4 So -- but if you decide to focus on the case of -- 5 if you don't want to -- how do I say this -- 6 Shoubridge is not explicit about the mechanism by 7 which a node reconnects to the network when its 8 link returns or a completely new node might be 9 added onto the existing torus. And so since he is 10 not explicit about this and one could imagine some 11 -- some alternatives, this is a potential 12 difference. 13 Similarly for 13, as I discussed before, since 14 there is more than one way to implement the 15 simulation, we can't know for sure that Shoubridge 16 used a computer process to run each simulated 17 participant. We can't know for sure that they used 18 a computer thread to run a participant. Either of 19 these would have been obvious, but since we don't 20 know which one it was, there is potentially a 21 difference there. 22 And then moving on to 16 and 17, again, 23 Shoubridge is not specific in their implementation. 24 If they were simulating on a single computer, then	Page 188 1 of claim ten with the exception of peer to peer 2 communications. Do you see where you state that? 3 A. Yes, I do. 4 Q. In paragraph 228? 5 A. Yes. 6 Q. You agree that Shoubridge does not 7 explicitly disclose peer to peer communications, 8 correct? 9 A. Can you repeat the question? 10 Q. You agree that Shoubridge does not 11 explicitly disclose peer to peer communications? 12 MR. DAVIS: Objection to form. 13 THE WITNESS: So as you can see by my 14 arguments in ground two, I do, in fact, opine 15 that Shoubridge does disclose all the 16 limitations of claim ten and that claim ten is 17 anticipated. 18 Q. So can you explain what you mean by this 19 sentence, Shoubridge explicitly discloses all the 20 limitations of claim ten with the exception of peer 21 to peer communications? 22 A. All right. Could you ask your question 23 again? 24 Q. My question was about paragraph 228 of

Page 189 1 your declaration where you state, Shoubridge 2 expressly discloses all of the limitations of claim 3 ten with the exception of peer to peer 4 communications. And my question was, do you agree 5 that Shoubridge does not explicitly disclose peer to 6 peer communications? 7 MR. DAVIS: Objection. Form. 8 THE WITNESS: No, I don't agree with 9 that. 10 Q. So this is a false statement that you 11 wrote? 12 MR. DAVIS: Objection. Form. 13 THE WITNESS: No, what I would say is 14 that the intent here is to say that all of the 15 other limitations are -- it's completely clear 16 that they are disclosed. And I believe that 17 this peer to peer communications claim is also 18 expressly disclosed, but should you wish to 19 disagree about the peer to peer one, here is 20 some addition -- here is an additional argument 21 for obviousness, beyond anticipation. 22 Q. When you say with the exception of peer to 23 peer communications, you mean that Shoubridge 24 expressly discloses peer to peer communications, is	Page 191 1 THE WITNESS: No, paragraph 228 is 2 regarding obviousness. However, 3 anticipation -- anticipation is stronger than 4 obviousness, right? It certainly implies 5 obviousness as well. 6 Q. Is there any difference between 7 obviousness and anticipation? 8 A. Yes. 9 Q. What's the difference? 10 MR. DAVIS: Objection to form. 11 THE WITNESS: So a summary of what I 12 understand about this can be found in the legal 13 standards section of the declaration, which can 14 be found on pages 30 and on in this document. 15 And as I describe there, I understand that 16 anticipation requires that every single element 17 of the claim actually has to be disclosed. 18 That's a summary, though, you can read the full 19 text. On the other hand, obviousness allows 20 for the idea that a person of ordinary skill in 21 the art would be able to apply what they know 22 in an obvious way, to go slightly beyond the 23 things that are explicitly disclosed by the 24 patent.
Page 190 1 that what you're saying for this sentence here? 2 MR. DAVIS: Objection. Form. 3 THE WITNESS: So if you look at 4 Appendix C, the claim charts. 5 Q. Yes. 6 A. It's on page 147. 7 Q. Yes. 8 A. I provide text explaining how I believe 9 that Shoubridge discloses peer to peer 10 communications and the intent of that text is to say 11 that, well, first, on ground two I believe that this 12 does explicitly disclose peer to peer communications 13 in that the peers are communicating directly to each 14 other. However, if you don't agree with that 15 argument of anticipation, here is an obviousness 16 argument. I didn't feel that there was a need -- I 17 felt that the other portions of the claim were 18 sufficiently clearly disclosed that I did not need 19 to sort of separate them out as, here is a 20 separate -- here is that, you can simply see it as 21 obvious. 22 Q. Is paragraph 228 of your declaration 23 regarding anticipation? 24 MR. DAVIS: Objection to form.	Page 192 1 Q. So you're not relying on knowledge of one; 2 skilled in the art to disclose peer to peer 3 communications in Shoubridge, right, you're saying 4 that it's explicitly disclosed? 5 MR. DAVIS: Objection to form. 6 Q. By Shoubridge -- 7 A. I am making two separate arguments. I am 8 asserting that, in my opinion, it is explicitly 9 disclosed, but that if somebody wishes to reject my 10 opinion that it is explicitly disclosed, then 11 certainly it would at least have been obvious to 12 somebody of ordinary skill in the art. 13 Q. Yeah, I understand that you're making two 14 separate arguments, but I'm just asking about 15 paragraph 228. 16 A. Uh-huh. 17 Q. I understand that to be regarding 18 obviousness? 19 A. Yes. 20 Q. And your obviousness opinion, it states 21 here, that Shoubridge expressly discloses all the 22 limitations of claim ten with the exception of peer 23 to peer communications, but you're saying that that 24 means that Shoubridge discloses -- expressly

