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FEDERAL TRADE COMMISSION
I N D E X (PUBLIC RECORD)

WITNESS:	DIRECT	CROSS	REDIRECT	RECROSS
Bechtelsheim	5736	5889		

EXHIBITS	FOR ID	IN EVID
CX		
Number 2383		5798
Number 340		5804
Number 2838		5979
Number 2405		5979

RX		
Number 162		5791
Number 143		5980

DX

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UNITED STATES OF AMERICA
FEDERAL TRADE COMMISSION

In the Matter of:)
Rambus, Inc.) Docket No. 9302
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Wednesday, June 18, 2003
9:30 a.m.

TRIAL VOLUME 30
PART 1
PUBLIC RECORD

BEFORE THE HONORABLE STEPHEN J. McGUIRE
Chief Administrative Law Judge
Federal Trade Commission
600 Pennsylvania Avenue, N.W.
Washington, D.C.

Reported by: Josett F. Hall, RMR-CRR

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P R O C E E D I N G S

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3 JUDGE McGUIRE: Good morning everybody.

4 Before we get started, is there anything the
5 court needs to take up?

6 MR. ROYALL: I don't believe we have anything.

7 MR. STONE: No. I think there are some open
8 issues as to exhibits used with Professor Jacob, but I
9 think we should do that when Mr. Oliver is here.

10 JUDGE McGUIRE: All right.

11 Also, I have received correspondence from
12 Arnold & Porter regarding nonparty Micron's opposition
13 to certain areas of inquiry.

14 Did respondent intend to offer any sort of
15 response to that correspondence?

16 MR. STONE: I think we should. It's
17 unfortunate they waited until just before
18 Mr. Appleton's testimony to do it. We didn't get it
19 until late last evening.

20 JUDGE McGUIRE: I just got it this morning.

21 MR. STONE: We will try to file something
22 tomorrow, if that's fine. I don't think we can make a
23 filing today.

24 JUDGE McGUIRE: Whatever you have, I'd like to
25 see it by 1:00 p.m. tomorrow.

1 MR. STONE: I think that should be fine,
2 Your Honor.

3 JUDGE McGUIRE: Okay. Then at this point
4 complaint counsel may call its next witness.

5 MR. STONE: In that regard, I should say, I
6 did, after I got it last night, send it on to the
7 lawyer at the Department of Justice, Nile Lynch, who
8 had intervened before because he appeared to have not
9 been copied on that and I think that DOJ should be
10 advised.

11 JUDGE McGUIRE: I agree.

12 MR. STONE: So I did send it on to him.

13 JUDGE McGUIRE: Anything you want to add to
14 that from complaint counsel's perspective?

15 MR. ROYALL: We also received that letter late
16 yesterday afternoon. I'm not sure that we have
17 anything to say on the matter. Obviously we filed a
18 motion in limine and you've ruled on that already.

19 JUDGE McGUIRE: Right.

20 MR. ROYALL: So I don't know that we have
21 anything to add.

22 JUDGE McGUIRE: All right. Very good.

23 MR. ROYALL: At this time then, Your Honor,
24 complaint counsel would like to call as its next
25 witness Mr. Andreas Bechtelsheim.

1 JUDGE McGUIRE: Sir, please come to the bench
2 and you will be sworn in by the court reporter.

3 - - - - -

4 Whereupon --

5 ANDREAS BECHTELSHEIM

6 a witness, called for examination, having been first
7 duly sworn, was examined and testified as follows:

8 DIRECT EXAMINATION

9 BY MR. ROYALL:

10 Q. Good morning, Mr. Bechtelsheim. As a
11 formality, could I ask you to state your full name for
12 the record.

13 A. Andreas Bechtelsheim.

14 Q. And where are you currently employed,
15 Mr. Bechtelsheim?

16 A. With Cisco Systems.

17 Q. Where is Cisco Systems headquartered?

18 A. In San Jose, California.

19 Q. Can you briefly explain the nature of
20 Cisco Systems' business?

21 A. Cisco is the market leader for Internet
22 switching and routing technologies.

23 Q. How long have you been employed by Cisco?

24 A. Since September of 1996.

25 Q. And what is your current title or position with

1 Cisco?

2 A. I'm the vice president and general manager of
3 the gigabit switching business unit.

4 Q. How long have you held that position?

5 A. For the last three years.

6 Q. And generally speaking, what are your duties
7 and responsibilities as vice president and general
8 manager of the gigabit switching business unit?

9 A. I'm responsible for one of Cisco's product
10 lines known as the Catalyst 4000 switching family.
11 This includes product development and market
12 positioning.

13 Q. Roughly, how many employees do you have that
14 report to you in that position?

15 A. My group has approximately 200 employees.

16 Q. And immediately before taking this position,
17 which I think you said was two or three years ago, did
18 you hold a different position at Cisco?

19 A. Yes. I was the vice president of engineering
20 for the gigabit switching business unit.

21 Q. And when you switched to the new title and new
22 position, did your responsibilities change in any way?

23 A. They changed somewhat since now the marketing
24 function reports to me.

25 Q. Let me ask you a few questions about your

1 background and your employment before you joined
2 Cisco.

3 First of all, where were you born?

4 A. I'm born in Germany.

5 Q. What city in Germany?

6 A. A very small town called Entraching, spelled
7 E-N-T-R-A-C-H-I-N-G.

8 Q. When did you immigrate to the United States?

9 A. I came here as a foreign exchange student in
10 1975. I'm still a German citizen, but I have a green
11 card.

12 Q. And you said you came as a foreign exchange
13 student, so I take it you came to study in the
14 United States; is that right?

15 A. Yes, I did.

16 Q. And where did you -- what institution or school
17 did you come to study at?

18 A. I first attended Carnegie-Mellon University in
19 Pittsburgh, Pennsylvania from 1975 to 1976, and then I
20 transferred to Stanford University in 1977 to 1982.

21 Q. Did you receive any degrees from
22 Carnegie-Mellon?

23 A. Yes. I have a master's in computer engineering
24 from Carnegie-Mellon.

25 Q. And after you completed your master's, was it

1 at that point that you transferred to Stanford?

2 A. It was actually one year after getting my
3 master's.

4 Q. And what did you study at Stanford?

5 A. Computer science and electrical engineering.

6 Q. And did you say that you were at Stanford until
7 1982?

8 A. That's correct.

9 Q. What did you -- well, first of all, did you
10 receive a degree from Stanford?

11 A. No, I did not.

12 Q. You were studying -- were you in the Ph.D.
13 program?

14 A. Yes, I was.

15 Q. In what field?

16 A. In computer science and electrical engineering.

17 Q. And you left Stanford in 1982.

18 What did you do upon leaving Stanford?

19 A. I cofounded a company called Sun Microsystems.

20 Q. You were one of the cofounders of
21 Sun Microsystems; is that correct?

22 A. Correct.

23 Q. How many other cofounders were there?

24 A. There was a total of four people including
25 myself that founded the company.

1 Q. And I take it then at some point you became
2 employed by Sun Microsystems; is that right?

3 A. I was the first employee. Yes.

4 Q. And how long were you employed by
5 Sun Microsystems?

6 A. I was with Sun until July of 1995.

7 Q. So roughly thirteen years?

8 A. Correct.

9 Q. Very generally, how would you describe the
10 business of Sun Microsystems?

11 A. Sun was a start-up company obviously that
12 started in 1982 and quickly became the market leader
13 for UNIX workstations and servers.

14 Q. You mentioned the term "UNIX." First of all,
15 can you spell that for us?

16 A. UNIX is spelled U-N-I-X.

17 Q. What does UNIX refer to?

18 A. UNIX is an operating system originally built by
19 Bell Labs that was subsequently enhanced at the
20 University of California at Berkeley and became the
21 most popular operating system for workstations in the
22 1980s, which is the system which Sun shipped.

23 Q. When you left Sun, I believe you said it was --
24 did you say 1997?

25 A. No. 1995.

1 Q. 1995.

2 When you left Sun in 1995, what did you do at
3 that point in terms of your career?

4 A. I founded a new company called Granite Systems
5 for the purpose of developing gigabit switching
6 products.

7 Q. Were there any other founders of
8 Granite Systems or were you the principal founder?

9 A. I was the principal founder.

10 Q. And what is a gigabit switching system?

11 A. It is a computer network apparatus that
12 performs packet switching function at
13 gigabit performance and speed.

14 Q. And is Granite Systems still in existence
15 today?

16 A. No. Cisco acquired Granite Systems in
17 September of 1996, which is how I came to Cisco.

18 Q. At the time that Cisco acquired
19 Granite Systems, roughly how many employees did the
20 company have?

21 A. Approximately 50 employees.

22 Q. Now, before we -- by the way, can everyone hear
23 me? It's not clear to me if the microphone is working,
24 but if everyone can hear me --

25 JUDGE McGUIRE: Yes, I can hear you.

1 BY MR. ROYALL:

2 Q. Before we go to your current work at Cisco, I'd
3 like to go back and ask you some questions about the
4 years, thirteen or so years, that you spent with
5 Sun Microsystems.

6 First of all, did I understand you correctly to
7 say that you were a cofounder of Sun Microsystems at
8 the same time that you were a graduate student at
9 Stanford?

10 A. Well, I actually developed the original Sun
11 workstation design while I was a student at Stanford,
12 so for the two years prior to Sun being founded I was
13 the sole hardware designer for this particular
14 product.

15 Q. Can you tell us a little bit about what events
16 led to you and the other cofounders establishing the
17 company, Sun Microsystems?

18 A. Yes. I actually had a business prior to Sun
19 that was in the business of licensing the Sun
20 workstation design to other manufacturers and I
21 realized that the idea of licensing hardware designs
22 would not allow me to build a substantial business.

23 Around the same time, I met Vinod Khosla, who
24 became one of the cofounders, and his friend
25 Scott McNealey, who is still the CEO of the company

1 today, and we concluded that there was an excellent
2 business case to attract venture funding and start this
3 particular company.

4 Q. And did you say that you were the designer of
5 Sun Microsystems' initial product?

6 A. Yeah. The Sun workstation -- Sun, by the way,
7 stands for the Stanford University Network project --
8 was an activity that I did as a graduate student while
9 I was a student at Stanford.

10 Q. You've mentioned the term "workstation."

11 What is a workstation?

12 A. A workstation is a high-performance personal
13 computer that at the time was unique in the sense that
14 it could perform 32-bit applications. It had virtual
15 memory, high-end graphics capabilities, networking
16 interfaces, and so on, which allowed customers to run
17 large applications in contrast to the personal computer
18 which was at the time designed to run much smaller
19 applications.

20 Q. And when you say "large applications," what
21 type of applications are you referring to?

22 A. Things like engineering and scientific programs
23 that would need many megabytes of memory.

24 Q. When Sun was founded, what was the focus of the
25 company's business or its product lines? Was it

1 limited to workstations or were there other products as
2 well?

3 A. In the early years our primary revenue source
4 was in fact workstations; however, we applied the same
5 design principles to build server products and over
6 time the server products became much more important to
7 the company's revenue where today most of the revenue
8 is from servers, not workstations.

9 Q. And what is a server?

10 A. A server is a computer that services a number
11 of clients or personal computers, workstations, but
12 performs a more centralized function. It's typically
13 located in a data center and is equipped with a large
14 amount of memory and disk storage.

15 Q. Was there a typical life cycle for the products
16 that Sun designed and developed in the time that you
17 were with the company?

18 A. Yes, there was.

19 Q. Did it differ for servers and workstations?

20 A. Yes. Workstations had a life cycle of I would
21 say about two to three years. Servers were a larger
22 investment for the customer, and as a result, we
23 designed them so they were more upgradable over a
24 longer period of time. My estimate is four to five
25 years for the life cycle.

1 Q. Generally speaking, how would you describe the
2 customer base of Sun Microsystems; and again, did that
3 differ depending on whether you're talking about
4 workstations or servers?

5 A. No. It was the same kind of customers.
6 Initially, we were very successful in the
7 computer-aided design automation markets where people
8 took advantage of the workstation graphics
9 capabilities for electronic and mechanical design
10 automation.

11 Later on, the company was very successful in
12 the financial markets where a lot of the Wall Street
13 trading desks and operations used Sun workstations.

14 Even later, the company became the market
15 leader for database servers where applications such as
16 Oracle or Peoplesoft run frequently on the Sun
17 workstations -- Sun servers. Excuse me.

18 Q. Understanding that it may have changed over
19 time, during the period of years that you were with
20 Sun Microsystems, who were the company's principal
21 competitors?

22 A. Early on, the principal competitor was a
23 company called Apollo, A-P-O-L-L-O, Computers, which
24 was later acquired by Hewlett-Packard. The other
25 principal competitors were Hewlett-Packard itself,

1 Digital Equipment Corporation and IBM.

2 Q. Was Sun Microsystems a public company?

3 A. No. Sun became public in 1996, so for the
4 first four years it was a private company.

5 Q. When Sun was established --

6 A. Can I correct myself. In 1986. Not '96.
7 1986.

8 Q. I believe you said earlier that you were the
9 first employee of Sun Microsystems?

10 A. Yes, I was.

11 Q. How many employees in the initial phase of the
12 company, start-up phase, how many employees, roughly
13 speaking, did the company have?

14 A. Well, in the first year, if I recall correctly,
15 we only had about 30 employees. By the time the
16 company went public, it was about -- it was greater
17 than 500, and today I believe the company has greater
18 than 30,000 employees.

19 Q. Did the revenues of the company grow quickly
20 through the 1980s?

21 A. Yes, they did. In 1987, the company achieved
22 \$1 billion in revenue.

23 Q. So roughly five years after it was
24 established?

25 A. Correct.

1 Q. And do you recall, generally speaking, what
2 Sun's revenues were at the time you left the company in
3 1995?

4 A. Yeah. They were greater than \$10 billion.

5 Q. Do you have any idea how large Sun is today in
6 terms of revenues?

7 A. It is still roughly the same size, greater than
8 \$10 billion.

9 Q. In your view or your estimation, did Sun
10 achieve rapid success in the markets in which it
11 competed?

12 A. Yes. Sun was at the time one of the most
13 successful new computer start-up companies and achieved
14 market leadership in both workstations and UNIX
15 servers.

16 Q. Is there anything particular that you attribute
17 Sun's rapid success to?

18 A. Yes. And this is the use of so-called open
19 standards in Sun's product design.

20 Q. What do you mean by use of the term "open
21 standard"?

22 A. Open standards meant that we would use industry
23 standard interfaces whenever possible to both reduce
24 the amount of work that we had to do from a design
25 perspective as well as to leverage other companies'

1 investment and resources in the market.

2 Q. And in what areas of the Sun products or the
3 technologies were open industry standards used?

4 A. Well, we tried to use them in every possible
5 area, ranging from software interfaces, specifically
6 the Berkeley UNIX system, which was considered an open
7 operating system because it was available on other
8 hardware in other vendors' products, to networking
9 protocols. We used the TCP Internet protocols that
10 were originally developed for the Arpanet-to-hardware
11 interfaces such as Multibus and VME industry standard
12 components, microprocessors, memories and so on.

13 Q. So there were a wide range of areas in which
14 Sun in developing its own products relied on industry
15 standards; is that a fair statement?

16 A. Correct. Whenever possible, we used the
17 industry standards because of the confidence that that
18 would enable us to build essentially a better product.

19 Q. Let me ask you to elaborate on that point.
20 When you say confidence that would enable you to build
21 a better product, what specifically do you mean by
22 that?

23 A. Well, number one, it is -- it was our belief
24 that open standards would allow us to build more
25 cost-effective products since the components that we

1 would use would also be used by many other companies
2 and as a result there would be more competition for
3 such components.

4 Number two, open standards receive a great deal
5 of scrutiny by many customers from a design perspective
6 and as a result are typically very well-developed and
7 mature.

8 And number three, customers preferred open
9 standards because it gave them the confidence that they
10 were not locked in with Sun as a sole, proprietary
11 system supplier but that they could also purchase other
12 products that would either perform the same functions
13 or interoperate with the Sun products.

14 Q. Let me ask you -- let me follow up on a couple
15 of things you said, but let me start with the last
16 point.

17 You referred to views of Sun's customers.

18 Did you personally, in the time period that you
19 were with the company, with Sun Microsystems, did you
20 interact with customers?

21 A. Yes, I did.

22 Q. And did you interact with customers relating to
23 the subject of open standards?

24 A. Yes. The open standards message was in fact
25 Sun's primary position and differentiation in the

1 market against its dominant competitors which were
2 known to build so-called closed systems or proprietary
3 systems.

4 Q. When you referred to the scrutiny that open
5 standards are given and the benefits from that, can I
6 ask you to explain what precisely you mean by that?

7 A. Yeah. Those also depend on the standard.

8 But in the area of hardware standards, which is
9 the area I was most involved with, these standards were
10 typically developed by industry standards groups, such
11 as the IEEE or JEDEC, and the process that has been
12 followed to develop such standards relies on the
13 objective contributions from the membership of these
14 standards bodies and they're sincere attempts to
15 develop standards that benefit the industry at large,
16 and as a result, a fair amount of scrutiny and effort
17 is applied to develop a standard that meets the needs
18 of the members and thus the industry at large.

19 MR. STONE: Your Honor, I must object and move
20 to strike Mr. Bechtelsheim's testimony about sincere
21 attempts of certain groups since I believe, based upon
22 his deposition testimony, he never attended a JEDEC
23 meeting. So having no personal observations of whether
24 their attempts were sincere or insincere, I must move
25 to strike as lacking in foundation.

1 If Mr. Royall could lay such a foundation, I
2 would --

3 JUDGE McGUIRE: Mr. Royall, any response?

4 MR. ROYALL: Your Honor, we'll come to JEDEC
5 later, but I don't see anything inappropriate with
6 that answer. It was at a high level of generality and
7 I believe the witness -- certainly there's nothing in
8 his deposition that would cause I think anyone to
9 reasonably conclude that he lacks that level of
10 general knowledge about JEDEC and other standards
11 practices.

12 JUDGE McGUIRE: I'm going to strike the
13 testimony in question and you can go into that if you
14 lay a proper foundation.

15 BY MR. ROYALL:

16 Q. Let's talk for a moment, Mr. Bechtelsheim,
17 about your personal role, your personal
18 responsibilities, at Sun Microsystems.

19 First of all, what was your initial position or
20 title with the company?

21 A. Director of hardware design.

22 Q. And how long did you hold that position?

23 A. I believe about one year.

24 Q. And what were the nature of your duties and
25 responsibilities as the director of hardware design?

1 A. I was the primary designer of the Sun
2 workstation product line.

3 Q. And were there others that worked with you in
4 that area?

5 A. Correct. I had a small group of engineers
6 working with me.

7 Q. And at some point in time did you assume a new
8 title or position within Sun?

9 A. Yes. That title was vice president of
10 technology.

11 Q. And that was roughly a year after the company
12 started; is that right?

13 A. Approximately, yeah.

14 Q. And how long did you hold that position?

15 A. Until I left Sun.

16 Q. And what were the nature of your duties or
17 responsibilities as vice president of technology?

18 A. I continued to be primarily responsible for
19 development of workstations, but in addition to that, I
20 had personal involvement in every kind of hardware
21 standardization, standard usage issues, such as memory
22 interfaces, disk interfaces, and so on.

23 Q. You mentioned earlier that Sun relied upon and
24 was known for relying upon various industry standards.
25 Do you recall that?

1 A. Correct.

2 Q. In your position as vice president of
3 technology, did you have any role in selecting the
4 various standards that Sun would rely upon?

5 A. Yes, I did.

6 Q. What was your role in that regard?

7 A. Well, I -- in many cases I was the primary
8 decision maker on what standards we would specifically
9 use as a company.

10 Q. Was your role in selecting standards for Sun's
11 products limited to certain product lines as opposed to
12 other product lines?

13 A. It was primarily on the workstation side, but
14 it also included some of the server considerations.

15 Q. You mentioned earlier in your testimony memory
16 standards.

17 Were you involved in selecting the types of
18 memory standards that Sun would incorporate into its
19 products?

20 A. Yes, I was.

21 Q. Was that limited to workstations or did that
22 role extend to servers as well?

23 A. It included both roles. As a company, we
24 attempted to minimize the number of distinct memory
25 devices we would use to obtain the highest

1 efficiencies.

2 Q. Let me ask you to elaborate on what you mean by
3 that.

4 What was the benefit to Sun of limiting the
5 number of distinct memory devices that you used?

6 A. Memory was the single largest cost component of
7 Sun's product, so it was very important to obtain
8 memory devices that are -- were readily available in
9 high volumes and cost-effective in the market, and from
10 an inventory management perspective, it was very
11 important to minimize the number of distinct devices.

12 Q. Was Sun, generally speaking, a significant
13 purchaser of computer memory?

14 A. Not in the early years, but as the company
15 grew, it was at the time one of the largest consumers
16 of DRAMs in the market.

17 Q. Do you have any rough estimate of the amount of
18 money that Sun would spend on an annual basis on DRAM
19 memory purchases in the time that you were with the
20 company?

21 A. Well, I recall that memory was approximately
22 one-third of our product cost, so if you take the
23 product cost of our systems and 30 percent of that, our
24 annual -- so my estimate here is our annual purchases
25 at the peak exceeded \$1 billion a year.

1 Q. I'm sorry. Did you say one billion?

2 A. Yes.

3 Q. And did all of Sun's products use DRAM memory?

4 A. Yeah. Eventually all Sun products embodied
5 DRAM technology.

6 Q. How would you compare -- let's start with a
7 workstation.

8 How would you compare the extent to which a
9 Sun workstation incorporated or relied upon computer
10 memory as compared to the typical desktop or PC
11 computer?

12 A. Well, the key difference is we used much larger
13 amount of memories, so a typical Sun workstation in
14 1987 would be configured with either 8 or 16 megabytes
15 of memory, which sounds like a small amount today, but
16 at the time, compared to a personal computer, the
17 personal computer typically had 64 kilobytes or 128 --
18 maybe a megabyte or two.

19 So we had I would say typically ten times the
20 amount of memory per system than a personal computer.

21 Q. Did Sun ever design its own proprietary memory
22 products?

23 A. No, it did not.

24 Q. ^ is there a reason why Sun did not choose to
25 design a proprietary memory?

1 A. Well, design of memory is a very complicated,
2 difficult, complicated task and the challenge is to
3 arrive at the most cost-effective design. The system
4 memory market is known to be a very cost-competitive
5 commodity-type market.

6 Q. And when you use the term "commodity" in
7 reference to memory, what specifically are you
8 referring to?

9 A. Well, the nature of the memory market is that
10 there's a number of suppliers which are fiercely
11 competing for the memory business and the cost or
12 prices for memories in the market behave very much like
13 a commodity-type market.

14 Q. Did Sun, during the time that you were with the
15 company, use any type of specialized or customized
16 memory in its products?

17 A. The one type of specialty DRAM technology I
18 recall is so-called video DRAM or VRAM which was used
19 at the time for graphics applications.

20 Q. And do you have any understanding of what
21 percentage of Sun's total product line would have used
22 that type of VRAM memory?

23 A. Well, the workstations did use VRAM and in
24 successive technologies, but the relative purchasing
25 volume for VRAM was a small percentage of the overall

1 DRAM consumption.

2 Q. Would it be fair to say that during your years
3 at Sun the bulk of the memory that Sun used in its
4 products was standardized memory?

5 A. Correct.

6 Q. And do you recall specifically what types of
7 standardized memory were used in the Sun products that
8 were developed and sold in the time you were with the
9 company?

10 A. Yes, I do.

11 Q. Can you explain to us which types of
12 standardized memory were used in that time period?

13 A. So starting in 1982, the company used the
14 industry standard fast page mode asynchronous DRAM. In
15 subsequent years, we used the EDO, spelled E-D-O,
16 asynchronous DRAM. And starting in the mid-'90s, the
17 company started to use the synchronous DRAM, and at
18 that point I left Sun.

19 Q. And were these the only types of standardized
20 memory that were used in Sun's products during your
21 thirteen-year tenure with the company?

22 A. I'm not sure if the video RAM was in fact a
23 standardized memory or not. I recall it was
24 manufactured by multiple companies, so we viewed it as
25 a standard interface or standard component, but I do

1 not recall whether it was, for example, the official
2 JEDEC-type standard or not.

3 Q. So putting aside VRAM, would it be correct to
4 say that during your thirteen-year tenure with Sun that
5 the company made only two transitions from one
6 standardized type of memory to another?

7 A. Correct.

8 Q. Do you have any understanding or explanation
9 as to why the company only transitioned from one
10 memory standard to another two times as opposed to
11 more often?

12 A. Well, we followed the general availability of
13 those components in the marketplace.

14 So in other words, what I'm saying is the
15 industry at large only made those primary transitions
16 that I was describing.

17 Q. Now, we've talked earlier about your role in
18 choosing memory standards for the company and that
19 extended to or -- that is, choosing industry
20 standards, and that extended to memory standards as
21 well; correct?

22 A. Correct.

23 Q. I'd like to ask you a few questions about the
24 process that you and others at Sun followed in choosing
25 memory standards.

1 First of all, let me ask, what were Sun's goals
2 or what were its criteria in terms of selecting memory
3 standards to use in its products?

4 A. Well, there were three primary concerns.

5 Number one, cost, so our goal was to use
6 components available from multiple suppliers that
7 adhered to a standard specification.

8 Number two, performance, so within the context
9 of cost, we would choose memory designs or memory
10 components that would allow us to achieve the highest
11 performance at the system level.

12 And I guess there was the availability, meaning
13 simply the fact that the supply base could manufacture
14 these type of memories in sufficient volumes at an
15 acceptable cost to meet our needs.

16 Q. In selecting among options for the memory
17 standards that you used, was it important to you that
18 the standard be an open standard in the sense that you
19 used that term earlier?

20 A. Well, at the time, I was only familiar with
21 open industry standards since in my recollection there
22 was no non-open memory interfaces in the period of the
23 initial -- the '80s when we made those design
24 decisions.

25 Q. Well, let me ask you about the other criteria

1 that you mentioned.

2 First of all, you mentioned that cost was one
3 of the factors that influenced your decisions about
4 memory standards.

5 Why did Sun care about the cost of memory?

6 A. As I testified earlier, memory was
7 approximately one-third of our total product cost at
8 the time; thus, if we had to use more expensive memory,
9 it would have had a significant impact on Sun's overall
10 product cost and our business model.

11 Q. What aspects of cost mattered to you at Sun in
12 terms of selecting memory?

13 A. Well, it was the cost per megabit, the cost per
14 device, the cost per DIMM -- I'm sorry -- the cost per
15 memory module assembly that we were able to obtain on
16 the open market.

17 Q. You didn't manufacture memory. I think you
18 said that earlier. Sun did not manufacture its own
19 memory?

20 A. No, we did not.

21 Q. Well, if Sun didn't manufacture memory, why --
22 strike that.

23 Did manufacturing cost matter to you, that is,
24 the costs of the manufacturers of the memory that you
25 were considering?