Page 193 1 discloses peer to peer communications, right? 2 A. Again -- 3 MR. DAVIS: Objection to form. 4 THE WITNESS: Again, under ground two 5 I was arguing that Shoubridge does expressly 6 disclose peer to peer communications. What I'm 7 saying here is that if you need a -- if you are 8 rejecting my anticipation argument, then I 9 think that you would agree that it is, 10 nevertheless, obvious in view of a person of 11 ordinary skill in the art. 12 Q. So just to be clear, Shoubridge explicitly 13 discloses peer to peer communications for your 14 obviousness opinion, correct? 15 MR. DAVIS: Objection. Form. 16 THE WITNESS: So my opinion is that 17 Shoubridge explicitly discloses peer to peer 18 communications. My opinion is also that even 19 if you don't think that it does, you would -- 20 it is nevertheless -- it is nevertheless the 21 case that a person of ordinary skill in the art 22 would have found it obvious, that these were 23 peer to peer communications. 24 Q. So ground three is what you're talking	Page 195 1 communications is obvious. 2 Q. Going back to the differences between the 3 prior art and the claimed invention. What is the 4 differences between Lin and the claimed invention? 5 MR. DAVIS: Objection to form and 6 scope, to the extent that it's concerning 7 claims 19 and above. 8 THE WITNESS: So I'm going to answer 9 this in pieces, but once again, I believe that 10 several of the claims of this patent are 11 anticipated by Lin and, therefore, that there 12 are no differences to be seen, but of the 13 remaining patents where I argue obviousness 14 under Lin. So I believe that Lin discloses 15 every element of claim one expressly, except 16 for the particular layer protocol element of -- 17 let me find it. So the one part of claim one, 18 I think, potential difference is -- oh, that's 19 the problem. Sorry, I scrambled numbers one 20 and ten. I have to start over. Yeah, so the 21 one place where there is a potential difference 22 in, again, claim one with the patent and with 23 Lin is in this idea of numbering data 24 sequentially so that the data received out of
Page 194 1 about, right, with paragraph 228, that's your 2 obviousness theory, right? 3 MR. DAVIS: Objection. 4 Q. That's different from your anticipation 5 theory or is it one and the same? 6 MR. DAVIS: Objection to form. 7 THE WITNESS: What do you mean by a 8 theory? 9 Q. You mentioned ground two as far as 10 anticipation? 11 A. Yes. 12 Q. Paragraph 228 is not regarding ground two 13 anticipation, correct? 14 A. That is correct, paragraph 228 is part of 15 my argument for obviousness. 16 Q. And for your obviousness opinion, 17 you're -- you're stating that Shoubridge expressly 18 discloses peer to peer communications, is that 19 correct? 20 MR. DAVIS: Objection to form. 21 THE WITNESS: Clearly in this 22 paragraph I am not asserting that. In this 23 paragraph I am asserting that it discloses 24 everything else and that peer to peer	Page 196 1 order can be queued and rearranged. And Lin 2 discloses that messages are flooded by nodes 3 the first time that they are received, which, 4 again, makes -- makes obvious this idea of 5 using sequence numbers because you need to 6 recognize the first time that things are 7 received, again -- again, with sort of TCP/IP 8 in the background as something that everybody 9 knows about, makes clear that you can use these 10 sequence numbers also to queue and rearrange 11 information that you receive out of order. 12 Moving on to claim -- what's the next claim, 13 claim two. So in claim three the patent describes 14 each participant being connected to an even number 15 of participants. Lin focuses on the case of four 16 regularity. So obviously four -- so there is 17 arguably a difference in that the patent is 18 considering other even degrees as well, but it is 19 obvious that four is even. So that is covered. 20 Q. Is there any differences between claim ten 21 and Lin? 22 A. I'm sorry, claim ten? So as you can see 23 on page 77, I do believe that claim ten is 24 anticipated by Lin.

Page 197 1 Q. So there's no differences? 2 A. In my opinion, everything in that claim is 3 covered in Lin. 4 Q. Regarding Shoubridge, you mentioned that 5 there -- 6 A. Actually, before the next question, can I 7 take a break? 8 Q. Sure. 9 A. Thanks. 10 VIDEO TECHNICIAN: Stand by. Time now 11 is 4:46 p.m. Off the record. 12 (Recess taken.) 13 VIDEO TECHNICIAN: The time now is 14 4:51 p.m. On the record. 15 Q. Previously you were referring to Appendix 16 C, their declarations. Do you remember that? 17 A. Either one or do you want to concentrate 18 on the Shoubridge? 19 Q. I just want to know what Appendix C is. 20 A. Oh, so Appendix C is a set of claim 21 charts, giving quotations out of the prior art 22 references that I believe match to the various 23 claims. 24 Q. Appendix C is regarding both obviousness	Page 199 1 analysis under anticipation than obviousness? 2 MR. DAVIS: Objection. Form. 3 THE WITNESS: My ground two claims are 4 anticipation claims and my ground three claims 5 are obviousness claims. 6 Q. What portion -- sorry, strike that. 7 What paragraphs of your declaration 8 correspond to your anticipation analysis of 9 Shoubridge? 10 MR. DAVIS: Objection to form. 11 Q. Let me ask a clearer question. 12 Do paragraphs 74 to 195 of your 13 declaration, is that your anticipation analysis of 14 Shoubridge? 15 MR. DAVIS: Objection to form. 16 THE WITNESS: So paragraph 74 to what? 17 Q. 195. 18 A. So paragraph 74 to 195 lay out an 19 obviousness argument regarding DirectPlay in view of 20 Shoubridge. Along the way in that -- in -- among 21 those arguments are statements of things that 22 Shoubridge discloses. 23 Q. So do paragraphs 75 to 195 of your 24 declaration apply the tests for anticipation against
Page 198 1 and anticipation? 2 MR. DAVIS: Objection to form. 3 Q. Is that correct? 4 A. I'm sorry, I don't know what you mean by 5 regarding? 6 Q. You said that Appendix C is a set of claim 7 charts. Are these claim charts obviousness analysis 8 or anticipation analysis or both? 9 MR. DAVIS: Same objection. 10 THE WITNESS: So as you can see on 11 page 79 on my declaration I refer to Appendix C 12 both in making my anticipation arguments, 13 ground two and also in making my obvious 14 arguments, ground three. 15 Q. So Appendix C applies to both your 16 anticipation analysis and obviousness analysis? 17 A. Yes. 18 Q. In your opinion, is it proper to determine 19 anticipation using the same test to determine 20 obviousness? 21 MR. DAVIS: Objection to form. 22 THE WITNESS: Anticipation and 23 obviousness have different tests. 24 Q. Did you provide a separate and different	Page 200 1 Shoubridge? 2 A. Once more. 3 MR. DAVIS: Objection. Form. 4 Q. Paragraphs 1 -- strike that. Paragraphs 5 74 to 195, they -- they do not apply the test for 6 anticipation, do they? 7 MR. DAVIS: Objection to form. 8 THE WITNESS: The paragraphs that 9 assert that Shoubridge discloses something are 10 applying the tests for anticipation. 11 Q. So paragraphs 74 to 195 apply the tests 12 for anticipation, correct? 13 A. No, the paragraphs that assert that 14 Shoubridge discloses something are applying the 15 tests for anticipation. 16 Q. Which paragraphs are you referring to 17 within paragraphs 74 to 195? 18 MR. DAVIS: Objection to form. 19 THE WITNESS: So paragraph 79 20 describes a disclosure by Shoubridge. 21 Paragraph 80 describes a disclosure by 22 Shoubridge. Paragraph 81 describes a -- 23 something that Shoubridge discloses. Paragraph 24 82 discloses information from Shoubridge.