1 A. Well, it was well-understood that the memory
2 market was a very cost-competitive market, but
3 ultimately the cost driver for the memory manufacturer
4 was primarily the device size and the yield, process
5 technology costs that they had to burden, that burdened
6 their cost model to arrive at the price that they were
7 willing to sell a memory device.

8 Q. And as you considered different memory options,
9 did you look into questions about the device size and
10 the yield in order to assess cost?

11 A. Yes, I did.

12 Q. And was it the manufacturer's cost that you
13 cared about or your own cost?

14 A. Well, we relied on the representations of the
15 memory manufacturers to us when evaluating those kind
16 of trade-offs.

17 So we frequently engaged in discussions with
18 manufacturers to understand what drove their cost
19 model and what choices they could make to reduce their
20 costs.

21 Q. And did you speak to multiple manufacturers
22 separately about these cost-related issues?

23 A. Yes, I did.

24 Q. And why -- was there any reason why you spoke
25 to the manufacturers separately?

1 A. Well, each manufacturer considered their own
2 cost data and cost projections as their own either
3 proprietary or confidential data.

4 Q. When you mentioned cost earlier, you mentioned
5 in that connection the issue of multiple suppliers?

6 A. Yes.

7 Q. And how does multiple -- the issue of multiple
8 suppliers relate to cost?

9 A. Well, it was well-understood that in a
10 competitive market where multiple manufacturers make
11 essentially the same type of component that the cost to
12 us as a customer would be significantly superior and
13 there would be a lot more cost pressure on the
14 manufacturers themselves to optimize the manufacturing
15 of their components.

16 Q. Did Sun use multiple memory manufacturers or
17 did it do business with multiple memory manufacturers
18 in terms of the procurement of memory?

19 A. Yes, it did.

20 Q. Do you recall how many, in the time you were
21 with the company, how many different memory vendors the
22 company worked with?

23 A. We used at least a half a dozen manufacturers
24 over the years.

25 Q. Now, earlier you said -- well, strike that.

1 Were there other cost-related issues that were
2 important to you in addition to device size, yield,
3 multiple suppliers? Were there other aspects of the
4 cost consideration that were important to you in
5 considering memory options?

6 A. Yes, there were.

7 Q. Which other factors?

8 A. Well, the other cost to the memory component is
9 the cost at the system level or the board level to
10 design the memory into our system.

11 So this is a cost that was more under our own
12 control, but we were very careful to minimize the
13 system design-in costs of any such memory.

14 Q. And why did you care about that?

15 A. Because this is a cost that we could manage and
16 our goal was, given the large amount of memory the
17 company was purchasing, to minimize such costs.

18 Q. And did the system design costs in terms of
19 designing a different memory into your system, did
20 those costs vary from one type of memory technology to
21 another?

22 A. Well, the impact was on the memory controller
23 design, the PC board layout, the design of the memory
24 modules that required, you know, different trade-offs
25 for different memory technologies.

1 Q. Who designed the memory controllers that were
2 used in Sun's products during the time that you were
3 with the company?

4 A. Well, Sun did, in many cases I did personally.

5 Q. In the role that you mentioned as director of
6 hardware and then later vice president of technology,
7 you were involved in actual design of memory
8 controllers?

9 A. Correct.

10 Q. Did Sun purchase memory controllers from
11 third-party sources?

12 A. No. At the time I was with the company, all
13 memory interfaces were designed by Sun for our
14 products.

15 Q. You mentioned earlier that one of the factors
16 that you considered to be important in evaluating
17 different memory options was performance?

18 A. Correct.

19 Q. What specifically were Sun's goals or
20 considerations in terms of the performance of the
21 memory products it would use in its own systems?

22 A. So our goal was to have a performance advantage
23 in the market compared to our competitors, and an
24 important ingredient to those performance numbers was
25 the actual performance of the memory system or

1 subsystem that ultimately determined application or
2 benchmark performance that was in fact visible to
3 customers.

4 Q. Now, I believe you said earlier that early on
5 at Sun all of the memory options that you were
6 considering were so-called open standards; is that
7 right?

8 A. Correct.

9 Q. And was there, in the memory area specifically
10 as opposed to other areas where you used standards,
11 was there any benefit to Sun from using an open
12 standard?

13 A. Yes.

14 Q. And what benefits?

15 A. Well, as I testified earlier, the primary
16 benefit was that we were dealing with a mature
17 technology that was cost-effectively delivered by a
18 large number of suppliers and which addressed our
19 concerns of price, performance and availability.

20 Q. Does the volume in terms of overall volume
21 produced and sold of a given memory product not only as
22 relates to Sun's purchases but others, is that
23 something that mattered to you in considering memory
24 options?

25 A. Yes. It did very much so.

1 Q. And why so?

2 A. Because volume is one of the primary drivers
3 for manufacturing efficiencies, which improve yield for
4 the memory manufacturer and thus reduce cost.

5 Q. Did you have any understanding or baseline
6 assumption as to whether the open standard memory
7 options that you considered were subject to or were not
8 subject to royalty-bearing patents?

9 A. At the time I did not have such understanding.

10 Q. You did not have an understanding one way or
11 the other as to whether the open standards were subject
12 to patents?

13 A. Yeah. My assumption was that there was no
14 patents I was familiar with certainly at the time that
15 in my understanding covered standard -- open standard
16 memories.

17 Q. And do you recall why you assumed that?

18 A. Well, the history of memory interfaces was
19 that -- in my experience was that it was an open,
20 multivendor setting that defined memory interfaces, and
21 I never heard of at the time that there was any patent
22 issues surrounding the memory interface itself.

23 Q. Now, in terms of the process that was followed
24 internally within Sun in choosing what memory option
25 you would use in your products, were there others in

1 the company who were involved with you in considering
2 these issues?

3 A. Yes, there were.

4 Q. And generally speaking, who else would be
5 involved in those types of issues?

6 A. Well, we had a number of different design
7 groups, and typically each design group, you know,
8 would do some of their own investigation of what memory
9 made the most -- was the most appropriate for their
10 particular design.

11 Q. In making decisions about different memory
12 options for Sun's products, did you meet with or
13 solicit input from anyone outside of the company,
14 outside of Sun?

15 A. Yes, I did.

16 Q. And whose input would you solicit in that
17 regard?

18 A. Well, primarily we met with manufacturers of
19 memory components to understand their road maps and
20 their development plans. And some of these road maps
21 and plans were also discussed at the JEDEC meetings.

22 Q. Putting aside JEDEC for the moment -- we'll
23 come to that -- but in terms of meetings with memory
24 manufacturers, were you personally involved in such
25 meetings while you were at Sun?

1 A. Yes, I was.

2 Q. And you said, if I'm not mistaken, that it was
3 important for you to understand the memory vendors'
4 road maps?

5 A. Correct.

6 Q. Why was that important, just --

7 A. Well, because the primary issue in terms of
8 memory availability is of course the memory
9 manufacturers' commitment to produce and manufacture
10 the next-generation memories in time, so we were
11 relying on statements made to us by memory
12 manufacturers in choosing next-generation memory
13 components.

14 Q. You identified an area where you solicited
15 input from the memory manufacturers in these
16 interactions.

17 A. Correct.

18 Q. Did you also seek to give input to the memory
19 manufacturers in these interactions?

20 A. Yes, I did.

21 Q. And what was the purpose of that and what was
22 the nature of the input that you gave?

23 A. Well, we encouraged manufacturers to move in
24 directions that made the most sense to us, both from a
25 component interface technology density availability

1 standpoint, so it was an exchange of information of
2 what would make the most sense for follow-on
3 components.

4 Q. And did that type of two-way exchange of
5 information with memory manufacturers, did that type of
6 dialogue continue throughout your time at Sun?

7 A. Yes. It was very much two-way.

8 Q. Were you involved at all times in that two-way
9 dialogue?

10 A. I was involved in most of such meetings, yeah.

11 Q. Now, when you met with memory manufacturers and
12 talked about different memory options, you said that
13 one of the things that you were concerned about was
14 next-generation memory chips?

15 A. Correct.

16 Q. And what was the nature of your focus or
17 concern as relates to next-generation memory chips?

18 A. Well, one of the primary concerns was any
19 change to the interface of the memory which would
20 impact our system design. However, even within the
21 same identical interface, memory vendors had road maps
22 on higher density devices, making technology changes
23 from one generation to the next generation technology,
24 improving the timing and performance characteristics of
25 memory, issues of that type, which affected our own

1 road maps in terms of the forwards and backwards
2 compatibility of memory devices vis-a-vis our system
3 design.

4 Q. You said that changes -- I believe you said
5 that changes to a memory interface could affect Sun's
6 own system design; is that correct?

7 A. Correct.

8 Q. How could changes in a memory interface affect
9 the system designs of Sun Microsystems?

10 A. Well, if a next-generation memory part was not
11 backwards compatible with the original part the system
12 was designed for, it would not perform or it would not
13 be functional in such a design, which would then
14 require Sun to change the system design to accommodate
15 the next-generation memory part.

16 Q. In terms of performance, which was one of the
17 factors that you mentioned that was relevant to you in
18 making these decisions, was Sun willing to pay whatever
19 price was needed in order to achieve higher-performing
20 memory?

21 A. No. This was the so-called cost-performance
22 trade-off where we would look at the cost or the
23 incremental cost for a higher-performance memory device
24 and then make a business judgment whether such a higher
25 cost was in fact warranted in terms of a value that we

1 could demonstrate in the market at the system level to
2 our customers.

3 Q. And were you involved in making these types of
4 cost-performance trade-offs as relates to memory
5 products while you were at Sun?

6 A. Yes, I was.

7 Q. Were there any particular guidelines that you
8 considered in making those types of trade-offs?

9 A. Yes. My primary guideline was to pick the
10 so-called sweet spot of the manufacturer in terms of
11 yield, so in many cases we would not choose the
12 highest-performance part but perhaps the second to the
13 highest-performance part that over the life cycle of
14 the product we felt confident that the vendor would
15 have high yield on this particular device.

16 Q. And let me ask you just to clarify.

17 What specifically do you mean by the sweet spot
18 in terms of the yield of a memory device?

19 A. Well, the sweet spot is a technical term to
20 describe the typical device that the manufacturer
21 actually achieves in its manufacturing process.

22 Q. In considering the costs of different memory
23 options, was the question of patents and royalties a
24 relevant consideration to you at Sun?

25 A. Well, it never came up at the time because I

1 was not familiar with patent issues surrounding
2 industry standard memory components. Now, if I had
3 known at the time, that would have been a
4 consideration, but at the time, I did not have such
5 information.

6 Q. And why would that have been a consideration or
7 how would that have affected your consideration of
8 memory options?

9 A. Because obviously the cost of a royalty on the
10 memory part would be passed on to the customer of the
11 memory devices, which was Sun.

12 Q. And when you say that that is obviously true,
13 what basis do you have for that view?

14 A. Well, because the memory manufacturers are in a
15 competitive market, but they do need a minimum amount
16 of profits or margins in their business model to
17 sustain their investments in manufacturing, and so on,
18 so as a result, any cost burdens that they would
19 encounter they would logically pass on to customers.

20 Q. We talked earlier about the different memory
21 standards that were used during your thirteen-year
22 period with Sun Microsystems, and I believe you said
23 that the last in that sequence of standardized memory
24 products was SDRAM; is that right?

25 A. Yes.

1 Q. Do you have an understanding of what SDRAM,
2 that acronym, stands for?

3 A. Synchronous DRAM.

4 Q. And were you involved in Sun's decision to use
5 synchronous DRAM in its products?

6 A. Yes, I was.

7 Q. To your knowledge, was synchronous DRAM or
8 SDRAM established as a standard by any particular group
9 or entity?

10 A. Yes.

11 Q. And what entity are you referring to?

12 A. JEDEC.

13 Q. Do you recall when you first learned that JEDEC
14 was developing synchronous DRAM standards?

15 A. In my recollection, I was contacted by or I
16 contacted -- I don't know which way it happened -- a
17 gentleman from NEC Electronics with the name of
18 Howard Sussman. And I may have read about his work in
19 the press or he contacted me knowing that I was
20 involved in the memory discussions at Sun.

21 MR. ROYALL: May I approach, Your Honor?

22 JUDGE McGUIRE: Yes.

23 BY MR. ROYALL:

24 Q. Mr. Bechtelsheim, I've just handed you a
25 document that has been marked for identification as

1 Exhibit RX-162. Do you have that?

2 A. Yes.

3 Q. And do you recognize this document?

4 A. Yes, I do.

5 Q. Can you explain what it is?

6 A. This is the letter that I received -- it says
7 by fax -- from Howard Sussman regarding his early
8 concepts of a synchronous DRAM interface.

9 Q. And if you haven't said earlier, who was
10 Howard Sussman?

11 A. I believed he worked for NEC Electronics, which
12 was a large manufacturer of DRAM at the time.

13 Q. And do you have an understanding as to why
14 Howard Sussman sent a letter to you in this time
15 period, which, for the record, the letter is dated
16 July 30, 1991?

17 A. Right. He, Howard, was in fact proposing a new
18 interface for DRAM and I believe he proposed this in
19 the context of the JEDEC effort, which would later
20 evolve and become known as the synchronous DRAM.

21 Q. Let me ask you a couple questions about
22 statements in Mr. Sussman's letter.

23 First of all, in the first line of his letter,
24 RX-162, Mr. Sussman states, "Thanks for taking the time
25 to chat with me from Maui."

1 Do you see that?

2 A. Yes.

3 Q. Do you recall what that refers to?

4 A. I think I attended some sales meeting in Hawaii
5 at the time when he contacted me.

6 Q. And do you recall anything in particular about
7 what you discussed with him in that conversation?

8 A. Well, he verbally described the idea of using a
9 clock to transfer the data to and from the DRAM, and
10 that made sense to me, so I asked him to send me a more
11 specific description of that, which he did.

12 Q. And in that same first paragraph of the
13 exhibit, the last sentence reads, "Any additional
14 comments that you have on this device would be greatly
15 appreciated."

16 Do you see that?

17 A. Yes.

18 Q. Do you recall whether you had given comments to
19 Mr. Sussman relating to the synchronous DRAM devices
20 discussed in this letter?

21 A. Yes. I did.

22 Q. Do you recall the nature of whatever
23 comments --

24 A. Well, my primary, initial, immediate concern or
25 question was would such an interface really improve the

1 performance of memory at the system level.

2 Q. And did you have reasons to question whether in
3 fact the use of a clock in a synchronous DRAM device
4 would improve system performance?

5 A. Yeah. My initial reaction was that there was
6 merit to this idea.

7 Q. Further down in this letter from Mr. Sussman
8 on the first page of RX-162, right in the middle of
9 the page, do you see there's a short paragraph, the
10 first sentence of which reads, "We are only proposing
11 using one edge of the system clock as I am concerned
12 with pulse symmetry and the differential rise/fall
13 times"?

14 Do you see that sentence?

15 A. Yes, I do.

16 Q. Do you have an understanding of what
17 Mr. Sussman was referring to by that language?

18 A. Yes. He was referring to single-edged
19 clocking, and I in fact shared his concerns regarding
20 pulse symmetry and the differential rise/fall times.

21 Q. When you say that you shared Mr. Sussman's
22 concerns, were those concerns concerns about use of a
23 single-edged clock or use of some other type of clock?

24 A. Well, in my experience, single-edged clocking
25 was easier to implement than dual-edged clocking.

1 Q. And when you say in your experience, what
2 experience are you referring to?

3 A. In my experience as a system designer of
4 electronic systems.

5 Q. And had you, in this time period in mid-1991,
6 had you had some experience with multi-edged clock
7 systems?

8 A. Well, I actually not had designed or delivered
9 a design with multi-edged clocking, but I had
10 investigated the issue and at the time my conclusion
11 was single-edged clocking was simpler to design.

12 Q. In your views, if I could ask you to limit your
13 answer to your views at the time that this
14 correspondence occurred, do you recall whether you had
15 views as to whether system performance would be limited
16 if you were to use a single-edged clock as opposed to
17 multi-edged clock?

18 A. No. That was not my concern.

19 Q. Do you recall why you did not have concerns in
20 that regard?

21 A. Because the range of clock frequencies that was
22 discussed at that time seemed plentiful to achieve the
23 performance objectives or performance goals set out for
24 this interface.

25 Q. And do you recall what those -- generally what

1 those performance goals were?

2 A. At the time, my recollection is the clock
3 frequency discussion ranged between 50 and
4 100 megahertz.

5 Q. Now, referring to that same paragraph in
6 Mr. Sussman's letter, RX-162, the very next sentence
7 reads, "With higher-speed clocks, this will be even
8 more severe."

9 Do you see that?

10 A. Yes.

11 Q. Do you have an understanding of what
12 Mr. Sussman was referring to by that statement?

13 A. Yes, I do.

14 Q. And can you explain what you understand that to
15 refer to?

16 A. Well, the issue with pulse symmetry and
17 differential rise/fall times versus the higher clock
18 rate is because it is the active period for the high
19 versus low period. That was the concern this is
20 describing.

21 Q. And do you recall whether you had any views on
22 that issue in this time period?

23 A. Yeah. I shared his concern.

24 Q. You shared his concern?

25 A. Absolutely.

1 Q. Now, in the next paragraph of Mr. Sussman's
2 letter, do you see toward the bottom of the paragraph
3 the sentence beginning with "although"?

4 It says, "Although Sun is not a JEDEC
5 member" -- do you see that?

6 A. Yes, I do.

7 Q. Is that correct? Was Sun not a JEDEC member in
8 this time frame, mid-1991?

9 A. As far as I know, that's correct.

10 Q. Did Sun at some later point become a member of
11 JEDEC?

12 A. Yeah. In response or in -- as we got more
13 involved in the synchronous DRAM discussions, as far
14 as I recall, Sun became a member of JEDEC after this
15 time.

16 Q. And when you refer to the synchronous DRAM
17 discussions, are you referring to discussions relating
18 to synchronous DRAM that occurred within JEDEC or
19 discussions outside of JEDEC or both?

20 A. Both of these. We had frequent discussions
21 with individual memory manufacturers surrounding
22 synchronous DRAM and there was also discussion at JEDEC
23 itself.

24 Q. So you consulted with other memory
25 manufacturers about synchronous DRAM in addition to

1 NEC; is that correct?

2 A. Yes, I did.

3 Q. Do you recall what other companies you
4 interacted with in that regard?

5 A. I don't recall specifically, but I believe the
6 list included Toshiba and Samsung. I'm sorry. Micron.
7 Micron.

8 Q. Now, you said that Sun did become a member of
9 JEDEC. Do you recall when that occurred?

10 A. I do not know when.

11 Q. Were you supportive of Sun becoming a member of
12 JEDEC?

13 A. Yes, I was.

14 Q. And why were you supportive of that?

15 A. Because I felt that it was important for Sun as
16 a large customer of memory to participate with the
17 JEDEC organization, which primarily represented the
18 manufacturers of memory, to establish the dialogue
19 regarding this synchronous memory development that
20 would result in the most cost-effective and timely
21 design.

22 Q. Were there other purchasers of memories, as
23 opposed to manufacturers of memory, who participated in
24 JEDEC to your knowledge?

25 A. I believe there were.

1 Q. Now, did you have an understanding in this
2 time period in the early 1990s of what JEDEC was
3 seeking to do in terms of establishing synchronous
4 DRAM standards?

5 A. Well, the goal of JEDEC is to develop standards
6 for the industry at large that result in
7 high-volume-type devices. And I guess I'm not sure I
8 understand the question. What is the goal of JEDEC in
9 establishing the industry standards? Could you
10 rephrase.

11 Q. Well, it wasn't a very clear question. Let me
12 restate it.

13 Did you have an understanding of what the
14 purpose of JEDEC's standardization process was as it
15 related to memory?

16 A. Well, the purpose was to develop standards that
17 could be used by all memory manufacturers to
18 manufacture devices that had the same functionality and
19 thus could be used as a multivendor, multistandard
20 device from multiple manufacturers.

21 Q. You mentioned the term "open standards"
22 earlier.

23 Did you have an understanding as to whether the
24 standards that JEDEC was developing would be open
25 standards?

1 A. My understanding at the time and even today is
2 that their primary -- that their stated goal is to
3 develop open industry standards.

4 Q. Did you personally participate in any JEDEC
5 meetings on behalf of Sun?

6 A. I attended a small number of meetings, but I
7 did not attend a large number of meetings.

8 Q. Do you recall how many, roughly, you attended?

9 A. Less than a handful.

10 Q. And do you recall over what time period that
11 was?

12 A. Starting in -- I mean, after the time of this
13 letter, so I do not recall the specific times, but
14 after '91.

15 Q. Do you recall whether the JEDEC meetings that
16 you attended related to the definition of SDRAM
17 standards as opposed to some other aspect of JEDEC's
18 work?

19 A. It was primarily for the SDRAM interfaces,
20 yes.

21 Q. Were you ever Sun's primary JEDEC
22 representative?

23 A. No, I was not.

24 Q. Do you recall who was?

25 A. I believe a gentleman whose name is

1 Clement Fang, F-A-N-G.

2 Q. And did you interact with Mr. Fang relating to
3 JEDEC, JEDEC-related issues?

4 A. Yes, I did.

5 Q. And what was the nature or purpose of that
6 interaction?

7 A. Well, I did not have the time to personally
8 attend each one of the JEDEC meetings or travel to such
9 meetings, so I typically would meet with Clement before
10 and after meetings to discuss, you know, the present
11 developments and the outcome of such meetings.

12 Q. Did you, based on your attending what I think
13 you characterized as less than a handful of JEDEC
14 meetings, did you have any understanding or detailed
15 understanding of any rules or procedures that applied
16 to JEDEC's work?

17 A. I was not familiar with their exact rules and
18 proceedings of how they would operate as a standards
19 group. My assumption was that it was an open industry
20 setting where --

21 MR. STONE: Your Honor, I don't think the
22 question calls for assumptions, so to that extent I
23 think he answered the question and I move to strike his
24 testimony about his assumptions, which I think are
25 speculation and not relevant.

1 JUDGE McGUIRE: Mr. Royall?

2 MR. ROYALL: I don't mind limiting the answer
3 there. I would ask that Mr. Stone refrain from
4 interrupting the witness.

5 JUDGE McGUIRE: Mr. Stone, I would appreciate
6 in the future -- if we're going to strike, we're going
7 to strike -- so if you'll allow opposing counsel and
8 the person on the stand the courtesy of concluding
9 their question or answer and then you will have every
10 opportunity to object in full.

11 MR. STONE: Thank you, Your Honor. And I
12 apologize to counsel and to Mr. Bechtelsheim.

13 JUDGE McGUIRE: All right. Thanks.

14 Now, Mr. Royall, what were you about to say?

15 MR. ROYALL: I can just continue with another
16 question.

17 JUDGE McGUIRE: Okay.

18 MR. ROYALL: If it's all right.

19 BY MR. ROYALL:

20 Q. I believe you said, and I don't have your
21 precise testimony in mind in terms of the language you
22 used, but I believe you said that you did not have a
23 detailed understanding of the rules and procedures of
24 JEDEC. Is that a fair statement?

25 A. Correct.

1 Q. Did you have any general understanding of any
2 aspect of JEDEC's rules or procedures based on the
3 limited exposure you had to the organization?

4 A. Yes. My general understanding was that it was
5 an open industry standards process.

6 Q. Did you have any understanding whatsoever
7 relating to the issue of whether JEDEC's rules and
8 procedures had any requirements related to the
9 disclosure of patents, patent applications or other
10 intellectual property?

11 A. I did not have any specific understanding of
12 that at that time.

13 Q. Did you have any general understanding --

14 A. Well, my general --

15 Q. Let me finish my question, please.

16 Did you have any general understanding relating
17 to that issue?

18 A. My general understanding was that the method of
19 an open industry standards process was to choose
20 technologies or interfaces in this context that were
21 not encumbered by proprietary patents or royalty
22 claims.

23 Q. And do you recall what the basis of that
24 general understanding was?

25 A. Well, my general understanding was that there

1 was no advantage to use proprietary or patented
2 technology because in typical design activity one can
3 make any number of choices, including choosing an
4 interface that was not encumbered by a patent or
5 royalty.

6 Q. Do you recall having any specific discussions
7 with Mr. Fang or anyone else about what JEDEC's rules
8 may or may not have required in terms of patent-related
9 disclosures?

10 A. I don't recall that today.

11 Q. Do you recall ever personally reviewing any
12 JEDEC rules or manuals in terms of written rules or
13 manuals?

14 A. Not at that time.

15 Q. Now, going back to JEDEC's efforts to develop
16 synchronous DRAM standards, do you recall what, if any,
17 views Sun sought to provide to the JEDEC process or
18 sought to contribute to the JEDEC process as to or
19 relating to the development of synchronous DRAM?

20 A. Yes, I do.

21 Q. And what do you recall in that regard?

22 A. Well, our primary objective was to achieve a
23 cost-effective part that could be manufactured
24 efficiently with minimum increase in die size and at
25 good yield such that we would have a technology

1 available that could in fact substitute for the
2 previous memory technology.

3 Q. What you just described, that's what you recall
4 being Sun's primary objectives relating to the
5 development of synchronous DRAM standards?

6 A. Correct.

7 There was some other objectives as well. For
8 example, keeping the interface or the part definition
9 as simple as possible so that it was easy to design in
10 and to use at the system level.

11 Q. Now, you mentioned -- let's start with the
12 yield issue -- that one of your primary objectives or
13 one of Sun's primary objectives as it related to the
14 development of synchronous DRAM standards by JEDEC was
15 achieving good yield.

16 What did you mean by that and why did Sun care
17 about that?

18 A. Well, the primary ingredients into the true
19 cost of memory manufacturing is the combination of die
20 size and yield because the yield describes how many
21 good devices you get on each wafer.

22 So a device that is difficult to manufacture
23 would be correspondingly much more expensive than a
24 device that is easy to manufacture and thus has higher
25 yield.

1 Q. And you mentioned that another consideration
2 for Sun relating to JEDEC's development of SDRAM
3 standards was keeping the interface as simple as
4 possible; is that right?

5 A. Correct.

6 Q. And why did Sun have that view as it relates to
7 SDRAM standards?

8 A. There was two concerns. One is the cost for
9 Sun to design the interface and dealing, you know, with
10 more complex interface. But perhaps an indeed more
11 important consideration was we wanted to make sure that
12 the manufacturers that were building their own unique,
13 separate designs were in fact able to make fully
14 identical, functionally compatible parts, thus a design
15 that has a simpler interface made that easier to
16 achieve than one that had a much more complex
17 interface.

18 Q. And why did Sun care whether the memory
19 manufacturers were able to make fully functional,
20 compatible parts?

21 A. Because, otherwise, we would have to deal with
22 different nuances or differences between these parts
23 that would have to be accommodated at the system
24 level, or alternatively, we could not use multiple
25 suppliers.