Page 201	Page 203
1 Paragraph 85, 86, 87, 88, paragraph 93, 2 paragraph 100, paragraph 104, 106, 112, 116, 3 117, 118. 4 Q. Number 118? 5 A. Yes. 122, 126, 131, 146, 150, 156, 160, 6 164, 168, 174, 188. So all of those paragraphs 7 describe things which Shoubridge explicitly 8 discloses. 9 Q. So is it fair to say that all the 10 paragraphs that you just listed out from 79 to 188 11 apply the test for anticipation? 12 MR. DAVIS: Objection to form. 13 THE WITNESS: Sorry, your question 14 again? 15 Q. The paragraphs that you listed from 79 to 16 188, do they apply the test for anticipation? 17 MR. DAVIS: Objection. Form. 18 THE WITNESS: So those paragraphs I 19 listed describe things which Shoubridge 20 discloses. By that I mean they disclose every 21 element or step. And those -- when Shoubridge 22 discloses every element in a claim that 23 fulfills the criterion for anticipation, at 24 other times I -- I argued that those things	1 you applied. Is it anticipation or obviousness? 2 MR. DAVIS: Objection. Form. 3 Q. Do you understand the difference? 4 MR. DAVIS: Same objection. 5 THE WITNESS: I understand the 6 difference between anticipation and 7 obviousness. I am using the same disclosures 8 in Shoubridge to make certain anticipation 9 arguments and certain obviousness arguments. 10 Q. So does paragraph 79 of your declaration 11 apply the test for anticipation or obviousness? 12 MR. DAVIS: Same objection. 13 THE WITNESS: So paragraph 79 14 describes a particular thing which Shoubridge 15 discloses, which is a communication graph in 16 which each node is a source of user traffic. 17 Q. My question is whether paragraph 79 18 analyzes Shoubridge under anticipation or 19 obviousness? 20 MR. DAVIS: Same objection. 21 THE WITNESS: Paragraph 79 by itself 22 is not analyzing Shoubridge under anticipation 23 or obviousness. It is providing a brick for 24 the wall of anticipation or obviousness and
Page 202	Page 204
1 that are disclosed by Shoubridge can -- you can 2 take those things and add on something obvious 3 or combine it with DirectPlay and then you get 4 an obvious argument. So those disclosures are 5 being used for both purposes. 6 Q. So just to be clear, I'm just talking 7 about the paragraphs 79 to 188. 8 A. Yes. 9 Q. You're saying that those paragraphs are 10 regarding both obviousness and anticipation or -- 11 MR. DAVIS: Objection. Form. 12 THE WITNESS: Those paragraphs 13 describe things which are described in 14 Shoubridge and if those disclosures together 15 cover all of the elements of the claim, then 16 that claim is anticipated. If instead I take 17 those disclosed things and combine them with 18 the knowledge of a person of ordinary skill in 19 the art or combine them with DirectPlay, then I 20 use those disclosures in an obviousness 21 argument. 22 Q. I understand that you're saying that 23 paragraphs 79 to 188 discusses what Shoubridge 24 expressly discloses, but I'm asking about which test	1 it's offering -- it is being used in both 2 contexts. 3 Q. Does that go for the rest of the 4 paragraphs that you listed between 79 and 188? 5 MR. DAVIS: Objection to form. 6 Q. They don't apply to -- they are not 7 applying obviousness or anticipation? 8 MR. DAVIS: Objection to form. 9 THE WITNESS: So each of those 10 paragraphs is present to serve as a component 11 in an obviousness or anticipation argument or 12 both. If you'd like, I can go through each of 13 them and figure out what it was being used as a 14 component for. That will take a little bit of 15 flipping around but I can do it, if you like. 16 Q. Please say what each of those are used 17 for, anticipation or obviousness. 18 MR. DAVIS: Objection. Form. 19 Q. And can you do it one by one? 20 A. That's what I'm working on. I'm starting 21 with 79 and I'm reading through the rest of my 22 declaration to find the spots where I sort of rely 23 on what I say there. 24 Q. So just to be clear, you're answering

Page 205 1 whether paragraph 80 is applying the test for 2 obviousness? 3 A. I thought you asked about 79. 4 Q. Oh, I thought you said that that did not 5 apply the test for anticipation or obviousness but 6 rather it's a building block. 7 MR. DAVIS: Objection. Form. 8 THE WITNESS: I said that each of 9 these paragraphs was described as something 10 that Shoubridge discloses is a building block 11 for my anticipation and obviousness arguments. 12 Q. So does paragraph 79 apply the test for 13 obviousness or anticipation? 14 MR. DAVIS: Objection. Form. 15 THE WITNESS: So, once again, you 16 don't apply -- the test for anticipation is 17 something that you apply to a claim and whether 18 all of the elements of that claim are 19 covered -- are disclosed. So what I'm 20 asserting here is that a certain element is 21 disclosed. In order to describe how it's used 22 as a building block, I need to look through all 23 of the claims and exactly what I'm referring 24 to, as I talk about obviousness grounds and	Page 207 1 THE WITNESS: The test that I applied 2 when I wrote paragraph 79 was whether 3 Shoubridge discloses the things that I am 4 claiming he discloses in paragraph 79. 5 Q. But that doesn't tell me whether it's 6 obviousness or anticipation. I'm asking which test, 7 obviousness or anticipation, did you apply in 8 writing paragraph 79? 9 MR. DAVIS: Objection. Form. 10 THE WITNESS: And, again, I'll say it 11 wasn't yet time to apply that test, right, 12 those tests of anticipation and obviousness are 13 applied to claims which is something that I 14 began to do later on in the document. 15 Q. So tests for anticipation and obviousness 16 are not applied to prior art, it's applied to 17 claims, is that -- 18 MR. DAVIS: Objection. Form. 19 THE WITNESS: It is applied to both. 20 The question is whether -- whether prior art 21 anticipates or renders obvious a claim. 22 Q. So for the disclosure that you write in 23 paragraph 79, what test did you apply, obviousness 24 or anticipation?
Page 206 1 anticipation grounds for those claims. 2 Q. So you're referring to other paragraphs 3 other than paragraph 79 -- 4 MR. DAVIS: Objection. 5 Q. -- to understand what paragraph 79 is -- 6 which test it's -- it's applying? 7 MR. DAVIS: Objection. Form. 8 THE WITNESS: Paragraph 79 is not 9 applying a test in itself. It is a statement 10 of what is being disclosed by Shoubridge. 11 Q. When you say a statement that's being -- 12 of what Shoubridge discloses, you did not view that 13 under any particular anticipation or obviousness 14 test? 15 MR. DAVIS: Objection to form. 16 THE WITNESS: So each of these 17 paragraphs is involved in at least one of the 18 anticipation or obviousness tests that I -- 19 that I offer later on in the document. A 20 paragraph standing by itself is not the entire 21 argument. 22 Q. I'm asking, which test did you apply when 23 you wrote paragraph 79? 24 MR. DAVIS: Same objection.	Page 208 1 MR. DAVIS: Same objection. 2 THE WITNESS: Paragraph 79 I applied 3 the test of whether Shoubridge was disclosing 4 the things that I asserted Shoubridge was 5 disclosing. 6 Q. I understand that. I'm asking a different 7 question though, which test you applied, obviousness 8 or anticipation, it's either/or? Do you understand? 9 MR. DAVIS: Same objection. 10 THE WITNESS: It's not either/or. 11 Paragraph 79 is a piece of an argument that 12 spans the entire document. And it's -- I think 13 it's an ill-formed question to ask whether this 14 paragraph is applying a test which is actually 15 being applied over the course of the entire 16 document. 17 Q. So you can't say either way what 18 paragraphs 79 to 188 that you listed apply 19 anticipation or obviousness, correct? 20 MR. DAVIS: Objection to form. 21 THE WITNESS: Let me give you an 22 example of what I mean. So in paragraph 84 I 23 assert that Shoubridge discloses -- I'm sorry, 24 in paragraph 85 I say that Shoubridge discloses