1 Q. And you explained to me in response to earlier
2 questions that Sun's objectives relating to the
3 development of synchronous DRAM standards by JEDEC
4 concerned cost questions and simplicity of the design.
5 You did not mention any particular technical features.

6 Were there any particular technical features
7 that Sun desired to see included in the JEDEC
8 synchronous DRAM standards?

9 A. Well, there may have been a very small number
10 of characteristics that we cared about at the technical
11 level, but the primary concern was that JEDEC was in
12 fact able to develop a standard that was suitable for
13 manufacturing of identical parts by all the memory
14 manufacturers.

15 So we were I would say equally concerned about
16 achieving the performance benefits of synchronous DRAM
17 as we were about arriving at a standard definition that
18 would enable the industry to manufacture these parts in
19 high volume.

20 Q. You mentioned that you only attended a small
21 number of JEDEC meetings.

22 Putting aside how many meetings you attended,
23 during the time period that JEDEC was developing the
24 synchronous DRAM standards, were you in your capacity
25 at Sun monitoring the progress that JEDEC was making in

1 that regard?

2 A. Certainly.

3 Q. And why were you monitoring JEDEC's progress on
4 synchronous DRAM standards?

5 A. Because it was a prerequisite for, in my mind,
6 for the memory manufacturers to actually produce and
7 manufacture these JEDEC-compatible parts. Thus, unless
8 there was a completed standard, we would never, you
9 know, get to the synchronous memory.

10 Q. Do you recall whether you had any particular
11 views as to how the process was going or how efficient
12 the JEDEC process was in terms of definition of a
13 synchronous DRAM standard?

14 A. Well, it took longer than I thought it would
15 take at first. And there was a number of, you know,
16 differences of opinions between different
17 manufacturers regarding features they wanted to
18 include. But in the end, you know, the result was
19 achieved and I can only speculate if one could have
20 done a more efficient process versus what actually
21 happened.

22 Q. And why did you and Sun care about the
23 efficiency of JEDEC's process in developing synchronous
24 DRAM standards?

25 A. Well, because if the process had not concluded,

1 there would not be a synchronous DRAM that was the
2 JEDEC industry standard definition.

3 MR. ROYALL: Your Honor, before I move to
4 another exhibit, I'd like to offer the prior exhibit,
5 RX-162.

6 MR. STONE: No objection.

7 JUDGE McGUIRE: Entered.

8 (RX Exhibit Number 162 was admitted into
9 evidence.)

10 MR. ROYALL: And may I approach?

11 JUDGE McGUIRE: Yes.

12 BY MR. ROYALL:

13 Q. Mr. Bechtelsheim, I've just handed you another
14 document that's been marked for identification as
15 Exhibit CX-2383.

16 Do you recognize this document?

17 A. Yes, I do.

18 Q. It's -- for the record, it's dated August 27,
19 1992.

20 Can you explain to me what this document is?

21 A. Yeah. Todd Lynch, who was one of Sun's
22 hardware design managers at the time, sent a letter to
23 JEDEC expressing Sun's concerns with the SDRAM
24 specification and schedule.

25 Q. And who is Todd Lynch or what role did he play

1 at Sun in this time period?

2 A. He managed one of the platform design groups.

3 Q. Do you recall whether you received a copy of
4 this August 27, 1992 letter to JEDEC at the time that
5 it was sent?

6 A. Yes, I did.

7 Q. And did you have an understanding as to why
8 Mr. Lynch sent this letter to -- I said to JEDEC. It's
9 addressed to "Dear JEDEC Member."

10 But do you have an understanding as to why
11 Mr. Lynch sent this letter?

12 A. Yes. Our feeling at the time was that the --
13 there was too many different features being discussed
14 by various manufacturers and we wanted to focus them
15 on the goal of completing a specification even if that
16 was simpler than some of the proposals that had been
17 made.

18 Q. And did you think that the views of
19 Sun Microsystems were important for JEDEC to consider
20 in this regard?

21 A. Well, I hope so. I did not attend the meeting
22 where this was presented, so I don't know what their
23 reaction was, but I know the objective was to provide
24 that type of feedback to the group.

25 Q. Let me ask you about a couple of statements in

1 Mr. Lynch's letter.

2 In the first paragraph, he states:

3 "Sun Microsystems intends to use synchronous DRAM in
4 future products. However, we have two major concerns.
5 The first is the schedule for the SDRAM specification:
6 Can it be completed in time so that parts will be
7 available when we need them?"

8 Let me stop there.

9 Do you see that language?

10 A. Yes, I do.

11 Q. Did you share that concern in this time frame?

12 A. Yes. Without a completed specification, the
13 parts would not become available.

14 Q. And the next sentence of that same paragraph
15 reads, "The second is making sure that the
16 specification is detailed enough so that parts will be
17 completely interchangeable."

18 Do you see that?

19 A. Yes.

20 Q. And did you share that concern as well?

21 A. Yes. There was a number of gratuitous
22 differentiation from different vendors in the proposals
23 regarding synchronous DRAM at the time.

24 Q. And in the next paragraph, the second sentence
25 states, "To help expedite the standardization process

1 we have written a detailed specification."

2 Do you see that language?

3 A. Yes.

4 Q. And do you recall that Sun in this time period
5 did put together a detailed SDRAM specification?

6 A. Yeah. It was presented in slide form as I
7 recall.

8 Q. And did you have any involvement in either
9 preparing or reviewing that specification?

10 A. Yes. That was reviewed internally and I
11 attended those meetings.

12 Q. Now, further down in the same letter, there is
13 a paragraph that begins "We do not."

14 Do you see that?

15 A. Yes.

16 Q. And it says, "We do not use every feature that
17 is described in this document, so we are willing to
18 make compromises if necessary to reach a quick
19 resolution on the standard."

20 Do you see that?

21 A. Correct.

22 Q. And did you agree with that, that viewpoint?

23 A. Yes. Very much so.

24 Q. And why did you agree that Sun should be
25 willing to make compromises relating to features

1 included in the SDRAM standards?

2 A. Well, we had not completed any system design
3 at the time using synchronous DRAM. As a result, we
4 were able or we were willing to adopt the industry
5 standard. Our primary objective was to get to
6 resolution of the standard itself so that the memory
7 manufacturers could build the parts and we could use
8 them.

9 Q. The very next sentence states, "Also since we
10 are very cost conscious, we are willing to drop
11 features that add too much cost or complexity."

12 Do you see that?

13 A. Yes.

14 Q. And did you agree with that viewpoint in this
15 time period?

16 A. Very much so. Our or my personal feeling was
17 that because some vendors were proposing features that
18 would add significant cost to memory and that was a
19 significant concern.

20 Q. Now, one of the views that's expressed in this
21 letter that we have commented on relates to how quickly
22 and efficiently JEDEC was finalizing its SDRAM
23 specifications, and I think you've said that that is
24 something that was of some concern to you at Sun; is
25 that right?

1 A. Correct.

2 Q. What I want to understand is why was it a
3 concern. Why -- how would Sun be impacted if JEDEC had
4 in this period taken longer than you had hoped to see
5 to finalize its SDRAM specification?

6 A. Because we could not start our own system
7 design cycle or system design activity until we were
8 confident that the memory manufacturers were in fact
9 going to manufacture the parts in volume, and we
10 believed that only would happen after there would be a
11 completed JEDEC specification.

12 Q. Are you saying that Sun in terms of developing
13 its own designs for its own workstations and servers
14 needed to know in advance what the memory specification
15 would be in terms of the memory incorporated into those
16 products?

17 A. Yeah. Very much so.

18 Q. And if the memory specification or the
19 finalization of that were delayed, that would delay
20 Sun's own design process; is that what you're saying?

21 A. Well, then we could not use such a memory, and
22 our design cycle was typically one to two years for a
23 new product, so we would need to know at the beginning
24 of that design cycle which exact memory technology we
25 could use at the time the product would be

1 manufactured.

2 Q. And would delay in the specification of the
3 memory design have the potential to impact adversely
4 Sun's business in terms of its sales and its delivering
5 to its customers?

6 A. Well, I wouldn't say it would impact Sun's
7 business, but it would impact the decision which
8 memory, specific memory component to use.

9 So for example, if synchronous DRAM did not
10 have a completed spec, we would choose to use the
11 previous memory technology, specifically the EDO
12 memory.

13 Q. And would there be any implications from such a
14 choice in terms of the performance or the value of your
15 product?

16 A. Well, we would not be able to take advantage of
17 the performance characteristics of the next-generation
18 synchronous DRAM. Yes.

19 MR. ROYALL: Your Honor, I still have a ways to
20 go, but I'm at a convenient breaking point, if this
21 would be a good time --

22 JUDGE McGUIRE: Let's take a ten-minute break
23 now.

24 MR. ROYALL: Thank you.

25 JUDGE McGUIRE: Off the record.

1 (Recess)

2 JUDGE McGUIRE: All right. Mr. Royall, you may
3 proceed.

4 MR. ROYALL: Your Honor, I don't believe I
5 have offered yet CX-2383. I'd like to do that at this
6 time.

7 JUDGE McGUIRE: Any objection?

8 MR. STONE: No objection.

9 JUDGE McGUIRE: Entered.

10 (CX Exhibit Number 2383 was admitted into
11 evidence.)

12 MR. ROYALL: May I approach?

13 JUDGE McGUIRE: Yes.

14 BY MR. ROYALL:

15 Q. Mr. Bechtelsheim, I've just handed you another
16 document that's been marked for identification as
17 CX-340.

18 Do you recognize this document?

19 A. Yes, I do.

20 Q. Can you explain to us what it is?

21 A. I believe this was the presentation that was
22 referred to in the previous exhibit, 2383, that was
23 giving advice to JEDEC regarding synchronous DRAM.

24 Q. And were you involved in any way in preparing
25 or reviewing this, this document?

1 A. Yes, I was.

2 Q. Were you present at the time that Sun made this
3 presentation to JEDEC?

4 A. No. I don't recall that.

5 Q. Let me ask you a few things about statements
6 that are made in this presentation, CX-340.

7 Focusing on the first page, there are multiple
8 slides here. The bottom slide on the first page of
9 CX-340 has a number of bullet points.

10 And the fourth line down or the second bullet
11 point states, "We are concerned about progress of
12 standardization effort -- will we get parts in time?"

13 Do you see that?

14 A. Yes.

15 Q. And does this relate to the same issue we were
16 talking about earlier in terms of Sun's desire to see
17 the standardization process finalized in an efficient
18 way?

19 A. Correct.

20 Q. And the next bullet point says, "We are
21 concerned about compatibility between parts from
22 different vendors."

23 Do you see that?

24 A. Yes.

25 Q. And I think this again relates to one of the

1 concerns that we focused on in connection with
2 Mr. Lynch's letter; is that correct?

3 A. Correct.

4 Q. In the bottom of that same slide on the first
5 page of Exhibit CX-340, there's a reference to Sun's
6 proposal and then below that three bullet points.

7 Do you see what I'm referring to?

8 A. Yes.

9 Q. And the second bullet point says "Contains
10 little that is new or radical."

11 Do you see that language?

12 A. Yes.

13 Q. Do you have an understanding of what that
14 refers to?

15 A. Yes.

16 Q. Can you explain?

17 A. We did not -- at Sun, we did not want to add
18 new requirements to the standardization effort from a
19 requirement perspective. Our primary goal was to
20 complete the standard in a timely fashion, as stated
21 above.

22 So it was not our goal to introduce new
23 material here that was different or radically
24 different than any previous ideas that had been
25 presented.

1 Q. Do you, Mr. Bechtelsheim, have an
2 understanding of the terms "evolutionary" and
3 "revolutionary" as they are sometimes used in
4 connection with DRAM designs?

5 A. Yes, I do.

6 Q. Let me ask you, take one at a time, but to
7 explain what you understand by the term
8 "evolutionary."

9 A. Well, evolutionary is to make modest changes
10 to a specification, to a DRAM interface specification,
11 that minimizes the effort required by a system
12 designer to design that new interface into a product.

13 Q. And what does the term -- what do you
14 understand the term "revolutionary" to mean in
15 connection with DRAM design?

16 A. Well, revolutionary is to make a much larger
17 change in interface that would imply a much more
18 significant effort on the system designer to
19 accommodate such.

20 Q. And did you have an understanding one way or
21 the other as to whether the SDRAM or synchronous DRAM
22 standards that JEDEC was developing in this time period
23 were evolutionary or revolutionary?

24 A. Well, they had some elements of both. They're
25 very evolutionary in the sense that they would allow

1 existing system design techniques to be used in terms
2 of voltage levels, logic, designing, et cetera.
3 Whether the clocking by itself was revolutionary or
4 not, that's something I think people could debate. But
5 from my personal perspective, I would call this a more
6 evolutionary direction than revolutionary.

7 Q. And was Sun supportive of JEDEC taking an
8 evolutionary approach to the development of synchronous
9 DRAM standards?

10 A. Very much so.

11 Q. And why was Sun supportive of that?

12 A. To reduce the difficulty of designing in this
13 next generation type of memory.

14 Q. So would it be fair to say that Sun as a
15 purchaser of DRAM memory benefited from evolutionary
16 development of DRAM standards?

17 A. Yes. That was also my view.

18 Q. And in terms of its own proposal to JEDEC, was
19 Sun's intent to promote the development of evolutionary
20 approaches to SDRAM?

21 A. Generally speaking, I agree. Now, again,
22 experts can have different opinions whether the
23 particular feature was in fact evolutionary or
24 revolutionary, but overall I would characterize the
25 synchronous DRAM as an evolutionary development.

1 Q. Now, turning to the next page, the second page
2 of Exhibit CX-340, do you see the slide at the top of
3 the page?

4 A. Yes.

5 Q. And the second to last line states, "We are
6 still very much concerned with cost and complexity of
7 SDRAMs."

8 Do you see that?

9 A. Correct.

10 Q. And I believe this relates to the same concepts
11 that we were discussing earlier in connection with
12 Mr. Lynch's letter; is that correct?

13 A. Yes. There was -- cost and complexity was one
14 of our primary concerns.

15 Q. And the next line says, "Sun is open for
16 discussion on SDRAM features and functionality."

17 Do you see that?

18 A. Correct.

19 Q. And what do you understand that statement to
20 mean here or to refer to?

21 A. That Sun itself did not have a strong view of
22 what exact features the part should have as long as it
23 would meet the cost, complexity and timely completion
24 of the standard.

25 Q. I don't have any further questions about this

1 document. You can set that aside.

2 And Your Honor, at this time I would like to
3 offer CX-340.

4 MR. STONE: No objection.

5 JUDGE McGUIRE: Entered.

6 (CX Exhibit Number 340 was admitted into
7 evidence.)

8 BY MR. ROYALL:

9 Q. Now, you mentioned earlier, Mr. Bechtelsheim,
10 that you monitored, you in your role as vice president
11 of technology for Sun Microsystems monitored JEDEC's
12 development of synchronous DRAM standards; is that
13 right?

14 A. Correct.

15 Q. When JEDEC finalized its synchronous DRAM
16 standards, did you familiarize yourself with the final
17 standards?

18 A. Yes. Because those were the standards we would
19 then design to.

20 Q. And just to be clear, why was it important for
21 you as vice president of technology for
22 Sun Microsystems to personally familiarize yourself
23 with the final JEDEC SDRAM standards?

24 A. Because I was involved in the design of the
25 system that was considering synchronous DRAM at that

1 time.

2 Q. Are you familiar with the term "mode register"?

3 A. Yes, I am.

4 Q. Can you explain to us what you understand that
5 term to refer to?

6 A. Well, a mode register is a control element
7 that allows the memory device to be programmed in a
8 number of different modes for different types of
9 operations.

10 Q. Do you have an understanding as to whether
11 JEDEC's final SDRAM standard or specification
12 incorporated use of a mode register?

13 A. Yes, it did.

14 Q. And what's your understanding?

15 A. It did incorporate it.

16 Q. And do you have an understanding of what the
17 purpose of the mode register was within the SDRAM
18 design?

19 A. Yes. The purpose was to allow programming of
20 different burst sizes and different CAS latency.

21 Q. Are you familiar with the term "programmable
22 CAS latency"?

23 A. Yes, I am.

24 Q. And what did you understand that term to refer
25 to?

1 A. Well, it allows the memory device to operate in
2 a number of distinct modes relative to the performance
3 of the CAS at this time.

4 Q. And do you have an understanding as to whether
5 JEDEC's finalized SDRAM standards incorporated use of
6 programmable CAS latency?

7 A. Yes, it did.

8 Q. And what is your understanding? It did?

9 A. That it did incorporate it, yes.

10 Q. What about the term "programmable burst
11 length"? Are you familiar with that term?

12 A. Yes, I am.

13 Q. And can you explain to us what you understand
14 that term to refer to?

15 A. Well, different -- that the memory part
16 supports, again, different modes relative to the burst,
17 which is the number of data cycles or data elements
18 being accessed in one access, and the burst mode
19 register allows us to set that number.

20 Q. And again, do you have an understanding as to
21 whether the JEDEC's final SDRAM standard incorporated
22 the use of programmable burst length?

23 A. Yes, it did.

24 Q. Do you recall when you first learned of JEDEC's
25 work on synchronous DRAM standards whether the design

1 proposals that you were familiar with at that time
2 incorporated the use of a mode register?

3 A. Okay. Can you repeat your question? You said
4 the final spec or the early work?

5 Q. No. I'm going back now to when you first
6 learned that JEDEC was working on synchronous DRAM
7 standards.

8 A. This is the time frame of the Howard Sussman
9 letter.

10 Q. Yes. Referring to the earlier exhibit, RX-162,
11 which is the letter, the July 1991 letter that
12 Mr. Sussman sent to you.

13 Referring to that time frame, when you -- I
14 think you testified earlier this was the time frame
15 that you were first beginning to learn about JEDEC's
16 work on synchronous DRAM standards.

17 In that time frame, do you recall whether you
18 understood that the proposals that you were familiar
19 with incorporated use of a mode register?

20 A. In my recollection, this early -- in the early
21 time frame of the Howard Sussman letter, there was no
22 discussion of mode registers.

23 Q. And you have that letter, RX-162, in your
24 hand.

25 Do you see anything in the letter that relates

1 to a mode register?

2 And in asking that question, I would also refer
3 you to the schematic that's attached as page 2 of
4 RX-162.

5 A. I don't see anything on this letter that refers
6 to mode register.

7 Q. Do you see anything in the letter that refers
8 to either programmable CAS latency or programmable
9 burst length?

10 A. No, I do not.

11 Q. I'm sorry?

12 A. I do not.

13 Q. But you learned at some later point that
14 JEDEC's SDRAM designs would incorporate or did
15 incorporate a mode register; is that right?

16 A. Correct.

17 Q. Do you recall how you learned about that or
18 when you learned about that?

19 A. I believe it was incorporated in the proposal
20 to JEDEC by some or multiple of the memory
21 manufacturers.

22 Q. Do you have any understanding as to whether Sun
23 desired to see a mode register included in the JEDEC
24 synchronous DRAM standards?

25 A. My personal preference was not to have a mode

1 register. There may have been others at Sun that had a
2 different view, but in my view, mode registers added
3 complexity to the design of the memory system
4 controller.

5 Q. And can you elaborate on that, that is, why you
6 did not favor use of a mode register in synchronous
7 DRAM?

8 A. Well, the mode register required that there
9 would be an initialization cycle performed to be -- to
10 program that mode register from the system controller
11 to load it with the correct values, and to me, that
12 seemed like an unnecessary complexity in the design.

13 Q. Were there any adverse implications of that
14 complexity being included in the design in terms of
15 performance or something else?

16 A. It wasn't a performance issue, but it required
17 additional logic design on the part of the memory
18 controller.

19 Q. And what, if any, implications were there to
20 adding additional logic?

21 A. It was design effort. I don't think it's a
22 performance issue.

23 Q. Did that have cost implication?

24 A. Not significant.

25 Q. Did you see anything useful about including a

1 mode register in synchronous DRAM?

2 A. Well, the objective was to allow for different
3 modes of the device and that by itself is a useful
4 ability. However, the same objective could have been
5 achieved in a different fashion.

6 Q. And what do you mean by referring to different
7 ways of achieving that same objective?

8 A. For example, one could have used additional
9 pins on the device to set the same modes without using
10 a mode register.

11 Q. Let me -- understanding that these concepts are
12 somewhat interrelated, but let me focus you
13 specifically on programmable CAS latency.

14 Did you personally have views one way or the
15 other as to whether it was useful to include the
16 feature of programmable CAS latency in the JEDEC SDRAM
17 standard?

18 A. Yes. Initially I thought it was superfluous,
19 but given the fact that people wanted to build systems
20 with a wide range of different clock frequencies, a way
21 to accommodate the different -- the wide range of
22 clocks implied the use of a means to adjust the CAS
23 latency.

24 Q. And in order to do that, was it necessary to
25 use programmability in a mode register or were there

1 other ways to achieve the same end?

2 A. Well, it could have been achieved with discrete
3 pins that would set the value of the CAS latency from
4 the outset.

5 Q. And in your personal view, did you see
6 advantages to using pins or some other alternative over
7 the approach of using programmability?

8 A. Personally, I actually preferred the pins
9 because it was simpler, less effort on the system side,
10 but the JEDEC group chose the mode register.

11 Q. Did you see any adverse cost implications of
12 using pins as opposed to using programmability for CAS
13 latency?

14 A. I recall dimly that there was spare pins
15 available on the package of the device at the time,
16 but I only have a very dim recollection, so I didn't
17 think there was a significant cost issue to using the
18 pins.

19 Q. Other than the use of pins, were there other
20 alternatives that occurred to you for achieving the
21 same purposes of programmable CAS latency in the SDRAM
22 design?

23 A. I seem to recall a discussion to use the
24 so-called JTAG, J-T-A-G, interface for setting some of
25 these modes.

1 Q. And did you have any views as to the advantages
2 or disadvantages of that approach?

3 A. Well, JTAG also required the use of some
4 additional pins, but the advantage was it also provided
5 other functions, including testability functions that
6 were desirable at the system level, and the programming
7 of these registers would not have to be incorporated in
8 the memory controller but, rather, in the JTAG
9 controller.

10 Q. Besides that approach and the earlier approach
11 of using pins that you described, were there any other
12 alternatives that you viewed as viable to -- that is,
13 alternatives on the use of programmable CAS latency?

14 A. I don't recall today.

15 Q. What about programmable burst length? Did you
16 have any views as to whether there were alternatives to
17 achieving the purposes of programmable burst length
18 within the SDRAM design?

19 A. Yes. It's exactly the same answers I gave
20 relative to the programmable CAS latency. One could
21 have used the discrete pin or the JTAG interface to
22 program those values.

23 Q. And would the use of alternative approaches to
24 programmable burst length or programmable -- let me
25 restate that.

1 Would the use of alternatives to programmable
2 CAS latency or programmable burst length within the
3 SDRAM design have -- would use of those alternatives in
4 your view have had any performance implications?

5 A. Not a performance implication.

6 Q. Now, as you've testified earlier, JEDEC did use
7 these particular approaches in the SDRAM
8 specifications.

9 You at the time, I believe you've testified,
10 knew that there were alternatives, but did you not
11 oppose the use of programmable CAS latency or
12 programmable burst length?

13 A. Well, it was more important to us to arrive at
14 the conclusion of an open industry standard than any
15 particular feature independent of what our or my
16 personal view or the views of the company were, so the
17 nature of an open standards process is people, you
18 know, get to express their views, but in the end, the
19 group majority or otherwise decides which direction to
20 go.

21 Q. At the time that JEDEC's SDRAM specifications
22 were developed, did you have any understanding as to
23 whether the technologies that we've been discussing,
24 programmable CAS latency or programmable burst length,
25 would be subject to any royalty-bearing patent claims?

1 A. I had no understanding at the time that there
2 would be a royalty associated with those features.

3 Q. If you had known of royalty -- the potential
4 for royalty-bearing patents to apply to those
5 features, is that something that would have been
6 relevant to you in analyzing those features as opposed
7 to alternatives?

8 A. Yes. I personally and Sun as a company would
9 have strongly opposed the use of royalty-bearing
10 elements in an interface patent -- in an interface
11 specification.

12 Q. And why is that?

13 A. Because, in our view, an industry standards
14 group in defining an interface can make any number of
15 design choices, so since the overarching goal is to
16 develop a cost-effective solution for in this case
17 memory interfaces, it is preferable to use an interface
18 that does not have proprietary royalty, patentable
19 royalty associated with it.

20 Q. You said that you and Sun Microsystems would
21 have opposed the use of royalty-bearing patents in an
22 interface standard.

23 Did you have different views with respect to
24 the use of royalty-bearing patents in other types of
25 standards other than interface standards?

1 A. It was our general view that for open standard
2 interfaces, which are those that are developed by
3 industry standard groups, it was always preferable to
4 choose a specification that would not be encumbered by
5 proprietary rights.

6 Q. And by taking that approach of favoring the use
7 of standards that are not encumbered by proprietary
8 royalty-bearing patents, did you believe that Sun was
9 necessarily sacrificing something in terms of the
10 cost-performance qualities of the standards that it was
11 incorporating?

12 A. No, I did not have that view.

13 Q. And why would it not -- why did you not have
14 that view?

15 A. That is because the nature of defining a new
16 interface is -- you know, it can be done in different
17 ways. It can be done in a proprietary fashion. It can
18 be done in an open standard fashion. There's no
19 disadvantage associated with an open standards process
20 in defining next-generation interfaces.

21 So I did not have a view that there would be
22 any limitation or issue that an open standard could not
23 come up with that would achieve the performance
24 objectives.

25 Q. You described for us earlier the various types

1 of standardized memory that were used in Sun's
2 products in your tenure, thirteen-year tenure with the
3 company. You did not mention in that connection
4 Rambus DRAM or RDRAM.

5 A. Right.

6 Q. Are you familiar with the Rambus DRAM
7 technology?

8 A. Yes, I am.

9 Q. And were you familiar with it at the time that
10 you were at Sun?

11 A. Yes, I was.

12 Q. Do you recall when you first became familiar
13 with or learned about Rambus DRAM?

14 A. Well, Rambus approached Sun I believe starting
15 in 1989 to discuss and describe to us their
16 developments.

17 Q. And did you have meetings or discussions with
18 Rambus after that period?

19 A. Yes. We had actually a fairly large number of
20 meetings with representatives from Rambus.

21 Q. Were you personally involved in meetings with
22 Rambus?

23 A. Yes. I attended a large number of those
24 meetings myself.

25 Q. And can you place this in time, during what

1 time period this large number of Rambus meetings
2 occurred?

3 A. Well, I do not recall the specific, you know,
4 years here, but my broad recollection, Rambus came back
5 on a frequent basis with additional ideas and
6 proposals, new presentations to describe to us the
7 purported advantages of their technology.