Page 209

1 a network topology that is for connected. In
2 paragraph 126 I refer to that in order to argue
3 that a for regular network is, let's see, I
4 think this is ground one, is obvious under
5 DirectPlay and Shoubridge. In paragraph 197, I
6 use exactly the same reference to paragraph 84,
7 to make the point that the for regular network
8 is anticipated by Shoubridge. So you see I'm
9 using paragraph 84 twice. Once as part of an
10 obviousness test and once as part of -- I'm
11 sorry, 85 -- and once as part of an
12 anticipation test. So it doesn't make sense to
13 talk about applying an anticipation test or an
14 obviousness test in just two paragraphs. It's
15 how I'm using it.
16 Q. You mentioned paragraph 197, correct?
17 A. Yes.
18 Q. I'm just asking about paragraphs 79
19 through 188.
20 A. Yes.
21 Q. You can't state either way whether those
22 paragraphs are regarding obviousness or
23 anticipation, correct?
24 MR. DAVIS: Objection to form.

Page 210

1 THE WITNESS: Paragraph 79 through 188
2 are building my first obviousness argument,
3 while also providing disclosure of information
4 that I then use in my anticipation arguments.
5 Q. So paragraph 79 through 188 apply the test
6 for obviousness and anticipation, correct?
7 MR. DAVIS: Objection to form.
8 THE WITNESS: These paragraphs, 79
9 through 188, in fact, 74 through 188, are part
10 of an overall argument of the obviousness of
11 these claims under a combination of DirectPlay
12 and Shoubridge.
13 Q. Are you aware of what secondary
14 considerations of non-obviousness is?
15 A. I am familiar with the concept of
16 secondary considerations of non-obviousness.
17 Q. What's your understanding secondary
18 considerations of non-obviousness?
19 A. That understanding is summarized in
20 paragraph 67 of this declaration. These are factors
21 such as commercial success of products practicing
22 the claimed invention, long-felt but an unsolved
23 need for this invention, teachings away from the
24 ideas of the invention, unexpected results that

Page 211

1 arise copying of the invention and praised by others
2 in the field.
3 Q. Would it be fair to say that those factors
4 that you just listed are required to be considered
5 to perform proper obviousness analysis?
6 MR. DAVIS: Objection to form.
7 THE WITNESS: It's my understanding
8 that the board may consider these factors.
9 Q. So is it fair to say that consideration
10 of -- secondary considerations of non-obviousness is
11 merely optional?
12 MR. DAVIS: Objection.
13 Q. To proper obviousness analysis?
14 MR. DAVIS: Objection to form.
15 THE WITNESS: Sorry, can you ask your
16 question again?
17 Q. In your opinion, is consideration of
18 secondary considerations of non-obviousness merely
19 optional?
20 MR. DAVIS: Objection to form.
21 Q. To performing a proper obviousness
22 analysis?
23 MR. DAVIS: Objection to form.
24 THE WITNESS: Optional for who?

Page 212

1 Q. Optional to -- in order to perform proper
2 obviousness analysis.
3 MR. DAVIS: Same objection.
4 THE WITNESS: Optional for who?
5 Q. For anyone.
6 A. For the board? For me?
7 Q. Let's start with the board. Is
8 consideration of secondary considerations of
9 non-obviousness merely optional for the board to
10 perform proper obviousness analysis?
11 MR. DAVIS: Objection to form.
12 THE WITNESS: So my understanding is
13 that the board may consider these factors, if
14 they are present. Some of them might not be
15 present and then, obviously, they would not be
16 considered.
17 Q. Yeah, I understand what you wrote here.
18 You said, the board may consider certain objective
19 factors if they are present. I'm asking a different
20 question. I'm asking if -- if consideration of
21 secondary considerations of non-obviousness is
22 merely optional or is it required for a proper
23 obviousness analysis?
24 MR. DAVIS: Objection to form.

Page 213	Page 215
1 THE WITNESS: What do you mean by a 2 proper obviousness analysis? 3 Q. Are you aware of the term proper? 4 A. As a standard English term, yes, but does 5 it have a special -- a special meaning here? Are 6 you saying that for it to be legally valid or 7 something like that? 8 Q. What's your understanding of proper? 9 MR. DAVIS: Objection to form. 10 THE WITNESS: So my understanding of a 11 proper analysis is -- is one that would 12 consider all of the relevant factors. And so 13 if these factors are present, they would seem 14 to be relevant. And so I would expect a proper 15 analysis to consider them. 16 Q. When you say, if these factors are 17 present, you mean secondary considerations of 18 non-obviousness? 19 MR. DAVIS: Same objection. 20 THE WITNESS: Yes. 21 Q. Did your obviousness analysis consider any 22 secondary considerations of non-obviousness? 23 MR. DAVIS: Objection. 24 Q. I'm sorry, let me strike that.	1 would instead say what I asked myself was 2 whether there was commercial success of a 3 product practicing the invention and I did not 4 consider that there was. 5 Q. How did you do -- what is the basis for 6 your determination? 7 A. My own knowledge, the sources of 8 information that I gathered for this case. 9 Q. Can you provide some specific -- can you 10 be more specific? 11 MR. DAVIS: Objection. Form. 12 THE WITNESS: You mean as to what 13 documents I considered when I was thinking 14 about whether there was commercial success? 15 Q. Correct. 16 A. The various documents that you can find as 17 exhibits for these proceedings. 18 Q. Do you mean the prior art and the 19 patents -- the patent in question? 20 MR. DAVIS: Objection to form. 21 A. Correct. 22 Q. Does the same apply for the other 23 secondary considerations that you considered, you 24 looked at the prior art documents and the patent in
Page 214	Page 216
1 In performing an obviousness analysis, 2 did you determine -- did you determine whether there 3 were any secondary considerations of non-obviousness 4 present? 5 MR. DAVIS: Objection. Form. 6 THE WITNESS: So I did consider these 7 factors in light of my own knowledge when 8 performing my obviousness analysis. 9 Q. Which factors did you consider? 10 A. I considered whether there was -- whether 11 I was aware of commercial success of -- of a product 12 reflecting the patent. I considered whether there 13 was a long-felt but unsolved need. I considered 14 whether there was significant teaching away from the 15 ideas proposed in the patent. I considered whether 16 there were unexpected results. I considered whether 17 these ideas had been copied. I considered whether 18 these ideas had been praised by others in the field. 19 Q. How did you determine whether there was 20 commercial success of any product practicing -- 21 where a claimed invention was present? 22 MR. DAVIS: Objection to form. 23 THE WITNESS: How did I determine 24 whether there was commercial success? So I	1 question? 2 A. And I also -- 3 MR. DAVIS: Objection to form. 4 THE WITNESS: And I also relied on my 5 own knowledge of the field. 6 Q. Can you elaborate? 7 MR. DAVIS: Same objection. 8 THE WITNESS: So I considered whether 9 I was aware of a long-felt but unsolved need, 10 whether I was aware of teaching away from these 11 ideas and so forth. 12 Q. But can you elaborate what you relied 13 upon, that's the knowledge that you're referring to 14 and not within these documents? 15 MR. DAVIS: Same objection. 16 Q. Did you understand the question, Dr. 17 Karger. 18 A. Can you ask it again? 19 Q. Sure. You seemed -- you can correct me if 20 I'm wrong. You seemed to indicate that there were 21 other documents that you considered beyond what was 22 cited in the proceedings in this case that you 23 considered -- 24 A. That's not what I indicated. What I

Page 217 1 indicated was that I also relied on my general 2 knowledge of the area. 3 Q. So -- 4 A. That is, if I had been aware of -- if I 5 had looked at these patents and said, oh, that 6 produces an unexpected result, that is something 7 that I would have considered when thinking about the 8 obviousness of the claims. 9 Q. So would it be fair to say that the 10 documents that you considered when you were 11 evaluating secondary considerations of 12 non-obviousness are the cited documents in your 13 declaration? 14 MR. DAVIS: Objection to form. 15 THE WITNESS: I did have those 16 secondary considerations in mind as I was 17 reading the -- as I was examining the documents 18 that are exhibited here. 19 Q. But are there other documents other than 20 what's cited in your declaration that you 21 considered? 22 A. No, not that I can recall. 23 Q. You didn't evaluate any licenses, correct? 24 A. Evaluate licenses?	Page 219 1 broadcast channel. I am simply saying that 2 communications network does not generically 3 mean the same thing as broadcast channel. 4 Q. For your mapping of Shoubridge to claim 5 ten, you're saying that Shoubridge's communications 6 network -- 7 A. -- serves as the broadcast channel. 8 Q. Just to be clear, where does this quote 9 communications network appear in Shoubridge? Just 10 correct me if I'm wrong, I think it appears in page 11 one, paragraph one; is that right? I didn't see 12 communications network quoted anywhere else. I just 13 want to make sure that I understood what you meant 14 by communications network. 15 A. The phrase communications network is used 16 possibly just once in the introductory paragraph. 17 However, when he refers to networks later on, he is 18 referring to that communication network. So under 19 the simulation model where he says that initial 20 network model has been developed based on stationary 21 stochastic, he's saying that he's going to create a 22 model of a communications network which will then 23 serve as the broadcast channel. 24 Q. What are you saying is the non-routing
Page 218 1 Q. Or are you aware of whether the 634 patent 2 was licensed? 3 A. No, I'm not aware of that. 4 Q. Can you go to Appendix C at 146? 5 A. Page 146? 6 Q. Correct. Do you see where you state 7 broadcast channel, eg, quote, unquote, 8 communications network? 9 A. Yes. 10 Q. You're equating Shoubridge's, quote 11 unquote, communications network with the broadcast 12 channel of claim ten, correct? 13 A. Well, to be clear, I am saying eg, not ie. 14 So I am saying that Shoubridge's communication 15 network is being used or studied as a broadcast 16 channel. 17 Q. What else are you equating to the 18 broadcast channel? 19 MR. DAVIS: Objection to form. 20 Q. For Shoubridge? 21 MR. DAVIS: Objection to form. 22 THE WITNESS: For this -- for this 23 mapping into the claims, I am taking 24 Shoubridge's communications network to be the	Page 220 1 table? 2 A. What am I saying is the non-routing table? 3 Q. Yeah, do you see how claim ten requires a 4 non-routing table based broadcast channel? 5 A. Yes. 6 Q. Are you saying that the -- what are you 7 saying maps to the non-routing table in Shoubridge? 8 A. I'm saying that the communication network 9 that Shoubridge is simulating, when used with 10 flooding, serves as a non-routing based -- 11 non-routing table based broadcast channel. 12 Q. So is it fair to say that you're mapping 13 flooding to non-routing table? 14 MR. DAVIS: Objection to form. 15 THE WITNESS: I'm not -- mapping 16 flooding to non-routing table. What I'm saying 17 is that this flooding protocol is a non-routing 18 table based protocol. 19 Q. Which protocol are you referring to? 20 A. Or flood algorithm, this procedure of 21 flooding where you send -- where you have every node 22 broadcast what it receives to its other neighbors. 23 Q. Are you talking about where it says 24 flooding algorithms simply broadcast user traffic