8 Q. Do you recall anyone specific that you
9 interacted with from Rambus?

10 A. There was one of the cofounders, Mike Farmwald,
11 and there was other gentlemen, but I do not recall
12 their names today.

13 Q. Understanding that there were, as you've
14 testified, a number of meetings and that your memory
15 may not -- you may not be able to break it out by
16 separate meetings, but what generally do you recall
17 about the nature of the information or the proposals
18 that were presented to you by Rambus in this time
19 period?

20 A. Rambus' claim was that they had a
21 revolutionary, much higher-performance type of memory
22 interface that in their view would lead to significant
23 advantages at the system level and thus should be of,
24 you know, great interest to Sun.

25 Q. And were you interested, when you first learned

1 about these revolutionary performance claims on the
2 part of Rambus, were you interested in considering what
3 merits those claims had?

4 A. Yes, I was.

5 Q. And why were you interested in considering
6 Rambus' claims?

7 A. Because if it was truly a significant
8 breakthrough in terms of performance that would allow
9 us at the system level to deliver a significantly
10 higher-performance system to the market, this would be
11 of great relevance to Sun.

12 Q. Do you recall whether, in your meetings with
13 Rambus, Rambus provided to you any either written
14 information that they left with you or any written
15 information that they had displayed for purposes of the
16 meetings?

17 A. They gave us a lot of PowerPoint-level
18 presentations.

19 Q. And do you have a recollection concerning what
20 those PowerPoints related to?

21 A. Well, they were discussing the nature of their
22 interface, the so-called Rambus memory protocol, and
23 the performance clock rates associated with that
24 interface.

25 Q. These discussions that you had with Rambus

1 while you were at Sun, do you recall whether they were
2 subject to any nondisclosure agreements?

3 A. Yes, they were.

4 Q. So the information that they were sharing with
5 you, you understood that that was information that Sun
6 had some obligation to keep in confidence; is that
7 correct?

8 A. Yes. It was made very clear from the beginning
9 that Rambus considered this proprietary information and
10 that in fact they were protecting their memory or their
11 idea with patents.

12 Q. So Rambus did explain to you in your meetings
13 with the company that the interface technology that it
14 was promoting was subject to patents or patent
15 applications?

16 A. Yes. They explained that they were an
17 intellectual property company that would obtain revenue
18 through licensing their technology to both memory
19 manufacturers and system manufacturers.

20 Q. Now, understanding that your consideration of
21 Rambus may have extended through time and your views
22 may have evolved over time, but do you recall what, if
23 any, initial reactions or thoughts you had when you
24 first began to learn about the nature of Rambus'
25 interface technology and its proposal?

1 A. Well, I was very surprised by their belief that
2 they could establish an intellectual property business
3 patenting a memory interface.

4 Q. Why were you surprised by that?

5 A. Because in the history of memory components, in
6 my understanding, they were always open standard
7 interfaces.

8 Q. And did you have an understanding one way or
9 the other as to whether Rambus' interface was an open
10 standard interface?

11 A. No. It was very clear that it was not. It was
12 a licensed, patented, proprietary interface.

13 Q. But that knowledge on your part that this was a
14 proprietary interface, did that cause you to lack any
15 interest whatsoever in the Rambus technology?

16 MR. STONE: Objection. Leading, Your Honor.

17 MR. ROYALL: I don't believe it is a leading
18 question.

19 MR. STONE: It suggests the answer to the
20 witness such that the answer to the question can be
21 yes or no and it doesn't simply ask an open-ended
22 question to which the answer could respond with
23 respect to his understanding as opposed to his
24 agreement or disagreement with counsel's
25 characterization.

1 JUDGE McGUIRE: Sustained.

2 Restate, Mr. Royall.

3 BY MR. ROYALL:

4 Q. You said that you understood that Rambus'
5 technology was not an open interface standard but a
6 proprietary interface standard.

7 Did that understanding influence your views as
8 to whether you thought Sun should consider this
9 technology?

10 A. Well, by itself, it was not a reason not to
11 consider technology if the technology in fact had other
12 overarching benefits for Sun at the system level.

13 Q. And was Rambus claiming that its technology did
14 have overarching benefits?

15 A. Yes. This was the whole either positioning or
16 representation to the market, was that their memory
17 interface was purported to be superior and would
18 support higher-performance systems, system design, than
19 the existing memory technologies.

20 Q. Did Rambus make any claims to you related to
21 the costs of the Rambus interface technology?

22 A. They were in fact representing a fairly modest
23 cost adder over conventional DRAMs; however, we did not
24 really give much credence to their cost claims because
25 they in fact are not the manufacturer of the memory

1 components and thus, you know, to get real cost
2 information we would contact the manufacturers that
3 would manufacture such components.

4 Q. Let me just pause on that, on that idea, for a
5 minute.

6 You understood that Rambus did not itself
7 manufacture memory; is that right?

8 A. Correct.

9 Q. But Rambus was making representations to you
10 about the cost of manufacturing its interface
11 technology; correct?

12 A. Yes. They were talking about the increase in
13 die size.

14 Q. And did you say that you did not give credence
15 to their cost-related representations?

16 A. Yes, I said that I did not give credence to
17 that.

18 Q. Why is that?

19 A. Because it did not model correctly the overall
20 costs of introducing their memory into the
21 marketplace.

22 Q. And what specifically are you referring to when
23 you say that they didn't model correctly the overall
24 costs?

25 A. Well, they didn't have any understanding of

1 issues such as testing cost, yields associated with the
2 interface, that in fact later became significant
3 burdens for their technology.

4 Q. Did you convey to Rambus that you believed that
5 their cost-related misrepresentation -- or cost-related
6 representations did not account for these cost
7 concerns?

8 A. Well, we had those discussions.

9 Q. And did they do anything to respond to that
10 concern on behalf of Sun?

11 A. Well, their response was that once the
12 technology gets to volume, the costs will come down;
13 however, we never, in the time I was at Sun, obtained
14 any costs on Rambus memory from manufacturers of the
15 memory that were even closely comparable to standard
16 memory.

17 Q. Now, you also mentioned that Rambus had made
18 performance claims relating to the performance of its
19 interface technology; is that right?

20 A. Correct.

21 Q. Did you or others at Sun do anything to
22 scrutinize Rambus' performance claims?

23 A. Yes. Our primary interest in fact was the
24 performance nature of their memory technology.

25 Q. And what did you do to scrutinize whether the

1 performance claims that they were making were or were
2 not accurate?

3 A. We analyzed the system-level performance of
4 using their memory parts in our system designs.

5 Q. And what, if anything, did you conclude based
6 on that analysis?

7 A. Well, my conclusion was that they in fact did
8 not provide a performance benefit at all and in some
9 cases would have a performance disadvantage.

10 Q. Can you elaborate on the specifics that
11 supported that conclusion?

12 A. Well, the basic premise of Rambus is that
13 they -- I'm talking about the first generation of
14 Rambus memory that I think is known as Rambus I -- is
15 that they used a serialized, multiplexed transmission
16 of both the address, control and data information over
17 one set of signals on the bus, and this serialization
18 of the transfer to a much narrower data path actually
19 increased the total duration of the transfer even
20 though they had a much higher clock rate.

21 A second attribute of the memory was that they
22 would cache or keep a lot of the banks in a so-called
23 precharge mode; however, when an access was not hitting
24 a precharged memory but would go to a random access,
25 the penalty to perform the complete access was

1 substantially longer than on the conventional-type
2 memory.

3 And my conclusion based on this performance
4 modeling was that in reality the performance would be
5 inferior to conventional memory.

6 Q. Based on your analysis of the Rambus technology
7 while at Sun, did you have any views one way or the
8 other as to whether Rambus offered any advantages in
9 terms of read access time?

10 A. Yeah. As I just testified, the only advantage
11 would have been if the part was in a precharged mode
12 where the element that's being accessed was already
13 cached in the memory part. In our own modeling -- and
14 we used application-level modeling here -- that was
15 much less frequently the case than Rambus believed.

16 Q. Did you have any views as to whether Rambus
17 offered advantages in terms of pin savings compared to
18 alternatives?

19 A. Yes. Rambus obviously had fewer pins, a
20 requirement for fewer pins, at the system level;
21 however, my view on pins was that they were cheap, and
22 to me, using fewer pins at a higher clock rate was
23 actually more difficult to achieve than using a larger
24 number of pins at a lower clock rate.

25 Q. Did you identify any particular issues in terms

1 of advantages or disadvantages to the clock rate
2 itself, that is, the clock rate used in the Rambus
3 technology?

4 A. Yes. And my belief was that it would be
5 extremely difficult to design Rambus memory
6 controllers, and I think Rambus agreed with us
7 suggesting that they should design such controllers,
8 but it was beyond a typical designer's expertise to
9 design such a high-frequency controller at that time.

10 Q. Generally speaking, did you have views as to
11 the level of difficulty associated with implementing
12 the Rambus technology as compared to alternatives?

13 A. Yes. I thought it would be extremely
14 difficult to implement both at the memory controller
15 level but also at the so-called SIMM or DIMM level,
16 which is the packaging used for most memory components,
17 that it would require new types of connectors and very
18 precise board-level interface due to the very high
19 clock rates.

20 Q. Based on these, the considerations that you've
21 explained, what was your ultimate conclusion as to
22 whether the Rambus technology in fact did offer a
23 performance advantage compared to alternative
24 technologies?

25 A. Well, my conclusion was that it did not offer

1 performance at the system level for Sun's
2 applications.

3 Q. And did you express your concerns to Rambus at
4 the time?

5 A. Yes, I did.

6 Q. And do you recall whether Rambus did anything
7 or said anything in response to your specific
8 concerns?

9 A. Yes. They would come back to us with more
10 presentations of even more why they thought they had an
11 advantage.

12 Q. And were you satisfied by the responses that
13 you received by Rambus?

14 A. Well, I don't recall specifically, but this
15 kept going on for quite a while and so they kept just
16 coming back to us with more presentations. I never
17 concluded that they would ever truly have a performance
18 advantage.

19 Q. When Rambus did come back, you would agree to
20 meet with them and hear what they had to say?

21 A. Yes. And part of my function and job at Sun
22 was to meet with potential suppliers to Sun.

23 Q. Now, you said earlier I believe that you did
24 understand -- that Rambus did convey to you that the
25 technology that it was proposing was proprietary

1 technology; correct?

2 A. Yeah. They made that very clear from the
3 beginning.

4 Q. So you understood that there were either
5 patents or patent applications that Rambus possessed
6 that related to the interface technology that they were
7 proposing?

8 A. Yes, I did.

9 Q. Did you have -- well, strike that.
10 Did Rambus ever show you copies of any patents
11 or patent applications?

12 A. I have never seen any Rambus patents.

13 Q. Do you know whether Rambus provided that
14 information to others at Sun?

15 A. I don't know about that.

16 Q. Did you have an understanding -- did you
17 personally have any understanding as to the scope of
18 Rambus' patented technology?

19 A. My understanding was that it covered their
20 Rambus DRAM, RDRAM, design and interface.

21 Q. When you say that it's your understanding that
22 Rambus' patented technology covered the RDRAM
23 interface, are you saying that you understood that it
24 covered that or you understood that it only covered
25 that or something else?

1 A. Well, that it covered that because that's what
2 they made clear to me since the beginning.

3 Q. And when you say that's what they made clear to
4 you, are you saying that's what they made clear to you
5 in terms of the nature of their -- the scope of their
6 patents?

7 A. Well, I have not seen the patents, but what
8 they made clear is that they were going to protect any
9 patent on their memory technology because that was
10 their business model.

11 Q. In your discussions with Rambus, did anyone
12 from Rambus ever say anything to you about whether
13 their patents would extend to other architectures
14 besides the Rambus interface?

15 A. Not to me.

16 Q. Do you recall that issue ever coming up?

17 A. No. Not to me personally.

18 Q. Did Rambus ever say anything to you to suggest
19 one way or the other whether its patents had any
20 application to synchronous DRAM?

21 A. They did not suggest that to me.

22 Q. Would it have been important for you to know
23 that?

24 A. Yes, it would have.

25 Q. Why?

1 A. Because we would then have provided strong
2 feedback to the JEDEC process to not use
3 patent-encumbered elements.

4 Q. Now, we'll get into this in more detail later,
5 but when you moved to Cisco in the '90s, did you also
6 have interaction with Rambus in that time frame?

7 A. Yes, I did.

8 Q. And was this relating to some later generation
9 of the Rambus technology as compared to the Rambus I
10 technology that you considered at Sun?

11 A. Correct. Yes. I don't know the exact time
12 frame when Rambus II became available, but if Rambus II
13 was in fact a superior design over Rambus I.

14 Q. And can you place generally in time when you
15 interacted with Rambus while at Cisco?

16 A. I believe it was between 1996 and 1999.

17 Q. And during that time period, do you recall
18 Rambus sharing with you any patents or patent
19 applications?

20 A. No, they did not share patent applications.

21 Q. Do you recall them making any representations
22 to you about the scope of their patent rights?

23 A. No.

24 Q. Did your understanding of the scope of their
25 patents change from what you described in terms of your

1 understanding while at Sun based on your interactions
2 with Rambus while at Cisco?

3 A. No, it did not.

4 Q. Did Rambus ever tell you while you were at
5 Cisco that its patents would or might extend to either
6 SDRAM or DDR SDRAM?

7 A. No, they did not.

8 Q. Would it have been important for you to know
9 that?

10 A. Well, at the time it was in my mind too late to
11 change the synchronous DRAM standard, but perhaps it
12 could have affected or influenced the evolution of
13 future memory standards, including the DDR or JEDEC
14 standard.

15 So it would have -- so yes, the answer is it
16 would have been important.

17 Q. Now, turning back to your consideration of
18 Rambus while at Sun, you've talked about your analysis
19 of Rambus' cost claims and its performance claims.

20 At the time that you were considering Rambus
21 technology at Sun, were you comparing it to some other
22 technology?

23 A. Yes, we did.

24 Q. Which other technology?

25 A. Both the existing EDO standard DRAM and the

1 emerging synchronous DRAM.

2 Q. And were you in this same time frame also
3 evaluating the cost and performance features of those
4 technologies?

5 A. Yes, I was.

6 Q. Did you -- well, strike that.

7 Do you recall whether there were any key points
8 of comparison in terms of cost and performance
9 between -- and let's limit it to RDRAM and synchronous
10 DRAM?

11 A. There was a lot of claims or discussion between
12 the memory suppliers and Sun what the truly incremental
13 die area/die cost would be for either the synchronous
14 memory over the EDO or the Rambus compared to
15 synchronous and EDO.

16 Q. I'll come back to that, but were there other
17 key points of comparison between synchronous DRAM and
18 RDRAM that were important to Sun?

19 A. Well, the obvious difference was one was an
20 open standard and the other one was a proprietary
21 standard, and as we could not determine any performance
22 advantage with the proprietary standard, our initial
23 decision was to go with the open standard.

24 Q. Now, you said earlier that the very fact that
25 you knew that Rambus' technology was subject to patents

1 was not enough in itself to cause you to lack interest
2 in --

3 A. Correct.

4 Q. -- Rambus; is that right?

5 But was it a concern to you? Was it something
6 that was of any concern to you, that the Rambus
7 technology was -- that you understood it was subject to
8 patents?

9 A. Yes. There was both short-term and long-term
10 concerns.

11 Q. Okay. Well, let's talk about those
12 separately.

13 You said there were short-term and long-term
14 concerns related to that.

15 What were the short-term concerns?

16 A. Well, the short-term concern was with whether
17 Rambus would ever be successful to promote their
18 business model with the memory industry and get them to
19 accept a royalty-bearing interface and that the
20 industry in fact start manufacturing the parts that,
21 you know, Rambus had specified.

22 Q. And from the standpoint of your decisions of
23 what memory technology to use, why was it of some
24 concern to you whether Rambus would be successful?

25 A. Well, if in fact Rambus had no performance

1 advantage, then my expectation was that no memory
2 manufacturer would in fact start manufacturing their
3 memory, and as a result, it would never be available in
4 the market.

5 Q. Were there any other short-term concerns that
6 you had related to the fact that the Rambus technology
7 was subject to patents?

8 A. We only had a general understanding of the
9 royalties or business model that Rambus wanted to
10 employ at that time because we were -- as far as I
11 know, Sun never entered into a license agreement with
12 Rambus, at least during my tenure there.

13 However, one of the general concerns with any
14 patented or proprietary interface is that one gets
15 locked into a road map where the owner of the interface
16 is able to evolve or change the terms to their
17 advantage over time.

18 Q. And is this what you -- one of the things you
19 were referring to when you said there were long-term
20 concerns?

21 A. Yes.

22 So specifically, as Rambus evolved from their
23 first-generation memory to second-generation memory, I
24 did not know the business terms surrounding this, but
25 it had the potential to take advantage of their

1 proprietary position to enhance their revenue.

2 Q. And you said something about how there's the
3 potential to get locked into a memory interface road
4 map; is that what you said?

5 A. Correct.

6 Q. And what did you mean by that?

7 A. Because once one -- the designers at any
8 company develop an expertise for a certain type of
9 memory interface or design, their nature or their
10 inclination is to stay with that type of design and
11 follow it in an evolutionary fashion.

12 Q. And why is there an inclination to do that, to
13 stay with a design and follow it in an evolutionary
14 fashion?

15 A. Because if it's not broken, we don't fix it.

16 In other words, unless there's an overarching
17 reason to make a change, people tend to do the same as
18 they did previously.

19 Q. And is there a cost-related reason for that?

20 A. Well, it takes time to verify, validate, prove
21 new memory components at the system level, which is
22 quite extensive.

23 So yes, there's a significant cost in
24 qualifying new types of memories.

25 Q. What do you mean by qualifying memory?

1 A. Well, the qualification process is that in
2 order to ship a product in high volumes and production,
3 one needs to make sure that both the system design and
4 the vendor parts meet the precise specification, and
5 this requires testing with all the different vendors
6 that make these parts in different combinations, that
7 is, at the system level, at low temperature, high
8 temperature, at low voltage, high voltage, and to
9 ensure that the design is manufactured within the
10 margin.

11 Q. And when you were at Sun, were you involved in
12 any way in this testing and qualification process you
13 just described?

14 A. Yes. I was personally involved in qualifying
15 our memory system in the early years and subsequently
16 dealt with, you know, surprisingly little problems we
17 have found with memories even in production.

18 Q. And did this testing and qualification process
19 have to be done separately for each of the separate
20 vendors you were working with?

21 A. Yes. Each had to be qualified separately
22 because each was a distinct design.

23 Q. And based -- well, let me strike that.

24 You said that each memory vendor's product was
25 a distinct design, but aren't these standardized

1 products that you're procuring from memory vendors?

2 A. The standard describes the interface at the
3 function and behavior of the device. It does not
4 describe how the design of the memory chip is
5 implemented inside the chip.

6 So the differences we were dealing with is
7 people use different process technologies, different
8 I/O cell designs to implement the standard, but in fact
9 there are new, sometimes significant differences
10 between different vendors' designs.

11 Q. And is that something that can be discovered
12 and identified through the testing and qualification
13 process?

14 A. The purpose of the testing and qualification
15 process is to ensure that the product can be used with
16 all qualified manufacturers.

17 Q. And based on your experience at Sun, when you
18 were undergoing the testing and qualification process
19 in terms of the memory used in a particular server or
20 workstation, generally how long would it take to
21 complete that process for all of the different memory
22 vendors that you were working with?

23 A. Well, it depended if there were any problems or
24 not, but it could take anywhere from a week or two to
25 in some cases many months to understand why a certain

1 vendor part did not behave as advertised.

2 Q. Now, going back to the comparison between SDRAM
3 and RDRAM while you were at Sun, ultimately, I believe
4 you said, the company chose to go with SDRAM; is that
5 right?

6 A. Correct.

7 Q. And can you explain to us why Sun chose to use
8 SDRAM as opposed to RDRAM in the generation of products
9 that were being developed in the time period that we've
10 been focusing on in the early to mid-'90s?

11 A. Yes. So there was three primary reasons.

12 One was synchronous DRAM did offer higher
13 performance than conventional memory.

14 Number two, it was the mainstream industry
15 effort to define the next-generation part.

16 And number three, it was a design that even if
17 there was some premium of cost initially had the
18 promise of a very cost-effective transition.

19 Q. And in making that determination to go with
20 SDRAM, were you making any assumptions or projections
21 as to whether SDRAM would become a high-volume
22 standard?

23 A. That was an important consideration for the
24 simple reason that we thought without very high volume
25 the manufacturers would never get the costs down. So

1 the manufacturing business efficiencies very much
2 was -- the volumes of just that go through the
3 manufacturing product line.

4 Q. We've talked about, in your comparison of SDRAM
5 and RDRAM, we've talked about the cost considerations,
6 performance considerations.

7 Did you also, in evaluating those products, did
8 you familiarize yourself with the architectures used
9 and any differences in the architectures or designs of
10 RDRAM versus SDRAM?

11 A. Of course, because this is an element of the
12 performance analysis.

13 Q. Generally speaking, in your view, were SDRAM
14 and RDRAM closely related in architecture or were they
15 different? What were your views?

16 A. Well, at the 100,000-foot level, every memory,
17 you know, is a dynamic memory array, internally dynamic
18 memory array. However, the way Rambus was attempting
19 to achieve their performance differentiation made very
20 significant changes to conventional memory
21 organization.

22 Specifically, this notion of having a large
23 number of banks and then keeping each of these banks in
24 an active mode in the attempt to achieve higher
25 throughput, I personally did not think that made a lot

1 of sense and would have significant die area, power and
2 performance disadvantage actually.

3 So yes, there was a difference in architecture
4 relating to how memory arrays were organized within the
5 memory device.

6 Q. Well, you said there was a difference in
7 architecture in your view between SDRAM and RDRAM.

8 Was it a modest difference? Was it a
9 substantial difference? How would you --

10 A. It was a very substantial difference.

11 Q. It was a substantial difference?

12 A. Yes.

13 Q. And what would you then imply was the
14 substantial difference architecturally between RDRAM
15 and SDRAM?

16 A. Well, there are three things that comes to
17 mind, is that again they used a large number of
18 internal banks to achieve this cache, cached preload
19 model.

20 Number two, they used a multiplexed bus running
21 at very high clock rate to transfer data and address
22 and control information.

23 And I guess number three was the high clock
24 rate difference, requiring the use of, you know,
25 elaborate circuit design techniques to achieve such

1 transfer rates.

2 Q. Are you familiar with the term "packetized" as
3 it's used in connection with DRAM designs?

4 A. Yes.

5 Q. Did you have an understanding as to whether
6 either RDRAM or SDRAM were packetized?

7 A. Well, RDRAM used a packet transaction format.

8 Q. Was that another difference architecturally
9 between the two?

10 A. Yes. That's what I referred to by saying they
11 had a protocol -- almost like a high-level protocol
12 that had a number of options and modes that would allow
13 them to do a variety of different transactions with the
14 memory itself.

15 Q. Now, you said that you -- you said earlier that
16 you knew that Rambus' interface technology was subject
17 to some patent, patent claims by Rambus; correct?

18 A. Correct.

19 Q. Did that -- well, strike that.

20 And you familiarized yourself with the
21 architecture and features of the RDRAM technology; is
22 that right?

23 A. Yes, I did.

24 Q. Did you expect that the use of any feature in
25 RDRAM in some other technology would also be subject to

1 Rambus patents? Did you have any expectation in that
2 regard?

3 A. No, I did not.

4 Q. And does this go back to what you said earlier,
5 that your belief or understanding was that the Rambus
6 patented technology was limited to the Rambus
7 interface?

8 MR. STONE: Objection, Your Honor. Leading and
9 misstates the witness' prior testimony.

10 THE WITNESS: Yeah, my understanding --

11 JUDGE McGUIRE: Hold on a second, sir. Let me
12 rule on this objection.

13 Sustained.

14 BY MR. ROYALL:

15 Q. Let me simply ask you this, Mr. Bechtelsheim.

16 You said that -- I believe you said in response
17 to my earlier answer that you did not expect that the
18 use of a feature in RDRAM if it appeared in some other
19 technology would be subject to Rambus patents, and so
20 my question is to you --

21 MR. STONE: Your Honor --

22 BY MR. ROYALL:

23 Q. -- why did you not expect that?

24 MR. STONE: -- that misstates the record.

25 The question that was asked was: "Did you have

1 any expectation in that regard?" That was the
2 question, and the answer was: "No, I did not." And
3 the question just framed misstates his prior testimony
4 and is still leading.

5 JUDGE McGUIRE: Sustained again.

6 BY MR. ROYALL:

7 Q. You said earlier that you did not have an
8 expectation as to whether the -- a feature used in
9 RDRAM if used in a different technology would be
10 subject to Rambus patents; is that what you said?

11 A. Yes, I did.

12 Q. And so if you saw a similar feature to one used
13 in the Rambus technology in a different technology,
14 would you have expected that feature as used in a
15 different technology to also be subject to Rambus
16 patents?

17 A. Are you specifically referring to the mode
18 register here?

19 Q. Or any other feature that you were familiar
20 with.

21 A. I'm not here as a patent business person of
22 course, but I would like to comment on the fact that
23 mode registers have been used on integrated circuits in
24 my entire career as an electronic design engineer
25 starting in 1975, so to me the use of a mode register

1 was a generally known design technique that did not
2 relate to Rambus' patented interface.

3 Q. Let me move on to something else.

4 We talked about the terms "evolutionary" and
5 "revolutionary" earlier, if you recall.

6 How would you characterize over the -- well,
7 let me restate that.

8 Based on your experience with DRAM technology
9 in your career, do you have any views as to whether,
10 generally speaking, the DRAM technology has developed
11 along an evolutionary path or a revolutionary path or
12 something else?

13 A. Evolutionary.

14 Q. And in your view, does this fact that DRAM
15 technology has progressed along an evolutionary path,
16 is that something that has been of benefit to the
17 companies that you've been associated with,
18 specifically Sun and Cisco?

19 A. Yes. It benefited both the users of memory as
20 well as the manufacturers of memory.

21 Q. And focusing on the users of memory, which is
22 what Sun and Cisco are, how do those companies, the
23 companies that you've been affiliated with, benefit
24 from the evolutionary development of memory standards
25 or memory technology?

1 A. Yes. Because it is easier to design into
2 existing or new products an evolutionary approach than
3 a revolutionary.

4 Q. I believe you said that -- well, let me ask
5 this in a more open-ended way in case I haven't asked
6 this question already.

7 Did you, when you were at Sun and you were
8 evaluating the Rambus technology, did you have any view
9 as to whether it was an evolutionary versus a
10 revolutionary technology?

11 A. I considered Rambus revolutionary.

12 Q. Are you aware of any revolutionary technologies
13 being adopted as broadly used standards in the memory
14 marketplace?