Page 221 1 through a network, is that the protocol that you're 2 referring to? 3 A. So what I'm referring to can be found on 4 page 149, where I quote Shoubridge as asserting that 5 end user packet transmitted from a node is copied to 6 and broadcast on all -- 7 THE COURT REPORTER: On all -- 8 THE WITNESS: -- on all outgoing 9 links. 10 Q. Where are you looking at? 11 A. I'm sorry, this is on page 149, at the 12 tail-end of the chart for claim c. 13 Q. Just to be clear, your mapping for 14 non-routing table doesn't appear on Appendix C at 15 page 146, right? 16 MR. DAVIS: Objection. Form. 17 THE WITNESS: Sorry, the question 18 again? 19 Q. You're mapping for a non-routing table, it 20 does not appear on Appendix C at page 146, correct? 21 MR. DAVIS: Objection to form. 22 THE WITNESS: It does because of the 23 fact that flooding does not maintain routing 24 tables, right? So my point is that my ground	Page 223 1 A. So I want to be careful to distinguish 2 what flooding can mean from what people of ordinary 3 skill in the art generally take flooding to mean. 4 Flooding can mean, I think a broader class of 5 flooding algorithms where you allow packets to 6 duplicate more where you send them back to the 7 originator and so forth. It's sort of a general 8 concept. Constrained flooding has been used to sort 9 of say specifically that we don't want it to go -- 10 we don't -- we want to limit the duplication. So 11 you don't send it back on the node that sent it. 12 You don't resend it the second time you receive it 13 and so forth. These are obvious things to do when 14 you're flooding. And so some people will be sloppy 15 and just use flooding and take it for granted that 16 people of ordinary skill in the art would understand 17 that you also apply these constraints to the 18 flooding. 19 Q. So Shoubridge uses constrained flooding, 20 correct, not the -- the broader sense of flooding? 21 A. Shoubridge is describing what we have just 22 labeled as constrained flooding, yes. 23 Another break, if possible. 24 Q. Sure.
Page 222 1 for non-routing table based is based on the 2 description of a flooding algorithm, which is 3 known not to maintain routing tables. And you 4 then asked me what is the particular flooding 5 protocol, and that's when I pointed to the 6 claim c mapping to do -- to explain that 7 Shoubridge describes the particular protocol is 8 for a node to send originating traffic on all 9 outgoing links and intermediate nodes descended 10 on all nodes except the one on which it was 11 received. 12 Q. What is that protocol called? 13 A. That's what -- hold on. That is the 14 protocol that Shoubridge is referring to as 15 flooding. 16 Q. Is there a particular name for that 17 flooding protocol? 18 A. Well, one can call it constrained 19 flooding, if you want to sort of distinguish it from 20 a broader class of flooding protocols that might 21 also send the packet out on other -- on the 22 originating link and such. 23 Q. How does constrained flooding differ from 24 the broader class of flooding?	Page 224 1 VIDEO TECHNICIAN: Time now is 2 5:46 p.m. Off the record. 3 (Recess taken.) 4 VIDEO TECHNICIAN: Time is 5:58 p.m. 5 On the record. 6 Q. Can we go to the 634 patent? Let me know 7 when you're there. 8 A. I'm here. 9 Q. The claims in particular? 10 A. Uh-huh. 11 Q. Do you see where it recites an indication 12 of four neighbor participants for claim ten? 13 A. Yes. 14 Q. What is an indication of four neighbor 15 participants? 16 MR. DAVIS: Objection to form. 17 Q. Did you understand the question? 18 A. Yes. I'm just checking my -- checking my 19 textbook before I speak. So can you repeat the 20 question? 21 Q. Claim ten recites an indication of four 22 neighbor participants. And I'm asking what does an 23 indication of four neighbor participants mean? 24 MR. DAVIS: Objection to form.

Page 225 1 THE WITNESS: Well, indication is a 2 rather broad term, right? I'm not sure if I 3 can define without using, but it is some way of 4 knowing which are the four participants that 5 will be considered neighbors of each 6 participant. 7 Q. Is the claimed indication something that's 8 generated by a system? 9 A. That's not part of the claim. 10 Q. I'm trying to understand what does an 11 indication mean in terms of the claims and is it 12 some kind of thing that's generated, like a data 13 structure or is it something different? 14 MR. DAVIS: Objection to form. 15 THE WITNESS: The claim doesn't 16 specify. So it appears that it could be any -- 17 it could be the data structure or it could be 18 something different. 19 Q. So it could be a data structure that's 20 generated but it doesn't have to be? 21 MR. DAVIS: Objection to form. 22 THE WITNESS: The claim doesn't assert 23 that it has to be. 24 Q. Can you go to Lin? Do you see the --	Page 227 1 you saying that Lin generates a -- a figure four 2 Harary graph as part of its flooding over a Harary 3 graph? 4 MR. DAVIS: Objection. Form. 5 THE WITNESS: I'm saying that -- well, 6 to save time, I'm saying that I don't know how 7 that figure was generated. 8 Q. How are Harary graph figures typically 9 generated? Sorry, strike that. Figure -- looking 10 at figure four these are two Harary graphs, right? 11 A. Yes. 12 Q. How does Lin draw these Harary graphs? 13 A. The answer is I don't know. I don't know 14 where these pictures came from. Lin could have 15 generated them with a drawing program or he could 16 have asked his system to output the Harary graph 17 that the system had generated. 18 Q. Are you aware of whether it's typical to 19 generate a figure for a flooding algorithm? 20 MR. DAVIS: Objection. Form. 21 THE WITNESS: I mean, it is very 22 common to generate network diagrams, to show 23 the structure of a network for a publication. 24 Q. Can you describe, what do you mean for a
Page 226 1 MR. DAVIS: Just a minute, while I 2 flip there. Go ahead. Thanks. 3 Q. Do you see figure four of Lin? 4 A. Yes. 5 Q. These are two Harary graphs, correct? 6 A. Yes. 7 Q. Is -- does figure four meet the indication 8 that's claimed in claim ten, is that an example of 9 an indication? 10 MR. DAVIS: Objection to form. 11 THE WITNESS: I would say that it is 12 incomplete because in order to understand how 13 figure four indicates the neighbors of the 14 participants, you have to understand which dot 15 in the figure corresponds to which participant. 16 Q. Figure four is -- is something that's 17 drawn by Lin, correct, it's not something that's 18 generated by its system? 19 MR. DAVIS: Objection. Form. 20 THE WITNESS: I'm not sure how figure 21 four was created. It could have been drawn by 22 Lin. It could have been generated 23 automatically. 24 Q. When you say generated automatically, are	Page 228 1 publication? 2 A. Well, figures are intended to be read by 3 people, right? So when I want to convey to somebody 4 what is the structure of a network, one easy way to 5 do that is to make a picture of the network and put 6 it into my publication. 7 Q. If -- if these figures of graphs were 8 drawn by -- by Lin, would that qualify as an 9 indication of four neighbor participants? 10 MR. DAVIS: Objection to form. 11 Q. Strike that. Let me ask a clearer 12 question. 13 So assuming that figure four is 14 something that Lin drew with a drawing program, 15 would that qualify as an indication of four neighbor 16 participants of that participant? 17 MR. DAVIS: Objection. Form. 18 THE WITNESS: Sorry, say your question 19 again. 20 Q. So looking at Lin, figure four, if that 21 was -- those two graphs were drawn by Lin using a 22 drawing program, would that qualify as an indication 23 of four neighbor participants of that neighbor -- of 24 that participant as claimed in claim ten?

Page 229 1 MR. DAVIS: Objection. Form. 2 THE WITNESS: So in combination with 3 the paper, which describes a system which uses 4 flooding over these overlaid Harary graphs, 5 this figure makes clear that each of the nodes 6 in this overlaid Harary graph is going to have 7 four neighbors. So in this case the system 8 that Lin is describing is going to indicate for 9 each of the processors what are their four 10 neighbors as determined by the Harary graph 11 that you're overlaying on the processors. 12 Q. To be clear, I'm not asking about the 13 system. I'm just asking about the figures. So 14 reading the 634 patent, you would understand that a 15 figure of a graph that's drawn by a drawing program 16 to be -- to qualify as an indication of four 17 neighbor participants of -- of that participant, is 18 that what you're saying? 19 MR. DAVIS: Objection. Form. 20 THE WITNESS: So the figure by itself 21 cannot really serve as an indication because 22 what's being discussed in the patent is a 23 collection of participants that have 24 indications of who their neighbors are. And	Page 231 1 graph it now becomes possible to infer from the 2 Harary graph which nodes -- which computers are to 3 be considered -- which processors -- which 4 processors are to be considered of neighbors of 5 which other processors. At that point you have this 6 indication of who the neighbors of each of the 7 processors should be. 8 Q. So are you saying that the indication 9 is -- the claimed indication is inherently disclosed 10 by Lin? 11 MR. DAVIS: Objection. Form. 12 THE WITNESS: Yes, I am saying that 13 the indication of neighbors is inherently 14 disclosed in Lin. 15 Q. You read the specification of the 634 16 patent, correct? 17 A. I did. 18 Q. Where does the 634 patent describe the 19 indication claimed by claim ten? 20 MR. DAVIS: Objection to form. 21 THE WITNESS: I'm sorry, can you 22 restate the question? 23 Q. I'm looking for where in the specification 24 does the 634 patent describe an indication of four
Page 230 1 these participants are supposed to send data to 2 the other participants. Now, if you were 3 starting to try to map this figure to the 4 claim, then you would have to take the dots to 5 be the participants. And dots don't send 6 information to other dots. Once you combine 7 that with the information disclosed in the 8 document and you understand that in this 9 system -- that this figure is a representation 10 of what the system is going to be doing, then 11 you can understand that that system is going to 12 indicate the four neighbors of each 13 participant. 14 Q. And how does the -- the system indicate -- 15 what in this system of Lin is this indication? 16 A. So if you look at page 25 of the Lin 17 exhibit, that's page 18 in the document, the article 18 asserts that for the single LAN network we imposed 19 the H 324 graph on the processors, right, and for 20 the small WAN H 634 was imposed. So what imposed 21 means is that you took those computers and you 22 assigned each of them to be or to act as one of the 23 vertices of the Harary graph. Having created a 24 mapping between computers and vertices of the Harary	Page 232 1 neighbor participants of that participant. 2 MR. DAVIS: Objection to form. 3 THE WITNESS: Okay. So in the time 4 that I've taken to skim it right now, I haven't 5 found any text that specifically refer -- uses 6 the phrase indication of. However, the 7 specification certainly does describe a system 8 in which each node has four neighbors. And it 9 also describes a process by which a node 10 forwards information it receives to each of its 11 neighbors. And, logically, if it doesn't know 12 who its neighbors are, it can't forward 13 information to them. So that sort of logically 14 implies that there is an indication of who 15 these neighbors are. 16 Q. So just to be clear, the -- whenever 17 you're imposing a -- a Harary 324 graph, that means 18 that it necessarily requires an indication of four 19 neighbor participants of that participant? 20 MR. DAVIS: Objection. Form. 21 THE WITNESS: Imposing a Harary graph 22 does not require an indication. It provides an 23 indication. 24 Q. What's the distinction? Can you explain?

Page 233

1 A. You don't have to have an indication in
2 advance in order to be able to impose the Harary
3 graph. When you impose the Harvey graph, that
4 provides the indication of what the neighbors will
5 be.
6 Q. Is it fair to say that a Harary graph
7 necessarily provides an indication --
8 MR. DAVIS: Objection --
9 Q. -- of -- let me start over.
10 Is it fair to say that a Harary graph
11 necessarily provides an indication of four neighbor
12 participants of that participant?
13 MR. DAVIS: Objection. Form.
14 THE WITNESS: So it's a little bit odd
15 to use necessarily in this context because this
16 is all about a choice to impose a Harary graph,
17 right? You're not forced to impose a Harary
18 graph. You're choosing to impose a Harary
19 graph. And one of the opportunities that
20 emerges from choosing to provide -- to impose a
21 Harary graph is you have a natural way to get
22 an indication of the four neighbors of every
23 node.
24 Q. So would it be -- would it be fair to say

Page 234

1 that one of the options that providing -- strike
2 that.
3 Would it be fair to say that one of
4 the options provided when a Harary graph is imposed
5 is or could be a -- an indication of four neighbor
6 participants of that participant?
7 MR. DAVIS: Objection. Form.
8 THE WITNESS: One of the options when
9 a Harary graph is imposed? Can you say that
10 again? It didn't parse -- it didn't parse
11 well. Repeat the question.
12 Q. I'm just trying to -- you said that you
13 wouldn't necessarily -- you wouldn't use that word
14 necessarily. And I just kind of want to understand
15 why.
16 MR. DAVIS: Objection to form.
17 THE WITNESS: So what I said was that
18 I was uneasy with the word necessarily because
19 what is being discussed here is a -- a
20 possibility that somebody could pursue of
21 imposing a Harary graph and through that Harary
22 graph get an indication of four neighbor nodes
23 for every node.
24 Q. When -- when were you engaged in this