15 A. Well, Rambus had some success getting the
16 technology adopted in specific market segments, so I
17 cannot say that it was unsuccessful in the market. In
18 fact, it was more successful than I expected.

19 However, it did not get accepted as the
20 mainstream memory technology at large, and perhaps
21 there was not enough others that had the same view that
22 the so-called revolutionary advantages of Rambus were
23 not sufficient to overcome the difficulties in
24 designing it in and using it.

25 MR. ROYALL: Your Honor, I'm at a convenient

1 breaking point. I could go longer, but this might be a
2 convenient time to break for lunch.

3 JUDGE McGUIRE: How much more time do you
4 anticipate your examination to be?

5 MR. ROYALL: I'd like to assess that over the
6 lunch break and see if I can streamline some of what I
7 wanted to go into, but I would expect we'll probably be
8 a little over an hour more.

9 JUDGE McGUIRE: Then let's break for lunch.
10 It's almost a quarter after twelve. We will reconvene
11 here at 1:30 p.m.

12 Off the record.

13 (Whereupon, at 12:11 p.m., a lunch recess was
14 taken.)

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1 A. Well, it was a surprise to me based on my own
2 personal analysis of their cost-performance metrics. I
3 would have thought that other people would do a similar
4 type of analysis and come to a similar conclusion, but
5 obviously that was not the case.

6 Q. Now, we've spent some time now talking about
7 your work at Sun Microsystems for the thirteen or so
8 years that you were employed there. You told us
9 earlier that when you left Sun, you went to -- you
10 started up another company, Granite Systems, and then
11 eventually it was acquired by Cisco; is that right?

12 A. Correct.

13 Q. And can you remind me again what year that
14 was?

15 A. Granite was acquired by Cisco in September of
16 1996.

17 Q. So you've been employed at Cisco since that
18 time?

19 A. Correct.

20 Q. I think you may have given a very general
21 description of the nature of Cisco's business, but let
22 me ask, to reorient us to Cisco, if you could describe
23 now what types of products Cisco designs and sells.

24 A. Cisco primarily manufactures switches and
25 routers. These are specialized devices that process

1 packets, network packets, either from the Ethernet or
2 Internet-type interfaces and allow people to build
3 large networks with many of these devices
4 interconnected.

5 Q. Let me take these two types of products
6 separately, starting with routers.

7 Can you explain to us what a router is or what
8 function it serves?

9 A. A router looks at each arriving network packet
10 which has a source and destination address and makes a
11 decision on which output interface to send this packet
12 out to its next neighbor.

13 Q. Roughly, if you know, roughly speaking, how
14 much of Cisco's business involves routers as opposed to
15 switches or some other product?

16 A. Yeah, the distinction is actually more
17 difficult lately because both technologies are getting
18 very similar. It used to be that these switches were
19 hardware-based and drivers were typically
20 software-based, but recently all the high-performance
21 routers and switches use hardware-type implementation.

22 But the way Cisco classifies the business, I
23 believe a larger percentage is switching and almost as
24 large a percentage but slightly smaller is routing.

25 Q. Well, how would you describe a switch and how

1 would you contrast that to a router?

2 A. Well, one difference is they use different
3 types of memories. Most switches use static RAM or
4 SRAM technology because they are designed for
5 enterprise applications that require much less memory
6 than the Internet routers, which typically use
7 DRAM-type technologies.

8 Q. And can you give us some general physical
9 description of switches and routers for those of us --
10 I assume there are many of us here who haven't ever
11 seen these products.

12 A. Well, they come in all kinds of sizes from
13 small, what's called stackable configurations to large
14 modular chassis that accept a variety of line cards and
15 controller cards.

16 Cisco is -- most of Cisco's revenues are the
17 larger type of systems, but it also sells a very large
18 number of smaller units that are used in small/medium
19 business and even home office kind of settings.

20 Q. What is the typical life cycle, if there is a
21 typical life cycle, of a Cisco router?

22 A. Cisco's life cycles are much longer than a
23 typical computer product because the function of these
24 routers and switches don't change as much over time, so
25 customers have a preference to keep the same kind of

1 equipment and receive upgrades both in hardware and
2 software over the life cycle of the product, so some of
3 Cisco's products have life cycles that are coming close
4 to ten years and others are well on their way there, so
5 a ten-year life cycle is not unusual for a Cisco switch
6 or router.

7 Q. Are you familiar with the term "mission
8 critical"?

9 A. Yes, I am.

10 Q. And what's your understanding of that term?

11 A. Well, this generally refers to the importance
12 of the equipment relative to a business function, and
13 mission critical means that if the equipment, in this
14 case the router or switch, were to fail, the business
15 would actually either stop or be impaired, and as a
16 result, the design of these machines has to be such
17 that a failure is very unlikely.

18 Q. And generally speaking, based on the
19 information available to you, do Cisco's customers view
20 these products, the switches and routers, as mission
21 critical?

22 A. It depends on the company, but for any large
23 Fortune 500 or enterprise company certainly all the
24 switches and routers become part of the
25 mission-critical infrastructure.

1 Q. And does that have implications for the manner
2 in which Cisco designs or markets these products?

3 A. Well, generally speaking, Cisco is a little
4 more conservative in its choices of technologies than
5 perhaps some other companies, but part of the goal is
6 that it wants to use technologies that are
7 well-established, mature, available a long time and
8 robust.

9 Q. Are durability and reliability important to
10 Cisco's products?

11 A. Yeah. Very much so.

12 Q. And why is that?

13 A. Because if the product were to fail, it may
14 have an impact on the customer and it may cause a
15 business disruption.

16 Q. How would you describe Cisco's customer base,
17 if there is a typical type of customer that does
18 business with Cisco?

19 A. Approximately 75 to 85 percent of Cisco's
20 customers are enterprise customers, meaning commercial
21 companies using these switches and routers in their
22 internal networks. The remainder is service provider
23 customers that use these switches and routers in the
24 network and offer as a service to others.

25 Q. And what's an example of the type of service

1 provider customer that you're referring to?

2 A. The service provider customer is a company like
3 SBC or Sprint that resells or offers Internet
4 connectivity service as their primary product.

5 Q. If you know, how large a company is Cisco today
6 either in terms of revenues or employees, roughly
7 speaking?

8 A. Well, Cisco's revenue for the last four
9 quarters I believe was around \$16 billion and the head
10 count is around 33,000.

11 Q. And who are Cisco's principal competitors,
12 understanding that there must be many, but who are the
13 principal competitors?

14 A. There are many.

15 In the enterprise space it's companies such as
16 Extreme, Foundry, Enterasys and Nortel.

17 In the service provider space it's companies
18 like Juniper, Alcatel, Lucent.

19 Q. Where are Cisco's products manufactured? In
20 the U.S., overseas or both?

21 A. They're manufactured in multiple locations
22 worldwide, and generally speaking, the company's goal
23 is to minimize the cost of manufacturing, so the
24 products get manufactured in the location that has the
25 lowest cost.

1 Q. Are there different components from a given
2 Cisco product or system that are manufactured in
3 multiple countries and then assembled in a single
4 place?

5 A. Yes. That can also happen.

6 For example, the PC boards or the line cards
7 can be manufactured in, say, Asia, whereas the final
8 assembly of the system could be in the U.S.

9 Q. What about Cisco's customers? Are they
10 principally concentrated in some geographic part of the
11 world or are they more dispersed?

12 A. Very dispersed. But similar to other high-tech
13 companies, roughly half of Cisco's revenue is in
14 North America, about 25 percent in Europe and
15 25 percent in Asia.

16 Q. What about in terms of third-party suppliers
17 that you work with? Are those companies also dispersed
18 around the world?

19 A. Correct. Cisco purchases either components or
20 board-level assemblies from manufacturing locations all
21 over the globe.

22 Q. Now, you've mentioned the term "board" in that
23 answer and in possibly other answers.

24 Can you explain to us what specifically you're
25 referring to by the term "board"?

1 A. The board or PC board is the assembly where
2 components, semiconductor components such as memory
3 chips, get attached to, soldered to, and then the board
4 is inserted into a larger chassis or enclosure.

5 So the primary design activity at Cisco is
6 actually board-level design.

7 Q. And do Cisco's switches and routers, do they
8 sometimes contain more than one board?

9 A. Yeah. Many of them have, you know, up to a
10 dozen different boards.

11 Q. Did you say 2,000?

12 A. No. No. Each product can have up to a dozen
13 or more distinct boards.

14 Q. A dozen. I'm sorry.

15 A. A dozen, yes. As many as a thousand, I don't
16 know. There are a large number of boards manufactured
17 at Cisco.

18 Q. Now, you mentioned earlier -- at the very
19 beginning of your testimony I believe I asked you what
20 your current position is and what other positions
21 you've held at Cisco. You mentioned then that you
22 currently have the title, I believe -- is it
23 vice president and general manager of the Cisco gigabit
24 switch business unit?

25 A. Correct.

1 Q. And you are responsible, ultimately
2 responsible for that business unit within Cisco; is
3 that correct?

4 A. Correct.

5 Q. And what products are designed within your
6 business unit?

7 A. The so-called Catalyst 4000 family of products,
8 which includes a large number of individual products,
9 and this represents approximately 10 percent of Cisco's
10 revenue.

11 Q. So your group, in terms of the products that it
12 designs and sells, then those products contribute in
13 terms of revenue -- did you say roughly 10 percent of
14 the overall company's revenues?

15 A. Correct.

16 Q. Do the switches, the gigabit switches that are
17 designed by your business unit, differ in some way from
18 the other switches that are designed and produced by
19 Cisco?

20 A. Well, in terms of the components we use, so
21 our switches typically use SRAM or static RAM
22 components. Some of the other ones use DRAM or
23 dynamic memory.

24 Q. Now, generally speaking, we talked a little bit
25 in connection with Sun about the process of designing

1 and manufacturing the Sun products that you were
2 involved with.

3 Are there any distinctions or differences in
4 terms of the design and manufacturing process of the
5 Cisco products that you now have responsibility for?

6 A. Yes. Somewhat.

7 So Cisco is a more diversified organization
8 where each individual business unit or design group has
9 their own product responsibilities and thus at least
10 historically made a lot of individual choices in terms
11 of what components they would use.

12 More recently, the company is attempting to
13 streamline some of the component decision-making by
14 forming a memory council so that the company can make
15 more efficient and organized choices in terms of memory
16 technologies in particular.

17 Q. We talked in connection with Sun about Sun's
18 reliance on various industry standards.

19 Does Cisco also rely on industry standards in
20 its products?

21 A. Yes. In fact I would like to comment that
22 Cisco is even more reliant on industry standards since
23 its primary products, which is the Internet switching
24 and routing, implement industry standard protocols such
25 as the TCP/IP family of protocols.

1 Q. Could you list for us the areas of technology
2 relating to Cisco's products in which the company
3 relies on industry standards, to your knowledge.

4 A. So what I'm saying is the basic product
5 specifications that the Cisco product fulfills are
6 actually specified in industry standard documents known
7 as RFCs or Internet standards and there are hundreds if
8 not thousands of such standards that the company's
9 products adhere to.

10 Q. Let's talk a little bit more about your
11 particular role at Cisco.

12 Can you describe for us the nature of your
13 duties and responsibilities as general manager and
14 vice president of the gigabit switch business unit?

15 A. So my major responsibilities include the
16 on-line evolutionary road map of the Catalyst 4000
17 family of products. I'm also working on some of the
18 cross-functional initiatives such as the new memory
19 council and other attempts to improve the efficiency of
20 the business overall.

21 Q. You mentioned something called -- I think you
22 called it a memory council?

23 A. Correct.

24 Q. What are you referring to?

25 A. Well, because individual design groups can make

1 their own choices, historically Cisco ended up with a
2 proliferation of different memory devices, modules,
3 memory types, and this has created some significant
4 inefficiency in purchasing, and the goal of this
5 council is to basically streamline and reduce the
6 number of choices that are available to designers going
7 forward.

8 Q. And this is an activity that you're involved
9 in?

10 A. Correct.

11 Q. How long have you been involved in having input
12 to memory selection while at Cisco?

13 A. Well, I had input from the very beginning I
14 arrived, but this memory council activity started
15 earlier this calendar year.

16 Q. And when you say that you've had input into the
17 memory selection process at Cisco from the very
18 beginning, are you referring only to memory choices
19 relating to the products designed and produced by your
20 business unit or more broadly?

21 A. No. More broadly.

22 Q. So just to be clear on this, as part of your
23 responsibilities at Cisco you've had input into the
24 selection of memory products across -- more broadly
25 across the entire Cisco enterprise?

1 A. Yeah. But more specifically on the road maps
2 that memory vendors would either investigate or develop
3 to meet Cisco's future needs.

4 Q. Well, if you're the vice president or general
5 manager of this particular business unit, why is it
6 that you're also involved in memory selection
7 decisions relating to other business units within
8 Cisco?

9 A. Because I had close relationships with the
10 memory manufacturers based on my tenure at Sun and a
11 reasonably good understanding of what it would take to
12 develop new types of memory standards.

13 Q. Does Cisco, like Sun, rely on industry standard
14 memory?

15 A. Yes, it does, for nearly all of its memory.

16 Q. You said nearly all?

17 A. Yes. Cisco, based on a recent survey, use
18 primarily the synchronous DRAM and are beginning to use
19 the DDR DRAM, but it also uses -- less than 1 percent
20 of Cisco's purchased volume is actually the Rambus
21 memory.

22 Q. You mentioned synchronous DRAM. You're
23 referring to SDRAM?

24 A. Yes, SDRAM.

25 Q. Do you know what percentage, roughly speaking,

1 of the overall memory purchases of Cisco are
2 synchronous DRAM?

3 A. About 80 percent.

4 Q. 80 percent.

5 And you also mentioned DDR. Do you know what
6 percentage of the total memory purchased by Cisco is
7 DDR?

8 A. About 15 percent.

9 Q. And you've already told us that less than
10 1 percent is Rambus.

11 Are there other types of memory that are
12 purchased by Cisco?

13 A. Yes. Cisco uses other specialty DRAM memory
14 including FCRAM -- it's spelled F-C-R-A-M -- reduced
15 latency DRAM and graphics DRAM. All of these are
16 approximately 1 percent.

17 Q. They're 1 percent each --

18 A. Yeah.

19 Q. -- roughly speaking?

20 Now, going back to the memory council that you
21 mentioned, the purpose of that, if I understand you
22 correctly, was to help make decisions about -- did you
23 say reducing the number of types of memory that are
24 used in --

25 A. That will be used in new designs going

1 forward.

2 Q. And why does Cisco view it as beneficial to
3 reduce the number of types of memory that are used in
4 the future?

5 A. To improve both the supplier efficiency and
6 our own design efficiency and manufacturing
7 efficiency.

8 Q. Do you have an understanding of how much money
9 Cisco spends in total on DRAM memory purchases every
10 year?

11 A. Yeah. It fluctuates of course with the price
12 of memory. At this point it's approximately
13 \$100 million.

14 Q. Do you have any understanding of what
15 percentage of overall world DRAM production Cisco
16 purchases?

17 A. This is less than 1 percent.

18 Q. Generally speaking, can you comment on how the
19 use of memory in Cisco's products compares to the use
20 of memory in the Sun products that we were talking
21 about earlier?

22 A. Yes, I can.

23 Q. Please explain.

24 A. So obviously -- not obviously. The amount of
25 DRAM that Cisco consumes as a percentage of its product

1 cost is much lower than Sun, and also it is not relying
2 on the memory as a performance or primary
3 differentiator towards its customers. As a result,
4 Cisco traditionally uses -- makes conservative memory
5 decisions where they use well-established, mature,
6 existing memory technologies instead of being the first
7 ones with a next generation, leading edge kind of
8 technology.

9 Q. When we were discussing Sun earlier, I think
10 you had said that Sun developed and designed its own
11 memory subsystems; is that right?

12 A. Correct.

13 Q. Does Cisco also design its own memory
14 subsystems?

15 A. Generally not. Cisco generally uses chipsets
16 from third-party suppliers that perform or implement
17 the memory controller functions.

18 Q. And does that in any way affect the choices
19 Cisco makes in terms of what type of --

20 A. Yes. Because it's really the chipset that
21 differentiates the memory choice, so if you use that
22 particular chipset, we can no longer make an
23 independent decision on the memory itself.

24 Q. Do you know whether Cisco works with multiple
25 DRAM suppliers?

1 A. Yes, it does.

2 Q. Do you know how many, roughly speaking?

3 A. About half a dozen in total.

4 Q. And are the reasons why Cisco works with
5 multiple DRAM suppliers similar to the reasons that you
6 described earlier in terms of Sun's decisions to do
7 that?

8 A. Yes. So continuity of supply is a prime
9 consideration in particular because Cisco's product
10 life cycle is so much longer than other products in the
11 market. But there's also an equal concern on just cost
12 competitiveness and safety of supply.

13 Q. Of the half a dozen or so different DRAM
14 manufacturers that Cisco works with, how many of them,
15 if you know, are headquartered in the United States?

16 A. Just one, which is Micron.

17 Q. So the remainder of the DRAM companies you work
18 with are foreign companies?

19 A. Yes, they are.

20 Q. In your work at Cisco, have you had occasion to
21 interact with DRAM memory vendors?

22 A. Yes. On many occasions.

23 Q. And what has been the purpose of those
24 interactions?

25 A. Well, I was permitted to understand their road

1 maps and availability of next-generation densities and
2 interfaces.

3 Q. And why is it important for you and Cisco to
4 have an understanding of the DRAM manufacturers' road
5 maps?

6 A. So that we could make the most -- the best
7 decision from a business standpoint which exact devices
8 to design into our next-generation designs.

9 Q. Now, does your role at Cisco or has your role
10 at Cisco involved overseeing any aspect of product
11 development?

12 A. It has done in the format I intended to, yes.

13 Q. And is that product development relating to the
14 products within your own business unit?

15 A. Yes. That's my primary responsibility.

16 Q. So does that involve you participating in
17 making decisions about the design of new products?

18 A. Yes, I do.

19 Q. Are you also involved in the type of testing
20 and verification process that we talked about earlier?

21 A. Yeah. I was not the person developing the
22 process, but I'm responsible for implementing it
23 correctly.

24 Q. Do you have any role within your business unit
25 in evaluating the costs associated with the designs of

1 the products you're responsible for?

2 A. Yes. I'm responsible for the cost of
3 delivering our products.

4 Q. And to the extent you get involved in
5 evaluating cost, can you explain to us the types of
6 cost-related issues that you personally deal with?

7 A. A little bit. There are three primary cost
8 components: the component cost of the components we
9 choose; the engineering cost, which is the cost of
10 implementing the design; and the prototyping expenses,
11 which has to do with how expensive it is to build the
12 required prototypes for the quality assurance process.

13 Q. And by "prototypes" you're referring to what?

14 A. Well, every time the company builds a new
15 product, before it's released to manufacturing, we
16 build between fifty to a hundred prototypes that are
17 paid for by my engineering, from my engineering
18 budget. That is a large percentage of my engineering
19 spending.

20 Q. Now, you mentioned earlier that -- you went
21 through the numbers with us of the various types of
22 standardized memory that Cisco's products used, and my
23 rough calculation is that somewhere north of 95 percent
24 or -- somewhere north of 95 percent of the products
25 use industry standard memory. Is that a fair

1 statement?

2 A. Yeah. We'll use the commodity high-volume
3 standard memory. Some of the other memories have
4 achieved some type of industry standardization but are
5 not considered commodity high-volume memories.

6 Q. And are the memories you're referring to in
7 that regard, do they include what you've called FCRAM?

8 A. Correct.

9 Q. And RLDRAM?

10 A. Correct.

11 Q. And what types of Cisco products use these
12 types of memories, FCRAM and RLDRAM?

13 A. Our high-performance routers.

14 Q. And are those routers that are designed in a
15 different business unit from yours?

16 A. Yes, they are.

17 Q. But have you been involved in making memory
18 selection decisions with respect to those types of
19 routers?

20 A. Not the actual selection, but I was involved in
21 the definition of both the FCRAM and the reduced
22 latency DRAM with the supplier base.

23 Q. Well, let's talk about that process, taking
24 them one at a time, starting with the FCRAM.

25 Can you explain to us what FCRAM is and how it

1 was developed?

2 A. FCRAM stands for fast cycle DRAM and it was a
3 proposal that originated with either Fujitsu or
4 Toshiba, or I guess both of them approached Cisco with
5 this idea and I was the -- involved giving them
6 feedback on the specification to enhance their spec so
7 it would become more usable by Cisco.

8 Q. And are there in fact today Cisco products that
9 are using this type of memory?

10 A. Yes, there are.

11 Q. And who produces the memory, if you know?

12 A. Fujitsu and Toshiba or whatever the latest
13 business entity's name is. I don't know what the
14 current name for the entity is. They sold off the
15 memory operation. I think it's called Renasys. I'm not
16 quite sure how to spell it.

17 Q. And are there particular advantages that Cisco
18 obtained through use of this memory as opposed to a
19 high-volume commodity-type memory?

20 A. Yeah. The advantage of FCRAM is that the
21 random cycle time is roughly half or twice as fast
22 than the commodity DRAM and as a result it can sustain
23 twice the number of random accesses over a traditional
24 DRAM.

25 Q. Do you know how the cost to Cisco of FCRAM

1 compares to the high-volume commodity DRAM products
2 that are used in the bulk of Cisco's products?

3 A. I don't know the precise cost, but I know it's
4 several times higher per bit than a commodity DRAM.

5 Q. And in your judgment, is it a sensible business
6 decision for Cisco to purchase FCDRAM (sic) for its
7 products at such a substantial premium over high-volume
8 commodity products?

9 A. The question in making that decision is to
10 have another technology available that would have been
11 more cost-effective and the other technology known that
12 is faster is the static RAM, which is much more
13 expensive than the FCRAM and is also much less dense.

14 So the FCRAM does fill a need for positioning
15 for the design of high-performance routers and
16 switches.

17 Q. Do you have -- do you personally have an
18 understanding as to why the FCDRAM devices are sold at
19 such a significant price premium over high-volume
20 commodity DRAMs?

21 A. Yes. Because the die size is significantly
22 larger and the -- I don't know about the yields, but
23 the volumes are much, much lower than commodity DRAMs,
24 and as a result there's a limited amount of suppliers
25 manufacturing it and as a result they're able to

1 command a much higher price.

2 Q. Let's turn then to the other customized or
3 specialized memory that you mentioned, RLDRAM. Were
4 you involved in the specification of that product?

5 A. Yes, I was.

6 Q. And how were you involved?

7 A. I interacted with the primary vendor
8 developing the product, which was Infineon, to arrive
9 at a specification that is even superior compared to
10 the FCRAM in achieving the multibank fast cycle
11 objective.

12 Q. So the product RLDRAM was developed by -- did
13 you say Micron?

14 A. No. The original developer was Infineon, and
15 subsequently Micron also agreed to manufacture the
16 product.

17 Q. So to your knowledge, does Cisco source that
18 product from both of those two companies?

19 A. I do not know who our actual suppliers are, but
20 I do know we're shipping a product today.

21 Q. Again, do you know how the price of RLDRAM
22 compares to more typical high-volume commodity DRAMs?

23 A. It is several times higher than commodity
24 DRAM.

25 Q. And are there performance advantages to RLDRAM

1 that in your mind justify paying that higher price?

2 A. Well, again, the design group that made the
3 decision must have concluded that it provided them with
4 a cost-performance advantage that was not achievable
5 with other choices. So yes, I would say so.

6 Q. Now, you mentioned that your estimate is that
7 roughly 15 percent of Cisco's products today use DDR
8 memory; is that right?

9 A. Correct.

10 Q. And by "DDR" are you referring to memory that
11 complies with JEDEC's DDR SDRAM specification?

12 A. Yes.

13 Q. Do any of the products in your -- developed by
14 your business unit use DDR memory?

15 A. We have investigated the use of DDR and are
16 planning to ship it in the near future.

17 Q. In the gigabit switches?

18 A. In products that I am designing, yes.

19 Q. You recall that we talked -- used the terms
20 "evolutionary" and "revolutionary" in characterizing
21 various technologies.

22 Do you have a view as to whether DDR is an
23 evolutionary or a revolutionary technology or something
24 else?

25 A. Evolutionary.

1 Q. And why do you say that?

2 A. Because it's a modest design change from the
3 original synchronous DRAM in terms of the conceptual
4 similarity of the two designs.

5 Q. And do you have in mind the types of modest
6 changes that are reflected in DDR SDRAM that aren't
7 reflected in the original SDRAM specification?

8 A. Well, it was primarily the change in the
9 clocking.

10 Q. Are you familiar with something called DDR-II?

11 A. Yes, I am.

12 Q. What do you understand that term to refer to?

13 A. Well, this is the evolutionary follow-on to the
14 DDR-I which changes the interface levels, voltages and
15 increases the clock rate over the DDR-I.

16 Q. In that answer you characterized DDR-II as
17 evolutionary compared to DDR-I.

18 Why do you say that?

19 A. Because it has very modest changes compared to
20 the DDR-I specification.

21 Q. And do you have in mind what types of modest
22 changes are reflected in DDR-II by comparison to
23 DDR-I?

24 A. As I just stated, it's a change in voltage
25 levels, a change in frequency of operation, setup and

1 clock times, termination, things like that.

2 Q. Do you know whether there are any plans or
3 considerations within Cisco today of using DDR-II
4 memory in future products?

5 A. Yeah. As far as I know, we're not designing
6 yet a DDR-II interface. However, once the part is
7 available in volume and is cost-effective, I am
8 confident we will use it at that time.

9 Q. And we talked a fair bit earlier about your
10 evaluation of RDRAM or Rambus DRAM technology while you
11 were at Sun.

12 Have you also had occasion since you joined
13 Cisco to evaluate RDRAM technology for potential use in
14 Cisco products?

15 A. Yes, I did.

16 Q. Can you tell us how you became involved in
17 considering Rambus technology or in connection with
18 what products you considered Rambus technology?

19 A. Well, there was another product group that
20 considered using the technology and there was a fair
21 amount of interaction with them to correctly model the
22 performance metric of the technology.

23 More recently, Cisco started to use an Intel
24 network processor chip that on the chip includes a
25 Rambus II interface and as a result this is now

1 starting to ship. We actually shipped Rambus memory
2 that's attached to this Intel network processor.

3 Q. And does this account for the less than
4 1 percent figure that you gave us earlier with respect
5 to purchases of RDRAM?

6 A. Yes, it does.

7 Q. Since you have been at Cisco, have you met with
8 Rambus representatives in relation to considering the
9 use or potential use of Rambus technology?

10 A. Yes. I don't recall the specific meetings,
11 but there was a number of meetings that discussed
12 that.

13 Q. Did you personally develop any views or
14 recommendations as to whether Cisco should use Rambus
15 technology in its products?