Page 235

1 case?
2 A. When was I engaged in this case?
3 MR. DAVIS: I'll object, to the extent
4 this is -- this verification, there is a
5 question, Mr. Lee, limited to these
6 proceedings, these P-tab proceedings.
7 Q. Let me clarify my question.
8 When were you engaged as an expert in
9 IPR 2015-01964 and IPR 2015-01996?
10 A. That is not a piece of information that I
11 have bothered to keep in my head.
12 Q. Do you have any -- any idea of when you
13 were engaged as an expert for these proceedings?
14 A. Do I have any idea? I mean, certainly
15 it's more than months. It's less than a decade.
16 Somewhere in between.
17 Q. Is it fair to say sometime during the
18 summer of 2015 or --
19 A. I really don't recall. I mean it's in my
20 records. I'm happy to look it up, but --
21 Q. Can you describe for me the process of
22 writing your declarations?
23 MR. DAVIS: I'll object. I think
24 that's impermissible under the board's case law

Page 236

1 as privileged. And I think we're out of time
2 as well.
3 MR. LEE: Just to be clear, you're
4 saying that the question of describing the
5 process of writing a declaration is privileged,
6 that's your --
7 MR. DAVIS: Well, I can -- I can go
8 into more detail. I think there's been at
9 least one BPAI case, Perverello (phonetic)
10 versus Land. It was an interference proceeding
11 where that -- that case kind of went into
12 detail to address that issue.
13 MR. LEE: Just to be clear, you're
14 instructing the witness not to answer, correct?
15 MR. DAVIS: I've -- I've objected to
16 privilege. I think it's -- and I'm instructing
17 the witness not to answer. It is privileged.
18 I also believe that we're out of time for the
19 day.
20 MR. LEE: So what is your basis for
21 saying that it's privileged?
22 MR. DAVIS: I just provided it to you,
23 right, that that's the -- that's the case law
24 and, you know, before the board.

Page 237 1 MR. LEE: I mean, what are the facts 2 you're saying that makes it privileged? 3 MR. DAVIS: We're out of time on the 4 -- on the record. I mean it's past your seven 5 hours. If you want to take this up off the 6 record, we can. 7 MR. LEE: I just want to make it clear 8 on the record, what is your basis for saying 9 something -- 10 MR. DAVIS: I can read the case to 11 you, but I mean the case goes into detail. 12 I've provided my basis. 13 MR. LEE: So it's just the case, 14 that's your -- 15 MR. DAVIS: And that it -- that it 16 would call into question work-product privilege 17 and potentially is there any client privilege 18 and that I think the case goes into more detail 19 into other rationales for that. 20 MR. LEE: Based upon your case that 21 you're referring to, just the case alone, 22 you're instructing the witness not to answer? 23 MR. DAVIS: I've stated the basis 24 multiple time, yes, I am instructing the	Page 239 1 cannot, that's fine, but I'm asking you -- 2 MR. DAVIS: I have clarified. It 3 calls into question potentially attorney-client 4 privilege, attorney work-product, that, you 5 know, the case goes into detail. That's all I 6 need to do. 7 MR. LEE: That's your position, 8 there's nothing else? 9 MR. DAVIS: I've stated my position 10 multiple times, Mr. Lee. 11 MR. LEE: So it is our position you 12 have not identified the clarifying reason why 13 it's privileged and it's not privileged. And 14 it's not a proper basis for objecting or for 15 instructing your witness not to answer. 16 MR. DAVIS: Okay. We both stated our 17 basis on the record. I think we're out of time 18 for questions. Why don't we go off the record. 19 MR. LEE: All right. So can I just 20 finish? 21 MR. DAVIS: No, we're out of time. 22 It's been seven hours. You have three days 23 with Mr. -- Dr. Karger. 24 MR. LEE: So there's no more -- you're
Page 238 1 witness not to answer. 2 MR. LEE: I just want to make sure 3 because I haven't heard anything other than the 4 case. 5 MR. DAVIS: And also privilege, right? 6 MR. LEE: No, the basis for 7 asserting -- for instructing him not to answer. 8 MR. DAVIS: That's privilege, right? 9 Attorney work-product privilege. And I'm 10 instructing the witness not to answer because 11 of that, the rationale for that set out in the 12 case. I think we're out of time. 13 MR. LEE: There's nothing else, right, 14 other than the rationale set forth in the case? 15 MR. DAVIS: You -- you keep 16 mischaracterizing my rationale, right? It's 17 privileged, right? And as explained in the 18 case that would be impermissible, right? So 19 it's both things. 20 MR. LEE: I'm just trying to 21 understand the basis for your saying that it's 22 privileged. And all I'm hearing is there's a 23 case, but I don't understand any other reason. 24 And I'm asking if you can clarify. If you	Page 240 1 saying that -- you're refusing -- you're 2 instructing him not to answer any questions -- 3 MR. DAVIS: No, I'm telling you that 4 we're out of time for -- for the day. You've 5 had seven whole hours with Dr. Karger. 6 MR. LEE: Did you have a redirect? 7 MR. DAVIS: Why don't we take a break 8 and we'll see. 9 VIDEO TECHNICIAN: Time now is 10 6:30 p.m. Off the record. 11 (Recess taken.) 12 VIDEO TECHNICIAN: Time is 6:44 p.m. 13 On the record. 14 MR. DAVIS: No further questions. 15 VIDEO TECHNICIAN: This concludes the 16 deposition of Dr. David Karger. Time is 17 6:44 p.m. Off the record. 18 (Deposition concluded.) 19 20 21 22 23 24

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CERTIFICATE
COMMONWEALTH OF MASSACHUSETTS

I, GENA NARDONE, RPR and Notary Public
in and for the Commonwealth of Massachusetts, do
hereby certify that the witness whose deposition is
hereinbefore set forth, was duly sworn and that such
deposition is a true record of the testimony given
by the witness.

I further certify that I am neither
related to or employed by any of the parties in or
counsel to this action, nor am I financially
interested in the outcome of this action.

I witness whereof, I have set my hand
and seal this 6th day of July, 2016.



Gena Nardone, Notary Public in and
for the Commonwealth of Massachusetts
My Commission Expires: February 11, 2020