16 A. Yes, I did.

17 Q. And what views, now referring to your
18 experience at Cisco, what views did you develop?

19 A. Well, my strong recommendation was to not use
20 it.

21 Q. And what was the reason or basis for that
22 recommendation?

23 A. Because a new concern which didn't exist at the
24 time I was at Sun was that since I didn't see Rambus
25 successful in its primary market, which was, you know,

1 PCs, and Cisco had a ten-year life cycle in its
2 products, I personally was very concerned that the
3 memory devices would simply no longer be manufactured
4 during the life cycle expectation of our products.

5 Q. And why was that a concern, just to elaborate?
6 You're talking about the --

7 A. Just because the cost of the device isn't just
8 the availability of supply would be diminished -- I'm
9 sorry. The cost would go up tremendously and there's a
10 possibility we could not obtain the devices at all at
11 some point in the future.

12 Q. And in the period of time in which you
13 considered Rambus technology while you were at Cisco,
14 did you see any improvements in the cost-performance
15 considerations that you had identified earlier?

16 A. No. It was the same kind of analysis, which is
17 the only real sustainable advantage of Rambus appeared
18 to be the fewer number of pins they required for the
19 interface running at the higher clock rate.

20 And in the case of the Intel network processor
21 that implements the Rambus, this was the reason they
22 apparently made that choice. Our feedback to Intel
23 was that we would require them to change to a more
24 conventional memory interface in the future versions
25 of this device because we were so concerned about

1 supply.

2 Q. You mentioned earlier I believe that Cisco,
3 generally speaking, takes a conservative approach to
4 memory selection; is that --

5 A. Yes.

6 Q. -- is that a fair statement?

7 In the time that you've been at Cisco since
8 1996 -- is that right? -- in that time, has -- have
9 you been involved in efforts within Cisco to transition
10 to a new memory standard in the design of Cisco
11 products?

12 A. So the only efforts that I've really driven
13 were the FCRAM/RLDRAM technologies, and those in my
14 mind are really specialty DRAMs, not commodity DRAMs.
15 On the commodity side, our primary goal was to use the
16 most available and lowest-cost components.

17 Q. Well, focusing then on the areas where you've
18 been most directly involved with the FCRAM and the
19 RLDRAM, in those instances, when Cisco was
20 transitioning to or developing new products that relied
21 on those types of memory, did you play a role in that
22 process?

23 A. Yes, I did.

24 Q. And what was your role?

25 A. Detailed review of interface specifications,

1 feedback to vendors whether these specifications were
2 usable and would meet the objectives.

3 Q. And in order to develop products that would use
4 these types of memory, were there things that had to be
5 done within the design of Cisco's own products to
6 accommodate this particular memory interface?

7 A. Correct. We would design our own memory
8 controllers for these high-end or special-purpose
9 specialty-type memories because there was no
10 off-the-shelf solutions and in many cases these
11 memories attach directly to our own ASIC or logic chip
12 designs.

13 Q. And once all that design work was done and you
14 were at the point of actually receiving a memory device
15 from the suppliers, was there further work that needed
16 to be done before you could ship the product?

17 A. Yes. So generally speaking, we go through
18 various -- extensive qualification process where we
19 qualified all the suppliers, not just one supplier, to
20 work directly over the extended temperature and voltage
21 ranges that are specified for the devices.

22 Q. And based on that experience, integrating these
23 memory designs into your products and the design,
24 testing and verification, do you have a sense of the
25 cost to Cisco of going through that process in

1 connection with a new memory design?

2 A. Yeah. Generally, yes.

3 Q. And what are the general parameters of the
4 types of costs or the quantity of costs associated with
5 that process?

6 A. Well, it depends on the complexity of the
7 system. A typical -- to release a typical PC board
8 that includes dynamic memory can cost us -- and this
9 includes the prototype expenses -- can cost between
10 500,000 and a million dollars or more.

11 Q. And that's cost per board?

12 A. No. This is the total expense that we would
13 pay for building the prototypes and engineering
14 expenses associated with that board-level development.

15 Q. And putting aside dollar figures, do you have a
16 sense of the amount of engineering time or resources
17 that are required, generally speaking, for this
18 complete design process or complete design cycle?

19 A. Yeah. Typically we have one or two engineers
20 per board and it takes typically six months.

21 Q. Would similar costs apply in the instance in
22 which Cisco was designing or redesigning products to
23 accommodate a new commodity-type memory as opposed to a
24 specialized memory?

25 A. Yes. Every time we make a design change to a

1 board, it has to go through the full qualification
2 process and would incur these kind of costs.

3 Q. And without going into detail, you've described
4 testing and verification I believe in connection with
5 your Sun experience.

6 Is there any significant difference in terms of
7 the testing and verification process that you need to
8 go through at Cisco?

9 A. Well, the Cisco process is even more rigid,
10 meaning it's very extensive to make sure there's no
11 possible design flaws before delivering it to
12 manufacturing.

13 Q. And do you and Cisco as well need to go through
14 the testing and verification process for each separate
15 vendor's product?

16 A. That's correct.

17 Q. Does Cisco have any particular attitude or --
18 we'll use that word -- attitude with respect to
19 transitioning to new memory?

20 A. As I said it earlier, it has a fairly
21 conservative attitude because there is no business --
22 significant business advantage to be early with a new
23 memory technology that is not yet fully mature. This
24 is for the commodity-type memory.

25 Q. Right.

1 Now, at some point in time since you've been at
2 Cisco, did you become aware of the fact that Rambus had
3 begun to enforce patents against SDRAM and DDR SDRAM
4 products?

5 A. Yes. I believe around in the year 2000 I read
6 in the press that this in fact was happening.

7 Q. And do you recall, when you learned about
8 this, whether you had any particular reaction or
9 response?

10 A. It was a complete surprise to me.

11 Q. And why was that?

12 A. Because I couldn't conceive that their, Rambus,
13 patented technology would apply to the JEDEC open
14 standard.

15 Q. And can you elaborate on why you couldn't
16 conceive of that?

17 A. Because the JEDEC standard was developed in an
18 open standards process that at least had a history of
19 making choices that were not encumbered by proprietary
20 patents or royalties.

21 Q. Before learning in 2000 through press
22 accounts, I think you said, about Rambus asserting
23 patents over SDRAM and DDR SDRAM, before learning of
24 that, had you ever heard any rumor or suggestion that
25 Rambus might have patents that would extend to SDRAM

1 or DDR SDRAM?

2 A. I did not.

3 Q. When you did learn about that in 2000, did you
4 have any concerns, from the standpoint of Cisco's
5 business, did you personally have any concerns as to
6 how the fact that Rambus was asserting patents over
7 SDRAM and DDR SDRAM could impact your company?

8 A. Do you mean regarding the memory supply or in a
9 more general setting?

10 Q. Well, if you could lay out any type of concern
11 that you may have had and then I can follow up.

12 A. Yeah. Well, on the memory side, the concern
13 was obviously that our costs may increase since the
14 expectations I had and I still have is that those kind
15 of costs would be passed on to the customer.

16 In addition, if the memory suppliers -- if some
17 of them would choose not to either manufacture the same
18 type of memory or to make a change to the memory, there
19 would be a tremendous cost to Cisco to redesign the
20 existing boards and systems Cisco was shipping to
21 accommodate this new type of memory.

22 Q. So to follow up on the last thing you said, one
23 of your concerns when you learned about Rambus seeking
24 to enforce patents over SDRAM and DDR SDRAM was that if
25 that were to result in changes to those memory

1 standards, it could impose costs on your company?

2 A. Yes.

3 Q. And you said -- you used the term "tremendous
4 cost to Cisco to redesign the existing boards and
5 systems."

6 Can you explain what specifically you were
7 referring to when you said that this could impose
8 tremendous costs on your company?

9 A. Well, we did a survey and Cisco was shipping
10 approximately 1500 distinct PC board assemblies that
11 included DRAM technology, so my previous estimate was
12 that at a cost of between \$500,000 to a million dollars
13 per board to redesign and requalify these boards with a
14 new type of memory technology, the cost to the company
15 could approach or exceed \$1 billion.

16 Q. So it's your understanding that if you were
17 required to redesign your -- the boards that are used
18 in Cisco's switches and routers to accommodate a
19 different type of memory or a different memory standard
20 that the cost could range as high as a billion dollars
21 for your company?

22 A. It would be extremely disruptive on top of
23 this, just the loss of opportunity to use the same kind
24 of engineering resources for new system development, so
25 generally speaking, we do not wish to redesign existing

1 systems or boards.

2 Q. Let me ask you about the opportunity -- loss of
3 opportunity or opportunity costs that you just referred
4 to.

5 Are you talking about the cost to Cisco of
6 redirecting engineering resources to a project such as
7 the redesign to accommodate a new memory? Is that what
8 you're talking about?

9 A. Yes.

10 Q. And why is that costly to your company?

11 A. Well, both the actual prototype expenses
12 required to recertify and revalidate the new designs,
13 but on the opportunity side it takes I would say an
14 average of a man-year of engineering to deliver a new
15 board to manufacturing, so if we have to redo
16 1500 boards, that would be 1500 man-years of
17 engineering required to do all this work. And this is
18 a significant use of Cisco's engineering resources.

19 Q. And when you gave the estimate a moment ago --
20 obviously it's a rough estimate -- of a billion dollars
21 of potential cost to Cisco, how does that compare to
22 the amount of money that Cisco spends on an annual
23 basis on DRAM memory?

24 A. We only spend about a hundred million, as I
25 said earlier, only about a hundred million dollars

1 this year on memory purchases, DRAM purchases, so it
2 would exceed the cost of operations by a factor of
3 ten.

4 Q. If Cisco were required to redesign its boards
5 to accommodate substitutes or different types of memory
6 standards to replace the existing SDRAM and DDR SDRAM
7 standards, do you have a sense of how long that process
8 might take?

9 A. It would take over one year. At least one
10 year.

11 Q. And that's one year after you -- after there
12 is a final new memory specification for you to work
13 with?

14 A. Well, more importantly, we can only start the
15 work once we know what the new specification is. In
16 some cases it could take two years.

17 So the one year was if we have memory
18 controller chips provided to us by third parties. If
19 we have to do our own chip development for this new
20 memory, the chip development itself takes a year or
21 longer, so the total time would be at least two years.

22 Q. Now, when you said that you learned through
23 press accounts about Rambus asserting patents over
24 SDRAM and DDR SDRAM, did you have an understanding as
25 to whether the patents that were being asserted were

1 U.S. patents, foreign patents, or both?

2 A. Well, when I first read it --

3 MR. STONE: Objection, Your Honor. I don't
4 think this witness' understanding as to the nature of
5 what patents are being asserted has any bearing on this
6 case. What patents are being asserted are what patents
7 are being asserted. That's a matter of fact. What
8 this witness reads in a press account is if not double
9 hearsay, it might even be triple hearsay, so I object
10 on the grounds of hearsay and it's irrelevant to this
11 case.

12 JUDGE McGUIRE: Mr. Royall?

13 MR. ROYALL: Your Honor, I think it's quite
14 relevant and I'm merely laying a foundation for later
15 questions as to his concerns relating to his business,
16 and to explore that, I need to have an understanding of
17 what the basis for his concern is or what knowledge he
18 had.

19 JUDGE McGUIRE: Overruled. I'll hear the
20 question.

21 BY MR. ROYALL:

22 Q. Do you have the question in mind, sir?

23 A. Yes. So I read in the press that both the
24 intellectual property rights or patents were asserted
25 both in the U.S. as well as in Europe.

1 Q. Now, you've described in previous answers the
2 nature of the concerns that you had from the standpoint
3 of the potential impact on Cisco's business of Rambus
4 enforcing patents over SDRAM and DDR SDRAM.

5 Were those concerns limited to concerns about
6 potential enforcement of U.S. patents only or did they
7 also extend to foreign patents?

8 A. Yeah. There's an additional issue here that
9 the memory business is of course a worldwide or
10 international business with some manufacturers in
11 Europe, many of them in Asia, and one remaining in the
12 U.S., so depending on the validity of such patent
13 claims, it could have created a dislocation in the
14 memory market depending on the country or area these
15 memory manufacturers were manufacturing the devices.

16 On top of that, Cisco also manufactures their
17 own products all over the world and there could be a
18 secondary issue of Rambus asserting claims against
19 Cisco at the location of manufacturing Cisco Systems'
20 own products.

21 Q. I have walked you through some of the concerns
22 that you had relating to the enforcement of Rambus
23 patents over DDR and SDRAM.

24 Are there any other concerns that you haven't
25 touched on?

1 A. Well, my broader concern is the nature of open
2 standards processes and the rights of industry
3 participants to join together to develop standards for
4 the benefit of its members or for the benefit of the
5 industry at large that are unencumbered by intellectual
6 property claims, patents, et cetera.

7 Personally, I have been more involved with the
8 IEEE and the ITF organizations rather than with JEDEC
9 in particular, but I am in fact very cognizant of the
10 fact that an open standards process can only work if
11 there is open disclosure during the process when people
12 are at the point of making design decisions of which
13 particular choice to make.

14 Because if the information is present that
15 there's certain technology that is in fact encumbered
16 by a patent claim and if that's known at the time, then
17 the consortium, the industry standards group, can
18 typically make other choices that would not burden the
19 standard that's being developed for the benefit of its
20 members with such a burden.

21 JUDGE MCGUIRE: Okay. That's enough. I mean,
22 he's gone beyond even the framing of your question.

23 MR. ROYALL: I understand.

24 JUDGE MCGUIRE: Mr. Stone?

25 MR. STONE: Your Honor, I move to strike on the

1 grounds that this testimony goes directly to the area
2 which we have proffered Mr. Keefauver as an expert
3 witness on and which complaint counsel made a motion,
4 which was granted, in limine preventing him from
5 testifying as to the conduct and understanding that
6 would come from other standards-setting organizations,
7 and this is based on the witness --

8 JUDGE McGUIRE: Sustained. I will not
9 entertain the answer regarding his understanding of
10 other organizations, the IEEE I believe he mentioned
11 and whatever the other one was.

12 MR. ROYALL: I understand, Your Honor.

13 BY MR. ROYALL:

14 Q. Let me come back to this issue,
15 Mr. Bechtelsheim, and ask you not to refer to your
16 experience at IEEE or other standards organizations.
17 You've described already the limited experiences you've
18 had at JEDEC.

19 But putting aside other standards
20 organizations, did the concerns that you had relating
21 to the potential impact on your company's business,
22 Cisco's business, of Rambus enforcing patents over
23 DDR SDRAM and the earlier SDRAM standard, did those
24 concerns have anything to do with the open standards
25 process?

1 Let me acknowledge at the outset the
2 significant contributions you have made to the
3 computing industry, which I think we've all benefited
4 from, and we appreciate it.

5 And the business model that you developed at
6 Sun was a very successful business model, was it not?

7 A. I believe so.

8 Q. \$5 billion of sales after how many years?

9 A. I don't know that we made five billion, but we
10 had one billion after five years.

11 Q. One billion after five years.

12 And of course, very lucrative to you
13 individually as well?

14 A. Absolutely.

15 Q. Okay. Has anyone suggested to you that Cisco
16 is not going to be able to continue to sell products
17 that utilize SDRAM?

18 A. No.

19 Q. Okay. Has anyone suggested to you that Cisco
20 will not be able to sell products that utilize
21 DDR SDRAM?

22 A. No.

23 Q. So in the course of your business, that is,
24 working at Cisco, have you ever sat down with the
25 other managers at Cisco and said, Well, we better

1 think about what might happen if we can't use SDRAM or
2 DDR SDRAM?

3 A. The only specific comment I made was the
4 absolute worst case. We did not have a specific
5 discussion that said let's plan for that purpose.

6 Q. And did anybody suggest to you that what you
7 called the absolute worst case would ever happen?

8 A. Not at this time.

9 Q. You work with memory manufacturers even today;
10 correct?

11 A. Of course.

12 Q. And you know that many of them are licensed
13 under Rambus' patents to manufacture SDRAM; correct?

14 A. Yes, I am, I am aware of that.

15 Q. Okay. So there's no threat -- all the patents
16 in Europe and the U.S. that Mr. Royall asked you about,
17 you understand those manufacturers have a license to
18 manufacture SDRAM?

19 MR. ROYALL: Objection, Your Honor. I think
20 this assumes facts not in evidence.

21 JUDGE MCGUIRE: Mr. Stone, do you want to
22 comment on that?

23 MR. STONE: I'm not sure what facts it
24 assumes.

25 JUDGE MCGUIRE: I'm not either.

1 MR. ROYALL: I'm sorry. Are you representing
2 that all manufacturers have licenses to Rambus patents?
3 That's the concern I had.

4 MR. STONE: I don't think that's the question.

5 JUDGE McGUIRE: Okay. Restate it, Mr. Stone.

6 MR. STONE: I will, Your Honor.

7 BY MR. STONE:

8 Q. You understand that there are manufacturers who
9 are licensed under all of the U.S. and European patents
10 that Mr. Royall asked you about; correct?

11 A. Yes.

12 Q. And do you know whether or not the other
13 manufacturers who aren't licensed have been offered a
14 license?

15 A. I would assume they have been offered a
16 license. I don't know this for a fact, but I assume.

17 Q. I'm sorry. I didn't mean to interrupt you.

18 Have you ever spoken with Micron about whether
19 they have a license?

20 A. I believe they do not.

21 Q. And did they tell you they had been offered
22 one?

23 A. They did not make that specific comment, but I
24 assume there must have been a discussion about this.

25 Q. Did you ask them if they planned to take a

1 license?

2 A. No, I did not ask that question.

3 Q. Did you ask them what their plan was if they
4 should lose the patent litigation?

5 A. No. I did not discuss it.

6 Q. Did they ever suggest to you that they were
7 concerned that they couldn't continue to supply SDRAM
8 or DDR SDRAM to Cisco?

9 A. They did not suggest that.

10 Q. Infineon is a company you work with today;
11 correct?

12 A. Yes.

13 Q. Has Infineon ever suggested to you that they
14 have any concern that they won't be able to continue to
15 supply SDRAM and DDR SDRAM to Cisco?

16 A. No, they have not.

17 Q. Do you work with Hynix?

18 A. To a lesser extent.

19 Q. Has Hynix ever suggested to you that they won't
20 be able to supply those --

21 A. I did not have those discussions.

22 Q. Has any company ever said to you they were
23 concerned they wouldn't be able to continue to supply
24 SDRAM and DDR SDRAM to Cisco?

25 A. No.

1 Q. Have any of these companies, these memory
2 manufacturer companies, ever told you that they were
3 planning to design around the Rambus patents?

4 A. Yes.

5 Q. And when did they first tell you that?

6 A. In 2000. I don't know the exact time, but it
7 was the advanced DRAM technology group.

8 Q. And was someone from Cisco involved with that?

9 A. Yes.

10 Q. And did you understand that one of the
11 purposes of the ADT -- was that the shorthand name for
12 it?

13 A. Yes.

14 Q. One of the purposes of ADT was to design around
15 the Rambus patents; correct?

16 A. That was my understanding.

17 Q. Has any development come out of the work that
18 started so far as you know in 2000?

19 MR. ROYALL: Objection. Lacks foundation.

20 JUDGE McGUIRE: Overruled. As far as he
21 knows.

22 THE WITNESS: Yes, as far as I know, there's
23 been no significant outcome of that work.

24 BY MR. STONE:

25 Q. Have you done any work on your own to develop a

1 design that doesn't -- that isn't impacted by the
2 Rambus patents?

3 A. No, I did not.

4 Q. Have you gone and looked at the Rambus patents
5 that are at issue in the litigation between Rambus and
6 some of the memory manufacturers?

7 A. I have not.

8 Q. Do you know what features if any features in
9 any of the products that Cisco uses today actually
10 infringe those patents?

11 A. Since I didn't look at the patents, I cannot
12 answer your question regarding to, you know, validity
13 of any claim in that patent relative to Cisco product.

14 Q. Has anyone told you what features of any of the
15 products that Cisco uses today infringe on Rambus
16 patents?

17 A. My general understanding is that the feature
18 that's being discussed the most is the mode register.

19 Q. And who has told you that?

20 A. That was reported in the press.

21 Q. Have you heard it from anyone else?

22 A. I believe I heard it from one of the memory
23 manufacturers themselves, but I do not recall from
24 which one.

25 Q. And do you recall what they told you about

1 that? Did they tell you they thought that the product
2 did infringe? Did they tell you it didn't infringe?
3 Did they tell you they thought the patent was valid or
4 invalid? Did they comment on that in any way?

5 A. My recollection is that the comment came from
6 either Infineon or Micron, and whoever the company was
7 felt that this was not a logical application of the
8 Rambus patent to claim the mode register in synchronous
9 DRAM.

10 Q. You said not a logic --

11 A. Not a valid application. But I'm not making
12 this -- I'm representing what I heard from them. I
13 have no personal knowledge of this.

14 Q. And you have no personal views one way or the
15 other on whether the Rambus patents are valid or not?

16 A. I have not reviewed their patents. I have
17 commented earlier in my testimony that mode registers
18 have existed on chips in my entire, you know, design
19 experience for the last thirty years, so I do not
20 personally view a mode register as an innovative
21 element.

22 Q. And you haven't looked at the patent to -- you
23 haven't looked at the patents to see whether what they
24 claim is a mode register or a particular application in
25 a mode register, have you?

1 A. I have not looked at the patent.

2 Q. Okay. When you told us earlier that you
3 understood an open standard should be one that is
4 unencumbered by patents, can you tell us what you mean
5 by "unencumbered"?

6 A. Unencumbered means that if there is
7 intellectual property ownership by a particular entity
8 that license to such intellectual property would be
9 available under reasonable and nondiscriminatory terms
10 to the -- to anyone who wants to license that
11 property.

12 Q. So it's okay to have patents on something that
13 is part of an open standard as long as you are willing
14 to license them on reasonable and nondiscriminatory
15 terms, in your view?

16 A. Well, it is preferable not to include patents,
17 so I think an essential element here is having matters
18 disclosed at the time the standards groups make certain
19 decisions so that the participants are fully aware of
20 the implication of making such a choice.

21 Q. And if they choose to use patented technology,
22 that's okay?

23 A. It is okay as long as the patent holder would
24 commit to licensing their required patents under
25 reasonable and nondiscriminatory terms.

1 Q. Yes. It's not your expectation that products
2 that are built to JEDEC standards will not be covered
3 by patents, is it?

4 A. No.

5 MR. ROYALL: Objection. Vague.

6 THE WITNESS: But that is not my expectation.

7 JUDGE McGUIRE: Overruled.

8 BY MR. STONE:

9 Q. When you first founded Sun, shortly after it
10 was founded, you applied for patents; correct?

11 A. Sure.

12 Q. And those patents were intended to cover
13 features of the product that you had designed and first
14 built while you were still at Stanford; correct?

15 A. Yes.

16 Q. And you didn't apply for a patent that covered
17 the entirety of the -- well, would you call it a
18 workstation at that time?

19 A. Yes.

20 Q. You didn't apply for a patent that said it
21 covers the entire workstation and everything in it; you
22 applied for patents that covered various features,
23 didn't you?

24 A. Correct.

25 Q. And you expected those patents would cover

1 those features whether they were used in a Sun
2 workstation or someone tried to build another
3 workstation -- let's call it the moon -- the moon
4 workstation and used the same features; right?

5 A. Well, the patents I had applied for earlier on
6 were very specific to Sun's implementation of the
7 workstation and thus were unlikely to be used by
8 another party doing an independent design.

9 So the primary purpose of the Sun patents at
10 that time was to prevent what's known as reverse
11 engineering where another party would simply copy the
12 design.

13 Q. And the idea was to prevent someone from
14 copying either part or all of the design; correct?

15 A. It would prevent people from copying the
16 specific parts that were patented under the patent.

17 Q. And you've obtained patents since that original
18 work that you did, have you not?

19 A. Correct.

20 Q. And you've obtained patents that cover SIMMs;
21 correct?

22 A. DIMMs. Dual in-line memories, not SIMMs.

23 Q. You're aware that some of those patents are on
24 the JEDEC patent tracking list; correct?

25 A. That's correct.

1 Q. And there they're described as SIMM patents;
2 correct?

3 A. I think the original name may have been SIMM
4 before the industry called it a DIMM, but I believe
5 everybody calls it a DIMM.

6 Q. Now, while you were at -- and you did that work
7 while you were at Sun?

8 A. Correct.

9 Q. While you were at Sun, did Sun expect companies
10 to pay it royalties if they utilized certain inventions
11 that were patented by Sun?

12 A. I was actually not either responsible nor
13 directly involved in the business discussions
14 surrounding how Sun should either license or protect
15 its patents and under what royalties it would license
16 such patents. It was not my responsibility.

17 Q. Do you have knowledge about the fact that Sun
18 expected companies to pay it royalties for memory
19 modules that connected to the SPARC workstation?

20 A. My general understanding is that that was in
21 fact the case.

22 Q. Now, the SPARC workstation was the evolution of
23 what you originally invented; am I correct?

24 A. Correct.

25 Q. And the memory module that was included in the

1 SPARC workstation, was that one that made use of JEDEC
2 standard products?

3 A. Yeah. Not the original design, but one of the
4 subsequent versions of the SPARC workstation included
5 the patented DIMM design.

6 Q. And did that patented DIMM design make use of
7 standardized memory?

8 A. Yes, it did.

9 Q. And was it your understanding while you were
10 at Sun that Sun expected those memory module
11 manufacturers to pay a 5 percent royalty to Sun if
12 they manufactured those modules that work on the SPARC
13 workstation?

14 A. I cannot comment on the exact royalties because
15 I don't have any firsthand information, but I believe
16 there was a royalty implication. I do not know the
17 amount.

18 Q. And during the time you were at Sun, did any of
19 your colleagues at Sun talk with you about the amount
20 or range of those royalties?

21 A. I do not recall the specific discussions.

22 Q. Do you recall general discussions?

23 A. There was a general discussion, yeah.

24 Q. And what was your understanding based on the
25 general discussion from the other people employed at

1 Sun?

2 A. The general understanding was that Sun tried to
3 protect its own memory business for its own systems but
4 was actually willing to let other people build
5 different type of DIMM modules for other systems that
6 would not conflict with Sun's business model.

7 Q. And was there any discussion that you can
8 recall in these general terms as to the amount of
9 royalty that Sun expected to be paid?

10 A. I don't recall the terms being discussed.

11 Q. Did you have any reaction one way or the other
12 to my suggestion that it was 5 percent?

13 A. I don't know whether that was the correct
14 number.

15 Q. Sun also was required to pay royalties on
16 certain products that it manufactured; correct?

17 A. Correct.

18 Q. One of the companies to whom it paid royalties
19 was Texas Instruments?

20 A. I believe so.

21 Q. Who were the others?

22 A. I believe Sun had a patent settlement with IBM
23 that I don't know the exact amount, but it was a fairly
24 large total payment up front.

25 Q. Now, when you said earlier that you expected

1 these open standards to be unencumbered by patents, and
2 you've now explained to us what you meant, did you ever
3 look at the JEDEC rules that describe whether patented
4 technology should or should not be included in the
5 standard?

6 MR. ROYALL: Asked and answered.

7 THE WITNESS: Yeah, I did not. I already
8 testified to that already.

9 BY MR. STONE:

10 Q. Are you aware of whether or not IBM has patents
11 on JEDEC standardized products?

12 A. I'm not specifically aware of that.

13 Q. You're familiar with the IBM high-speed toggle,
14 are you not?

15 A. High-speed?

16 Q. Toggle. T-O-G-G-L-E.

17 A. Relative to memory?

18 Q. Memory, uh-huh.

19 A. I'm not sure what the term refers to. This was
20 an IBM term?

21 Q. Do you know that some of the TI patents cover
22 JEDEC standardized memory?

23 A. I believe TI had general patents in packaging
24 integrated circuits. I do not know which of these
25 specifically applied to memory.

1 Q. And do you know how much royalties are paid to
2 various companies by memory manufacturers today?

3 A. I do not know.

4 Q. Do you know whether the products that Sun
5 purchased, the DRAM products that Sun purchased while
6 you were there, were ones on which royalties were being
7 paid by some of the manufacturers?

8 A. I believe on the packaging, plastic packaging
9 patents, there was some royalty, but I'm not
10 specifically familiar with this.

11 Q. Well, did you make inquiry to find out how much
12 the royalty was so that you could take it into account
13 in your consideration of what particular DRAM to
14 choose?

15 A. No, we did not.

16 Q. You expected it to be included in the price you
17 were charged; correct?

18 A. Well, my understanding of the packaging patent
19 was that it applies to any packaged device, that was
20 irrespective of the specific DRAM technology.

21 Q. Are you familiar with Motorola's patents on the
22 fundamental design of SDRAM?

23 A. I am not familiar with those.

24 Q. Do you know whether Motorola received
25 royalties from various companies who manufactured

1 DRAM?

2 A. I don't have any knowledge of that.

3 Q. One of the products that you considered --
4 well, let me ask you one other -- are you familiar with
5 the Hitachi patents on SDRAM?

6 A. No, I'm not.

7 Q. And have you ever inquired of anyone whether
8 they pay royalties to Hitachi to manufacture DRAM?

9 A. I did not.

10 Q. Did you look at the burst EDO product when it
11 was being developed?

12 A. So this was an enhancement of the EDO that a
13 particular company proposed?

14 Q. I'm going to hesitate with the word
15 "enhancement," but let me say it was an EDO product
16 that was another step beyond EDO and was called burst
17 EDO developed by --

18 A. Yes, I recall that development, but I don't
19 think it achieved market success or market momentum.

20 Q. Was that presented to you as one to consider
21 when you were making your considerations of where to go
22 next?

23 A. I remember dimly that we considered that at the
24 time, but I do not recall specifics on that.

25 Q. And at that time did Micron or any company tell

1 you that Micron had a significant number of patents on
2 burst EDO?

3 A. I do not recall.

4 Q. When you were first at Sun, what was the first
5 memory product that you purchased? Was it DRAM?

6 A. Not -- the first product was fast -- the
7 standard multiplexed commodity DRAM.

8 Q. Fast page?

9 A. Fast page.

10 Q. And then at some point in time you considered
11 whether to stick with fast page or move to something
12 else; correct?

13 A. Well, the next step was EDO.

14 Q. Were there any other alternatives to choose
15 from at that point in time?

16 A. Not that I can. There may have been some
17 unusual proposals from smaller companies, but I don't
18 think we considered anything else except the mainstream
19 developments.

20 Q. And then there came a time -- and you
21 ultimately went with EDO; right?

22 A. Yes.

23 Q. Did there come a time when you faced a choice
24 as to whether to stay with EDO or go to something
25 else?

1 A. Well, eventually we moved from EDO to SDRAM,
2 but at that same time when EDO arrived at the scene I
3 don't recall another competing technology.

4 Q. Okay. Let me just make sure I'm clear. I
5 struggled a little with your accent and it's my fault,
6 not yours, so let me just make sure I understand.

7 You said that when EDO first was on the scene
8 you don't recall if there was any other competing
9 technology or not?

10 A. Correct.

11 Q. Okay. And then after you'd been using EDO for
12 several years you considered whether to move to SDRAM?

13 A. Correct.

14 Q. Were there any competing technologies to choose
15 from at the time you looked at SDRAM?

16 A. Rambus. As I testified earlier.

17 Q. What were those competing technologies?

18 A. The Rambus technology.

19 Q. Okay. And was it good or bad to have a
20 choice?

21 A. It was interesting. But it -- as I testified
22 earlier, you know, the difficulties in using Rambus in
23 my mind were so high that I very quickly came to the
24 conclusion that it was not going to work for Sun.

25 Q. And you understood as the choices were being

1 made by other companies that some other companies had
2 made a different choice than you had made at Sun?

3 A. Yes. And that was surprising, but in
4 retrospect, I think at the end I was probably right.

5 Q. And your concern with picking the Rambus
6 products today is that Rambus may not be around for
7 another ten years to continue to ensure the supply?

8 A. Well, not so much Rambus, the company, but I'm
9 talking about the willingness of memory manufacturers
10 to build what was going to be a specialty memory
11 product in declining volume and, you know, importing it
12 to the next-generation processes, maintaining
13 continuity of supply. So the, as you know, the number
14 of manufacturers that are still manufacturing Rambus
15 has dwindled.

16 Q. So if -- and I say this as if -- if the memory
17 manufacturers had gotten together and decided that they
18 were going to try to put Rambus technology out of
19 business, your concern today is they might be
20 succeeding?

21 MR. ROYALL: Objection, Your Honor. Lacks
22 foundation. Calls for speculation.

23 JUDGE McGUIRE: Sustained.

24 BY MR. STONE:

25 Q. Let me go back to the royalty question for just

1 a minute.

2 Does Cisco pay royalties?

3 A. I'm not familiar with our exact license
4 arrangements. I believe we had a patent exchange with
5 IBM and perhaps other companies.

6 Q. And has Cisco recently been sued by Lucent for
7 patent infringement?

8 A. That was some time ago, but in terms of the
9 Lucent -- you can just strike the rest. Thank you.

10 Q. But it also is correct, is it not, that Cisco
11 collects royalties from companies for its patents?

12 A. I'm not familiar with that. In fact, my belief
13 is that Cisco traditionally has not asserted its
14 patents against anyone.

15 Q. Unless someone first asserted patents against
16 it?

17 A. Correct.

18 Q. And when you first heard about the SDRAM, was
19 that in June of 1991?

20 A. I cannot testify to the exact date. It was
21 when it was reported in EETimes magazine. I thought it
22 was in early 2000.

23 Q. Let me just see where I put those.

24 MR. ROYALL: I don't know if, Greg, you're
25 following this, but I think that the last question he

1 may have -- based on the answer, he may have
2 misunderstood the question. I don't know if you want
3 to clarify that. If you look, you'll see what I'm
4 talking about.

5 BY MR. STONE:

6 Q. I understand the question and answer. I
7 appreciate it, but you first heard about SDRAM when you
8 read about it in EETimes?

9 A. Actually, thank you for clarifying.

10 Is your question relating to when I first heard
11 of SDRAMs relative to Mr. Sussman's letter from NEC in
12 1991 or are you referring to Rambus' claims against
13 SDRAM?

14 Q. No, no, no. When you first heard of the
15 product SDRAM.

16 A. I'm sorry. Thank you for clarifying.

17 So that was the letter from Howard Sussman that
18 was Exhibit RX-0162.

19 Q. And that's the first you recall hearing about
20 it?

21 A. Correct.

22 Q. And did you speak with him before the letter?

23 A. There was a conversation on the phone where he
24 explained to me verbally the concepts that are
25 expressed in this letter.

1 Q. So you had heard about it before the letter?

2 A. Well, the conversation on the phone was
3 preceding the letter by a matter of days I believe.

4 Q. And did you initiate that contact or did he?

5 A. I do not recall. I may have heard about it in
6 the popular press, contacted him, or he may have known
7 of me and contacted me. I do not recall who initiated
8 that conversation.

9 Q. Now, you told us earlier today I believe that
10 you expected -- let me strike that.

11 You told us earlier that you believe that
12 Mr. Sussman was going to propose the SDRAM design in a
13 JEDEC meeting; correct?

14 A. Correct.

15 Q. Now, do you know one way or the other whether
16 what he did after he talked to you was he had a meeting
17 that was not a JEDEC meeting, with only some of the
18 people who were involved in the industry, at which he
19 discussed this?

20 A. I have no firsthand information about such
21 meetings.

22 Q. And did he tell you that he had a meeting in
23 Foxborough or Boston, Massachusetts at which this was
24 discussed planned when you talked to him?

25 A. Well, he did not describe to me other

1 meetings. He may have referred -- since you mention
2 it, he may have referred to that he is discussing it
3 with others, but I do not know who the other parties
4 were.

5 Q. Okay. Prior to July of 1991, which is the date
6 of this letter from Mr. Sussman, RX-162, you had had
7 some meetings with Rambus; correct?

8 A. Correct.

9 Q. And at those meetings did you have an
10 understanding based on what was shown to you or given
11 to you at those meetings that one of the features of
12 the Rambus design was to use both edges of the clock?

13 A. Yes, I had that understanding.

14 Q. And I want to show you a couple of documents to
15 see if you recall having seen these documents or
16 similar documents at your Rambus meetings either before
17 July of 1991 or after. And I'm going to show you RX-94
18 and RX-130.

19 May I approach, Your Honor?

20 JUDGE McGUIRE: Yes.

21 BY MR. STONE:

22 Q. Mr. Bechtelsheim, I've handed you two exhibits,
23 RX-94 and RX-130. RX-94 is on top. And if you could,
24 leaf through them and tell me whether you recall having
25 seen these or similar documents at any of the meetings

1 you had with Rambus in the late 1989 or early 1990s
2 time frame.

3 A. Yeah, I do not recall today these specific
4 documents.

5 Q. Do you recall seeing documents like these that
6 were technical descriptions in some detail?

7 A. The documents that I recall were in the form
8 of PowerPoint presentations that may have covered, you
9 know, some of the subject matter, but I do not recall
10 very detailed specs of this nature in this time frame.

11 Q. Okay. Do you recall the PowerPoint
12 presentations showed you that dual-edged clocking was
13 utilized?

14 A. Yes, they did.

15 Q. Did you understand from the early presentations
16 that Rambus was contemplating the use of a mode
17 register?

18 A. I do not recall the mode register from those
19 early presentations.

20 Q. But you can't say that it's not included;
21 correct?

22 A. Yeah, I can't say that it was not included.

23 Q. And early on did you recall from your
24 discussions with the Rambus individuals that they
25 planned to use either something like a PLL or a DLL to

1 help deal with the dual-edged clocking issues that
2 might arise?

3 A. Yes. I had an understanding there was going to
4 be a DLL/PLL circuit.

5 Q. And at the time, you thought that was a very
6 complicated thing to include and you weren't sure it
7 was necessary; right?

8 A. But I was thinking I recall that it was a very
9 burdensome circuit because of the power required to
10 power this DLL or PLL circuit, which I thought was one
11 of the disadvantages of the technologies that I
12 referred to earlier.

13 Q. Let's bring up if we can RX-162.

14 And if we could go to the third paragraph and
15 bring that up.

16 Do you have -- you have it on the screen in
17 front of you.

18 Where it says there, "We are only proposing
19 using one edge of the system clock" -- do you see that
20 phraseology?

21 A. Yes, I do.

22 Q. Was that -- at the time you received this
23 letter in July of 1991, did you understand that to be
24 drawing a distinction between what Rambus was doing or
25 proposing at the time were two edges and what

1 Mr. Sussman was proposing?

2 A. Well, I did not think of Rambus at the time I
3 read this letter. To me, using a single-edged
4 clocking interface was a well-established design
5 technique to transfer information. In fact, in most
6 systems I've designed I've used single-edged clocking,
7 so I didn't think of this as a fundamental
8 characteristic of a -- how should I say -- Rambus-type
9 design. I didn't have any correlation to Rambus when
10 I read this.

11 Q. If there had -- in your mind, what reason was
12 there for Mr. Sussman to tell you in July, We're only
13 using one edge of the system clock?

14 MR. ROYALL: Your Honor, it calls for
15 speculation as to the state of mind --

16 MR. STONE: Let me rephrase.

17 MR. ROYALL: -- third person.

18 BY MR. STONE:

19 Q. What was your understanding as to why, if you
20 had one, as to why Mr. Sussman was pointing out to you
21 that he was only going to use one edge of the system
22 clock?

23 A. Well, as I testified earlier, it was my shared
24 belief that single-edged clocking was in fact easier to
25 use relative to the issue of pulse symmetry.

1 Q. Was there a proposal on the table at all to use
2 dual-edged clocking at this point in time, July of
3 1991?

4 MR. ROYALL: Objection. Vague as to where this
5 proposal -- what this proposal relates to.

6 JUDGE McGUIRE: Sustained.

7 BY MR. STONE:

8 Q. Had you heard from any source about a design of
9 a DRAM that would use dual-edged clocking prior to July
10 of 1991?

11 A. Not from Howard Sussman. Of course, the Rambus
12 information that you referred to earlier included such
13 a design.

14 Q. And did you discuss the Rambus information with
15 Mr. Sussman or he with you?

16 A. Not as far as I can recall.

17 Q. Did you have a meeting in August, within a
18 month or so of this letter, RX-162 --

19 JUDGE McGUIRE: In August of?

20 BY MR. STONE:

21 Q. 1991 -- with personnel employed by Toshiba?

22 A. That's possible. I don't recall the specific
23 date of the meeting.

24 Q. Do you know a Mr. Unquera, U-N-Q-U-E-R-A?

25 A. Dim recollection, not a specific recollection.

1 Q. And you recognize the name Avo Kanadjian?

2 A. Yes, I do recognize the name.

3 Q. And do you recognize the last name of Horiuchi,
4 H-O-R-I-U-C-H-I?

5 A. Correct.

6 Q. And did you meet with them to talk about a
7 proposed design for SDRAM sometime in August of 1991?

8 A. It's possible. I don't recall the specific
9 time of the meeting, but I recall having a meeting with
10 Toshiba.

11 Q. And did that follow shortly after a meeting
12 that you had had with Rambus?

13 A. I cannot testify to that.

14 Q. Do you recall sharing with people at Toshiba
15 that you had had a meeting with people at Rambus
16 preceding your Toshiba meeting?

17 A. What I recall about discussing Rambus with
18 other manufacturers is to get their views on die size,
19 cost, practicality of this design. I do not recall
20 whether that was in the same meeting or previous
21 meetings.

22 Q. Let me show you a document to see if I can
23 refresh your recollection. It is not marked as a trial
24 exhibit, although it was produced in this case. And it
25 bears production numbers TAEC 0013943 through 47.

1 May I, Your Honor?

2 JUDGE McGUIRE: Yes.

3 BY MR. STONE:

4 Q. And I want to direct your attention if I might
5 just initially at just the second page of this -- I'm
6 sorry -- at the very last page of this document.

7 And at the very last page -- I don't think we
8 have it on the system. Your Honor, I apologize. Can I
9 hand a copy up?

10 If you would, look at just the last page of the
11 document for just a moment.

12 Do you see it refers to a date and time of a
13 meeting at the top and then it shows attendees? Your
14 name is listed there as well as the names I just asked
15 you about from Toshiba.

16 Do you see that, Mr. Bechtelsheim?

17 A. Yes, I do.

18 Q. And then if you would, read that first
19 paragraph.

20 JUDGE McGUIRE: To himself?

21 BY MR. STONE:

22 Q. To yourself.

23 A. Okay. I read it, yes.

24 Q. I'm just trying to see if I can refresh your
25 recollection about something that I know is almost

1 twelve years ago.

2 A. The way I would interpret this sentence, that
3 there may have been a meeting --

4 MR. ROYALL: Your Honor --

5 JUDGE McGUIRE: Wait a minute. He hadn't asked
6 you a question.

7 THE WITNESS: You asked me what I read here.

8 JUDGE McGUIRE: Do you have a question,
9 Mr. Stone?

10 MR. STONE: Yes, I do.

11 JUDGE McGUIRE: Go ahead.

12 BY MR. STONE:

13 Q. Have you had a chance to read it?

14 A. Yes.

15 Q. Does this at all refresh your recollection
16 that you met with Rambus and then after that at some
17 later date, days or a week or so later, you met with
18 Toshiba and talked with them about the meeting with
19 Rambus?

20 A. Okay. The way I read this sentence, and I'm
21 trying to --

22 Q. No.

23 JUDGE McGUIRE: All right. I'm going to
24 apprise you of the same thing that I cautioned him on
25 earlier, that only one person can talk in this

1 courtroom at a time, and I'll entertain your objection,
2 Mr. Royall.

3 So I think he was trying to answer that
4 question, and then I'll entertain your objection.

5 So are you through, sir, with your answer?

6 THE WITNESS: No.

7 MR. STONE: And let me restate my question and
8 let me withdraw it.

9 JUDGE McGUIRE: All right.

10 BY MR. STONE:

11 Q. I'm asking you to do something that is a little
12 awkward for a lot of us to do in that I'm asking you if
13 I have jogged your recollection so that I don't want
14 you to necessarily read what it says here and tell me
15 what it means. I can read the words, and so on. So
16 what I'm really trying to see is if I can jog your
17 memory at all by showing you this document.

18 So think about -- you don't have to do it
19 physically, but think about setting the document to one
20 side and just tell me if you remember from the
21 August 1991 time frame this meeting with Toshiba.

22 A. I recall a meeting with Toshiba, yes.

23 Q. And do you recall whether the meeting with
24 Toshiba came on the heels of a meeting you'd had with
25 Rambus?

1 A. I do not know whether I attended this Rambus
2 meeting, if that's what's being referred to here or
3 not. And the sentence says after the Rambus meeting
4 with Sun. It doesn't say that I was present at that
5 meeting. It appears there was a meeting. I do not
6 recall whether I was at such a meeting or not.

7 Q. Okay. Do you recall from your Rambus meetings
8 in the '89, 90, '91 time frame, at any point in those
9 time frames talking with them at all about
10 programmable CAS latency or programmable or variable
11 burst length?

12 A. I do not recall.

13 I can extend my comment here. I do recall that
14 I did not give a lot of feedback to Rambus on their
15 specification for the simple reason that they owned the
16 spec and it wasn't clear how we could participate in
17 modifying their spec, if you see what I mean.

18 They presented us a complete specified
19 solution, it says here. This says roughly they would
20 drive the development of the spec since they claimed
21 the intellectual property ownership of it, so there was
22 a very limited way for us to actually, you know, assist
23 them with improving the spec.

24 Q. Let me ask you on the stack of documents that
25 Mr. Royall showed you earlier if you could find the

1 August 27 letter, CX-2383. August 27, 1992.

2 I have skipped ahead a little bit in time and I
3 may come back. Let's maybe move to the 1992 time
4 frame.

5 This letter indicates -- and I think you were
6 asked about this earlier -- that a document was
7 enclosed. Do you see that?

8 A. Yes.

9 Q. And Mr. Royall asked you earlier whether the
10 PowerPoint presentation CX-340 was the enclosed
11 document. Do you recall that?

12 A. Yeah.

13 MR. ROYALL: For the record, I think that
14 misstates the record. I don't think I asked that
15 actual question.

16 JUDGE MCGUIRE: Then explain to me how it
17 misstates the record so I'll know.

18 MR. ROYALL: Well, I didn't focus any attention
19 at all, frankly, on the reference to an enclosure in
20 CX-2383. I'm not disputing that it does refer to it.
21 And I made no connection in my questions as to whether
22 this proposal was the actual enclosure.

23 MR. STONE: Well, Your Honor, the record -- I'm
24 sure the record will speak for itself on that point,
25 and let me just rephrase my question.

1 BY MR. STONE:

2 Q. I must have misheard earlier, Mr. Bechtelsheim,
3 but let me be clear.

4 Was or was not CX-340 the enclosure to the
5 letter, CX-2383?

6 A. Well, I cannot testify from firsthand
7 knowledge that it was, but it appears to me that, you
8 know, the dates on those documents relate to each
9 other.

10 Q. Let me suggest to you -- I'm going to show you
11 another document, but let me suggest to you that if the
12 letter is dated August 27 and the PowerPoint slides in
13 CX-340 are dated September 16 that the September 16
14 document may not have been an enclosure to an August 27
15 letter.

16 Do you see that relationship with the dates?

17 A. I do, but I can draw a different conclusion.

18 MR. ROYALL: I object, Your Honor, to the
19 representation. It wasn't in the form of a question,
20 and so I move to strike that, but he did later ask a
21 question that I have no problem with.

22 JUDGE McGUIRE: Can you connect it up,
23 Mr. Stone?

24 MR. STONE: Yep. I'm going to right now,
25 Your Honor.

1 JUDGE McGUIRE: I'm going to give you that
2 chance.

3 BY MR. STONE:

4 Q. Let me show you another exhibit, CX-2838.
5 May I approach?

6 JUDGE McGUIRE: Yes.

7 BY MR. STONE:

8 Q. And CX-2838 is a little bit out of order,
9 Mr. Bechtelsheim, so if you'll bear with me, let me
10 walk you through a couple of pages, and then feel free
11 to browse at it at your leisure.

12 If you would turn to page 5 --

13 MR. ROYALL: Your Honor, I assume that
14 Mr. Stone will lay a foundation as to whether he's seen
15 this document before he asks any questions about the
16 substance.

17 JUDGE McGUIRE: I'm sure he will.

18 BY MR. STONE:

19 Q. Let me ask you to turn to page 5.

20 A. Yes.

21 Q. Is that the same letter that Mr. Royall showed
22 you earlier today?

23 A. Yes. It appears to be.

24 Q. And you've seen it before?

25 A. I have.

1 Q. Okay. And now I want you to, if you would, to
2 turn to page 6 with the heading 16-Megabyte SDRAM
3 Specification, dated August 27, 1992.

4 Do you see that?

5 A. Yes, I do.

6 Q. Have you seen this document before?

7 A. I recall now having seen this document in the
8 past. I can't say the exact time frame, but it seems
9 to be around this time.

10 Q. And now looking at it -- and I will represent
11 to you that this document that I'm showing you came
12 from Rambus' files, at some point in time they had a
13 copy, and if it's a bit out of order, which it is, the
14 first few pages seem to be out of order, I apologize,
15 but that's the way it was produced in this case. I
16 haven't re-sorted the pages.

17 But accepting that, if you will, take a look at
18 this document, CX-2838, and tell me, if you can, if
19 this is an SDRAM specification developed by Sun with
20 your participation and sent by Sun to various JEDEC
21 members.

22 MR. ROYALL: Can I ask that we be specific
23 about Bates numbers since he's asking the question
24 about a part of the exhibit and not the whole exhibit
25 and the record currently does not reflect that?

1 JUDGE McGUIRE: Sustained.

2 BY MR. STONE:

3 Q. I'm going to ask about the whole exhibit except
4 for page 5.

5 A. Yes, it appears to be.

6 Q. Okay. Thank you.

7 And you had a role in preparing this document;
8 correct?

9 A. Yes. As I testified earlier, I was involved in
10 the general discussions of this interface. I do not
11 recall being an author on this document, so I believe
12 there was another person actually writing this detailed
13 specification, but I remember attending meetings where
14 we had internally discussed the status of the
15 synchronous DRAM.

16 Q. And does this proposal -- does this document,
17 CX-2838, reflect Sun's proposal for the SDRAM
18 specification as of August of 1992?

19 A. I believe this document is what was referred to
20 in the cover letter as the proposal that was submitted
21 with the cover letter.

22 Q. And did the Sun proposal that we see here,
23 CX-2838, include a proposal for variable or
24 programmable CAS latency through the use of a mode
25 register?

1 And I can direct you to pages --

2 A. Yeah.

3 Q. -- 19, 20 and 21 if it helps.

4 A. It appears to be, yes.

5 Q. And did the Sun proposal as of August of 1992
6 also include a proposal for the use of programmable
7 burst length, as referenced in CX-2838?

8 A. Yes, it did.

9 Q. And in the PowerPoint slide presentation we
10 looked at earlier, CX-340, was there a proposal to use
11 a mode register in that PowerPoint presentation?

12 A. There's a reference to a mode register and
13 there are basic pictures.

14 Q. And was that intended to -- is the mode
15 register intended to be used, as presented in September
16 of 1992 by Sun, intended to be used for programming
17 burst length and programming CAS latency?

18 MR. ROYALL: Objection. Lacks foundation as to
19 whether this witness has any knowledge of the intent
20 for which that mode register was used.

21 MR. STONE: That's why I'm asking, to find out
22 if he knows why.

23 JUDGE MCGUIRE: Overruled. I'll hear the
24 question.

25 THE WITNESS: I believe it referred to that

1 mode register.

2 BY MR. STONE:

3 Q. You believe the mode register's uses were to
4 program CAS latency and burst length?

5 A. Yes.

6 Now, I would venture to say that in my
7 recollection now that these were features that were
8 already discussed at JEDEC at that time. In other
9 words, this was not the first time these features were
10 written up in a document.

11 Q. And I don't mean to suggest that they were.

12 A. Okay.

13 Q. You told us earlier, I think, if I remember
14 correctly, that you didn't believe Sun had anyone who
15 was a JEDEC member prior to the time that you received
16 the letter from Mr. Sussman, RX-162.

17 A. That's my recollection.

18 JUDGE McGUIRE: Now, again, I'm not clear as to
19 the date.

20 MR. STONE: I'm sorry, Your Honor. July 30,
21 1991.

22 JUDGE McGUIRE: All right.

23 BY MR. STONE:

24 Q. And that was the date you had in mind because
25 that's the date of RX-162; correct?

1 A. Correct.

2 Q. Let me show you a document if I might, RX-143.

3 May I approach, Your Honor?

4 JUDGE McGUIRE: Yes.

5 BY MR. STONE:

6 Q. If we could bring up RX-143.

7 You'll notice this is a document that the first
8 page of which of RX-143 appears to be a fax cover
9 sheet.

10 Do you notice that, Mr. Bechtelsheim?

11 A. Yes.

12 Q. And if you would, on the first page, I just
13 want you to look down at the fourth name in the list,
14 and you'll see the name Bolo, B-O-L-O, Cannataro,
15 C-A-N-N-A-T-A-R-O.

16 Do you see that?

17 A. Yes, I do.

18 Q. And is that someone who in May of 1991 was
19 employed by Sun?

20 A. I do not recall.

21 Q. Does the name ring a bell with you at all?

22 A. No.

23 Q. And you'll notice it says "Sun" alongside that
24 person's name?

25 A. Yeah, I can see it, but I do not recall Bolo.

1 Q. And then you'll notice the second page of
2 Exhibit RX-143 shows that the memo at the top is
3 addressed to all JEDEC JC-42.3 members. Do you see
4 that?

5 A. Yes, I do.

6 Q. Having seen RX-143, does this at least suggest
7 to you that a Sun person was regarded as a member of
8 JC-42.3 in May of 1991, prior to the time that you
9 received the letter from Mr. Sussman on July 30 of that
10 same year?

11 A. I could only speculate whether that was the
12 case or not.

13 Q. So I guess we can be clear that it could be
14 that Sun had members on JEDEC prior to July of 1991,
15 but you might not have known about it?

16 A. That was only my recollection, yeah.

17 Q. And do you know a Guy Moffat at Sun?

18 A. That name I recall.

19 Q. And do you know whether he was asked by Sun to
20 attend a meeting sponsored by Mr. Sussman outside of
21 JEDEC that was held in October of 1991 in Portland,
22 Oregon?

23 A. I do not recall.

24 Q. Did you have anyone ever report back to you
25 that Sun had attended a Portland meeting sponsored by

1 Mr. Sussman that was not a JEDEC meeting to talk about
2 the SDRAM specifications?

3 A. I do not recall today.

4 Q. Did anyone ever report back to you that in
5 December of 1991 at the JEDEC meeting that was
6 attended -- let me strike that.

7 Ultimately, you did become familiar with the
8 person's name at Sun who attended some JEDEC meetings?

9 A. Clement Fang. Yes.

10 Q. And did Mr. Fang from time to time fill you in
11 on what happened at JEDEC meetings?

12 A. Yes, he did.

13 Q. Did Mr. Fang ever tell you after the
14 December 1991 meeting that Mr. Sussman had been
15 reprimanded at that meeting for holding at least two
16 meetings to talk about SDRAM that were not official
17 JEDEC meetings, to which everyone was not invited?

18 A. I don't recall that comment.

19 Q. Did anyone ever report to you, Mr. Fang or
20 Mr. Moffat or anyone else report to you that these
21 Sussman-sponsored meetings were being held outside of
22 JEDEC so they could talk about Rambus as well as other
23 things?

24 MR. ROYALL: Objection, Your Honor. This
25 assumes -- this question assumes facts not in evidence.

1 He's laid no foundation as to whether any so-called
2 Sussman-sponsored meetings ever occurred or whether the
3 witness knows anything about them, and every single
4 question --

5 JUDGE McGUIRE: Sustained.

6 MR. STONE: Your Honor, could I be heard for
7 just a moment?

8 JUDGE McGUIRE: I'll let you be heard.

9 MR. STONE: Thank you, Your Honor.

10 Today, counsel asked this witness everything
11 that would happen if DDR or SDRAM was not available,
12 and he went through a long litany of questions.

13 The first thing I established when I got up on
14 cross with this witness was no one has ever told him
15 that would happen. And there was absolutely no
16 foundation for those questions.

17 Now, I have foundation because we have in the
18 record that these meetings occurred and we have in the
19 record that Mr. Moffat attended, so the basic facts are
20 all in the record.

21 I want to find out whether what happened at
22 these meetings was shared with this witness, but to
23 object that I can't ask a question --

24 JUDGE McGUIRE: Just lay the foundation.

25 MR. STONE: Okay.

1 JUDGE McGUIRE: Then I'll let you get into it.

2 MR. STONE: But the problem is --

3 JUDGE McGUIRE: That was the objection, was it
4 not, Mr. Royall, no foundation as to what he knew about
5 these meetings?

6 MR. ROYALL: It's both the foundation and he's
7 assuming in the answer that he has any knowledge about
8 something that may or may not have happened.

9 JUDGE McGUIRE: Well, then I'll let you go back
10 in on that on redirect.

11 But if you lay a proper foundation, then I'll
12 let you go into that inquiry.

13 BY MR. STONE:

14 Q. In 1991, there were two competing technologies
15 for the new generation of DRAM; correct?

16 A. Rambus and synchronous DRAM you're referring
17 to. Yes.

18 Q. And you knew that Mr. Sussman was talking to
19 you about the synchronous DRAM?

20 A. Correct.

21 Q. And Dr. Farmwald and others at Rambus were
22 talking to you about RDRAM?

23 A. Correct.

24 Q. And did you know from what you heard from
25 Mr. Sussman or others involved with JEDEC that one of

1 the concerns of the SDRAM proponents was to make sure
2 that their product was competitive with RDRAM?

3 A. Well, I wouldn't use the word "competitive." I
4 think the goal of the synchronous DRAM was simply to
5 develop an evolutionary high-performance product.

6 It was clear that the Rambus clock frequencies
7 were significantly higher than any target that
8 synchronous DRAM had at that time. But based on my own
9 analysis, I concluded synchronous DRAM would perform
10 just as well or in fact better.

11 Q. And did you understand from Mr. Sussman or
12 others that one of the design goals of the group
13 looking at SDRAM was to try to ensure that the product
14 would be satisfactory to a sufficient percentage of the
15 market that it would be preferred by a sufficient
16 percentage over RDRAM?

17 A. Well, I didn't have that specific
18 understanding from Mr. Sussman, but in my own personal
19 understanding, it was clear to the extent the effort
20 to create a new interface standard would only be
21 successful if the product was appealing to a large
22 element of the market.

23 Q. Okay. And some of the features, some of the
24 features that were in the proposed SDRAM included
25 programmable CAS latency and programmable burst length;

1 correct?

2 A. Yeah. I personally didn't care for these
3 features as I said earlier, but that's --

4 JUDGE McGUIRE: That's not the question, sir.
5 Just answer the question.

6 THE WITNESS: Yes.

7 JUDGE McGUIRE: We'll keep this a lot cleaner.

8 BY MR. STONE:

9 Q. I think you and I can agree pretty quickly
10 here, Mr. Bechtelsheim, that many -- that the RDRAM
11 product is not your favorite DRAM product and some of
12 the features that are in the SDRAM and DDR are not your
13 favorite features?

14 A. Yes.

15 Q. And we can go into that if we need to. I don't
16 mean to cut you off, but I think we understand you on
17 that point, if that helps you.

18 A. I guess the point I was trying to make, that in
19 my mind these features are not required to deliver a
20 competitive product to the markets.

21 Q. Do you know where the idea came from to include
22 programmable CAS latency?

23 A. I do not know.

24 Q. Do you know where the idea came from to include
25 programmable burst length?

1 A. I do not know.

2 Q. It wasn't your idea?

3 A. No.

4 Q. Did anyone at Toshiba in your meeting with them
5 ever tell you that they had invented programmable
6 latency?

7 It's not going to be in that document I don't
8 believe.

9 A. I do not recall that.

10 Q. Do you know Howard Kalter of IBM?

11 A. I heard the name. I don't recall him
12 personally.

13 Q. Okay. Did you ever hear anyone say that
14 Toshiba claimed to have invented programmable CAS
15 latency?

16 A. I do not recall such a statement.

17 Q. Do you know one way or the other whether the
18 early technical descriptions of RDRAM, two of which I
19 showed you earlier that you said you hadn't seen
20 before, but do you know from any source whether those
21 early descriptions of RDRAM made plain that Rambus was
22 proposing to use a mode register for programmable CAS
23 latency and to determine variable burst length?

24 A. In my recollection, you know, without reviewing
25 this document here, is that the primary modes in the

1 Rambus protocol were selectable on a command-by-command
2 basis.

3 In other words, the protocol had a lot of
4 programming capability, but I do not recall
5 specifically any mode registers.

6 Q. Okay. Sometimes I have to check the
7 transcript to make sure I understood. I apologize for
8 doing that.

9 You did tell us just a moment ago that you
10 thought the programmable CAS latency was a feature
11 which you had preferred not be included?

12 A. Correct.

13 Q. And you would have either fixed the latency to
14 just one value or you would have controlled it with
15 pins; correct?

16 A. That would have been my proposal, yes.

17 Q. And you shared that proposal with others;
18 correct?

19 A. I believe I did.

20 Q. And Mr. Sussman as well as the people from Sun
21 who attended JEDEC meetings were recipients of your
22 advice, weren't they?

23 A. Yeah. I don't recall specifically who I
24 shared it with, but you know, there was a discussion
25 at one point that it would be simpler not to have

1 this.

2 Q. And do you know -- and JEDEC ultimately
3 rejected your advice; correct?

4 A. Yeah. Well, they chose the mode register.

5 Q. Do you have an understanding as to why they
6 chose to use the mode register and to have programmable
7 CAS latency?

8 A. No, I do not know.

9 Q. Similarly, with respect to programmable burst
10 length, you would have preferred not to have
11 programmable burst length; correct?

12 A. Correct.

13 Q. And if you were going to have it, you would
14 have preferred to have either -- you would have
15 preferred to have used pins; correct?

16 A. That's what I would have done.

17 Q. And again, this is something on which you made
18 your views known and JEDEC decided to reject your views
19 and go --

20 A. I was not a member, so I did not advocate my
21 views very strongly, but my recommendation --

22 Q. Did you share your views with Mr. Fang who did
23 attend from Sun?

24 A. I believe we discussed it within Sun. I do
25 not know the exact timing or context of those

1 meetings.

2 Q. And do you know how he voted on any of those
3 proposals one way or the other?

4 A. I do not know.

5 Q. And do you know why JEDEC chose to go with a
6 programmable burst length?

7 A. I do not know.

8 Q. Are you familiar with the development of
9 DDR-II?

10 A. Vaguely, not specifically, but in general
11 terms.

12 Q. Do you know whether the initial proposal of the
13 DDR-II specification that was published by JEDEC
14 included a fixed burst length?

15 A. I believe at one point it had a fixed burst
16 length.

17 Q. Do you know that it was changed to have a
18 programmable burst length in about September of 2001?

19 A. I believe the current spec has the programmable
20 burst length, yes.

21 Q. And if the change, if I'm correct on the date
22 September of 2001, that would be after you were aware
23 of the Rambus litigation; correct?

24 A. Yeah. I was not participating in this JEDEC
25 activity at that time regarding this issue. But it

1 was after I was aware of the Rambus patent assertion,
2 yes.

3 Q. Were you at that time still talking to memory
4 manufacturers?

5 A. On other projects, not on DDR-II. I remember
6 an early discussion where they discussed having a fixed
7 burst length, and my feedback was that was just fine,
8 no problem at all.

9 Q. And did anyone ever -- did you ever ask anyone
10 why, in light of the Rambus litigation, they chose to
11 put programmable burst length back in?

12 A. No, I did not.

13 Q. Did you ever suggest to anyone designing DDR-II
14 that you felt you were aware of products that would
15 need the variable burst length?

16 A. I did not suggest that to anyone.

17 Q. When the -- Your Honor, I don't know if there's
18 a time you'd like to take a break or --

19 JUDGE MCGUIRE: I guess we ought to. It's been
20 two hours. Let's then go on break for 10 or
21 15 minutes.

22 Off the record.

23 (Recess)

24 JUDGE MCGUIRE: This hearing is now in order.

25 Mr. Stone, you may proceed with

1 cross-examination.

2 MR. STONE: Thank you, Your Honor.

3 BY MR. STONE:

4 Q. Mr. Bechtelsheim, with respect to pins that we
5 were talking about a minute ago, if you were to use
6 pins to determine the different CAS latencies and the
7 different burst lengths that are in use in the products
8 that are being purchased by Cisco today, how many pins
9 would it take in the simplest configuration that you
10 envision?

11 A. Three pins.

12 Q. And let me show you, if I might, CX-2405.

13 May I approach, Your Honor?

14 JUDGE MCGUIRE: You may.

15 BY MR. STONE:

16 Q. Directing your attention to CX-2405 that I've
17 handed you, do you recognize this to be an Infineon
18 data sheet for a 256-megabit SDRAM?

19 A. Yes, I do.

20 Q. And is Infineon one of the suppliers who
21 currently supply SDRAM to Cisco?

22 A. I believe so.

23 Q. And is the 256-megabit SDRAM one of the
24 products purchased by Cisco today?

25 A. I believe so.

1 Q. Turn if you would to page 3 of 2405.

2 A. Yes.

3 Q. And if you'll look at the outer ring of pin
4 names for the 16x16 version of the product, if we want
5 to look and see how many open pins are available to use
6 for purposes that aren't really taken up, am I correct
7 that we look for where it says "NC"?

8 A. Correct.

9 Q. And NC would be no-connect?

10 A. Correct.

11 Q. And do you agree that in this configuration as
12 shown in the Infineon data sheet for the 16x16 there is
13 one no-connect pin available?

14 A. That's correct.

15 Q. Okay. So if we were to add -- if we were to
16 use fixed pins to achieve the variable burst length and
17 the programmable variable CAS latency that you've
18 described, we would need to add two pins to that
19 configuration of this product or do something different
20 with the existing pins?

21 A. Well, your previous question was in the
22 simplest configuration. I can implement this function
23 with one pin.

24 Q. And that's by using different voltages?

25 A. Yes.

1 Q. By using four -- multiple voltages on a single
2 pin is in itself more complicated than simply having a
3 high and a low --

4 A. It's very simple to implement, but it is
5 slightly more complex to develop.

6 Q. Is that concept of multiple voltages in use in
7 any commercially available DRAM today?

8 A. I am not familiar with that.

9 Q. Okay. Earlier you said that in 1991 it was
10 your view that -- well, let me -- before I go to that,
11 let me ask you another question about the SDRAM
12 specification, if I might.

13 There was a time in 1992 when you felt that the
14 JEDEC specification was not sufficient to ensure
15 compatibility of parts from different manufacturers; is
16 that right?

17 A. Well, at that time different manufacturers had
18 somewhat different proposals relative to the standard
19 SDRAM specification, so we were concerned about the
20 conversions of these proposals into a single
21 specification.

22 Q. And this was at the time when you were at Sun?

23 A. Correct.

24 Q. And ultimately Sun began to purchase SDRAM
25 product; correct?

1 A. Yes.

2 Q. And was the product that Sun purchased, the
3 SDRAM product that Sun purchased, manufactured in
4 compliance with PC100 or PC133 specifications?

5 A. I believe so.

6 Q. And was it your understanding that those were
7 Intel specifications that Intel had developed because
8 they felt the JEDEC specifications weren't sufficient
9 to ensure interoperability?

10 MR. ROYALL: Objection, Your Honor. Lacks
11 foundation.

12 THE WITNESS: I was actually not familiar --

13 JUDGE McGUIRE: Just a minute, sir, until I
14 rule on the objection.

15 Sustained.

16 BY MR. STONE:

17 Q. Were you familiar with the development of a
18 specification for SDRAM by Intel?

19 A. I was not specifically familiar with that
20 effort.

21 Q. Did you have a general familiarity with it?

22 A. Well, I believe they needed to clarify the
23 specification for the personal computer market.

24 Q. And were the products -- if you know, were the
25 products that were purchased by Cisco, the SDRAM

1 products, in compliance with the Intel specification?

2 A. Well, I believe -- I should say I don't have
3 firsthand knowledge of this, but my understanding is --
4 my general understanding is that we're buying the --
5 we're purchasing the industry standard parts at Cisco
6 which are a subset of the Intel-defined category that
7 you mentioned.

8 Q. Okay. Let me ask you now about dual-edged
9 clocking and single data rate if I can.

10 In 1991, was it your view that the use of
11 single-edged clocking was much simpler than the use of
12 dual-edged clocking?

13 A. Yes, it was.

14 Q. And did there ever come a time when you felt
15 that it was necessary to go to dual-edged clocking?

16 A. Well, I personally still believe single-edged
17 clocking is a simpler overall approach; however, the
18 industry and JEDEC has chosen to use dual-edged
19 clocking.

20 Q. And do you know whether in connection with the
21 development of the DDR-II standard consideration was
22 given by the industry to using single-edged clocking?

23 A. I do not know.

24 Q. You were asked some questions earlier about
25 business models. And I think you described the Sun

1 business model as being built on an open standard; is
2 that right?

3 A. Correct.

4 Q. So that it was Sun's view that anyone who
5 wanted to manufacture products that were the same as
6 Sun's could do that?

7 A. Well, it's the same at the interface level. In
8 other words, the functional behavior was not of an open
9 protocol -- I'm sorry -- open standard was available to
10 others to implement. The implementation, how you
11 actually provided this function within the device or
12 the system, obviously would differ between different
13 manufacturers.

14 Q. Was JAVA developed by Sun?

15 A. Yes, it was.

16 Q. And was that perceived to be or intended to be
17 an open language, an open standard?

18 A. It was positioned to be an open but licensed
19 alternative, not alternative, an open licensed
20 language.

21 Q. So when we talk about something that is open
22 and licensed, that means it's available to companies so
23 long as they pay a license fee?

24 A. Yeah. I'm not familiar with the JAVA licensing
25 that Sun has deployed. This all happened after I left

1 there.

2 Q. You understood from your earliest meetings with
3 Rambus that their design was -- their business model
4 was one that intended to realize revenue through
5 royalties and license fees?

6 A. Correct.

7 Q. And that's a business model that you thought
8 had some flaws?

9 A. Yeah. I thought it would not be successful.

10 Q. And you thought they should instead be
11 manufacturing product?

12 A. No. That -- I didn't say that.

13 Q. What was the alternative? Did you have in mind
14 at the time -- I don't ask you to make it up now, but
15 did you at the time have in mind a business model they
16 should pursue?

17 A. No. I didn't have a recommendation for
18 Rambus.

19 Q. Okay. And you understood that the success of
20 their model depended on the ability to protect their
21 technology legally?

22 A. Of course.

23 Q. Did you expect that they would seek patents for
24 their technology?

25 A. Yes. That's what they represented.

1 Q. And did you expect that they would seek patents
2 that were as broad in their coverage as the patent
3 office thought was appropriate?

4 A. I'm not familiar --

5 MR. ROYALL: I object. Sorry.

6 Objection, Your Honor. Lacks foundation and
7 indeed I think calls for a legal conclusion.

8 JUDGE MCGUIRE: Sustained.

9 BY MR. STONE:

10 Q. Was it your understanding, at the time you met
11 with the Rambus representatives, that the patents that
12 you understood they would seek would cover as fully as
13 they could obtain coverage of the inventions they had
14 made?

15 MR. ROYALL: Same objections, Your Honor.

16 JUDGE MCGUIRE: Well, also sustained.

17 BY MR. STONE:

18 Q. I'm asking you just about your understanding,
19 Mr. Bechtelsheim.

20 When you understood from Rambus that you
21 thought they would obtain patents, what did you
22 understand the patents would cover?

23 A. My understanding was that they would cover the
24 Rambus DRAM.

25 Q. To the extent they had invented it?

1 A. To the extent -- I mean, as I said earlier,
2 I've not seen the patents, but my understanding, that
3 is what they were protecting.

4 Q. And you got patents yourself by this time?

5 A. Excuse me?

6 Q. You had obtained patents yourself by this time?

7 A. Yes, I have.

8 Q. And you understood that you're entitled to
9 claim what you invent but not something that you didn't
10 invent; correct?

11 A. Well, I'm not a lawyer, so I don't think I can
12 have a legal conclusion.

13 Q. And I'm not -- I'm trying to explore your
14 understanding, not any legal conclusions, if you have
15 an understanding.

16 JUDGE MCGUIRE: I think that goes, counselor,
17 without saying. That you can't claim something you
18 haven't invented.

19 MR. STONE: Fine, Your Honor.

20 JUDGE MCGUIRE: Now, the court takes notice of
21 that point.

22 BY MR. STONE:

23 Q. Did you have any understanding from your
24 conversations with Rambus that they did not intend to
25 claim patent coverage for those things that they had

1 invented?

2 A. Can you repeat the question?

3 Q. Certainly.

4 Did you have any understanding that Rambus
5 inventors were not going to claim patent coverage for
6 all that they had invented?

7 MR. ROYALL: Objection, Your Honor. Lacks
8 foundation.

9 JUDGE McGUIRE: Overruled. I think he can
10 answer that question.

11 THE WITNESS: As I said earlier, I have never
12 seen the Rambus patents, so I am not sure what
13 patent -- what you're referring to when you say what
14 Rambus has invented. So I'm not sure I can answer your
15 question since I don't know any of their patents.

16 BY MR. STONE:

17 Q. In your conversations with them, did they ever
18 say to you, We're not going to get some of the patents
19 that we would be entitled to in our view, or words to
20 that effect?

21 A. I don't recall them having said any such
22 thing.

23 Q. Okay. In your experience, there are business
24 models in the computer industry that are not built on
25 open standards that have been successful, aren't

1 there?

2 A. Correct.

3 Q. So it's not a necessary condition of success
4 that you share your commitment to open standards;
5 correct?

6 A. No. I didn't say that.

7 Q. Okay. Let me see if I can rephrase it.

8 Is it a necessary condition to success in a
9 business sense that you engage in a commitment to open
10 standards as you have discussed today?

11 A. I never represented that.

12 Q. Okay. You talked earlier about road maps that
13 you were shown by memory manufacturers; correct?

14 A. Yes.

15 Q. And would they show you those road maps in
16 written form?

17 A. Typically in PowerPoint presentations.

18 Q. Would they sometimes leave copies with you or
19 just show them and not leave copies?

20 A. They would typically leave copies.

21 Q. And would those road maps generally reflect
22 expectations in terms of price and volume over time?

23 A. Some of -- primarily the road maps referred to
24 specific device developments they were planning to
25 undertake. In some cases there was a discussion of

1 expected price premiums for certain technologies over
2 others.

3 Q. And did you see road maps which included
4 reference to price premiums for RDRAM?

5 A. I do not recall having seen such road maps in
6 written form, but there were certainly discussion of a
7 price premium for RDRAM, yes.

8 Q. And did you also see either in PowerPoint
9 presentations or written materials that you were given
10 road maps that showed die size predictions for RDRAM?

11 MR. ROYALL: Your Honor, could I just ask for
12 clarification as to the time frame that we're focusing
13 on here?

14 JUDGE MCGUIRE: Mr. Stone?

15 BY MR. STONE:

16 Q. What was the time period -- earlier today you
17 were asked about seeing memory road maps. Do you
18 recall that?

19 A. I was referring primarily to my tenure at Sun.

20 Q. Then referring to your tenure at Sun, did you
21 see road maps at that time that indicated die size
22 differences for RDRAM?

23 A. I seem to recall that people were unwilling to
24 put those in written form, but there was certainly
25 discussion of the projected die area premiums for

1 different technologies.

2 Q. And was it important in your consideration at
3 that time this information you got from manufacturers
4 as to die size and predicted price?

5 A. Yes, it was.

6 Q. And if they had predicted to you that the die
7 size differential for RDRAM as compared to DDR was less
8 than 5 percent, would that have been a significant
9 factor?

10 MR. ROYALL: Your Honor, I object. It calls
11 for speculation and I don't believe there's any
12 evidence in the record that he considered DDR while at
13 Sun.

14 JUDGE MCGUIRE: Sustained.

15 BY MR. STONE:

16 Q. If they had shown you a comparison between the
17 die size for SDRAM and RDRAM and if the differential
18 was under 5 percent, would that have been of
19 significance to you at the time?

20 A. It would have been. In my recollection, it was
21 much larger than 5 percent, but I do not recall the
22 specific percentage today.

23 Q. And if they had shown you pricing comparisons
24 which indicated that the price they expected to charge
25 for RDRAM would be within 5 percent of the price they

1 expected to charge for SDRAM, would that have been
2 significant to you?

3 A. That would also have been interesting, but it
4 never happened. The only company that was projecting a
5 modest price premium for the Rambus memory was Rambus
6 itself. There was never a time I recall the
7 manufacturer of the components was projecting the same
8 kind of premiums.

9 Q. And do you know whether what they were
10 projecting in terms of die size differential and cost
11 differential to you was the same thing that they were
12 projecting internally?

13 A. I have no -- I cannot testify because I don't
14 know what they projected internally, no.

15 Q. Have you ever attended an Intel Developers
16 Forum?

17 A. I have in the past, yes.

18 Q. And from time to time at Intel Developer
19 Forums, have you seen projections of die size
20 differential and cost differential between RDRAM and
21 other products?

22 A. I don't recall attending a meeting of the
23 Intel Developer Forum that discussed that subject.

24 Q. Have you seen that that's been on the agenda of
25 those forums when you've been in attendance?

1 A. I believe Intel made a projection or made a --
2 attempted to set an expectation what this premium
3 should be, but again, Intel was not a manufacturer of
4 DRAM at that time, so their projection didn't have a
5 lot of credibility.

6 Q. And earlier today, you told us that if the
7 volume of DRAM becomes quite high you expect the price
8 to go down; correct?

9 A. Yeah. The price is very much volume driven.
10 That is correct.

11 Q. So if the volume of RDRAM had become much
12 higher than the volume of either SDRAM or DDR, would
13 you expect that would have changed the price
14 relationship between those products?

15 A. Yes. I would have expected that the price
16 premium would have declined if that had happened.

17 Q. If RDRAM had become a commodity DRAM at a
18 price similar to the price today for DDR, would you
19 have objections to RDRAM being the memory product
20 utilized in Sun or Cisco products that you're
21 responsible for?

22 A. Yes, I would.

23 Q. And that's because you thought technically it
24 was not as simple?

25 A. Based on my own analysis, the performance was

1 slower or worse than commodity DRAM and it was much
2 more difficult to use at a higher power consumption.
3 It had all kinds of qualification issues. And there
4 was a litany of problems that I saw.

5 Q. So even if it was at the same price, you would
6 still choose a different product?

7 A. It would have -- okay. Let me restate exactly
8 what I said in my earlier testimony.

9 If Rambus had been able to demonstrate a
10 significant performance advantage, that would have been
11 a consideration. However, given my own analysis, there
12 was no performance advantage at all, and the price was
13 higher. Even at the same price I would have not
14 considered it.

15 Q. And would there be a point in time at which if
16 the price were lower you would have considered it?

17 A. If the price had been lower, that would have
18 been an interesting outcome. I didn't see how that
19 would have happened, but that would have been a
20 consideration that would be worth making because then
21 you would trade a lower performance at a lower price
22 point.

23 Q. And that's something that you do all the time
24 is try to compare price and performance; correct?

25 A. Correct.

1 MR. ROYALL: Could I note for the court
2 reporter that we're having difficulty with the
3 real-time.

4 JUDGE McGUIRE: Let's go off the record for a
5 moment.

6 (Discussion off the record.)

7 JUDGE McGUIRE: Mr. Stone, you may proceed.

8 MR. STONE: Thank you, Your Honor.

9 BY MR. STONE:

10 Q. In the last couple of years that you were at
11 Sun, did any memory manufacturer talk with you about
12 what they understood or believed Rambus' patents to
13 cover?

14 A. No, they did not.

15 Q. And after you went over to Cisco, in the first
16 few years you were there, end of -- I guess starting
17 in '96, '97, '98, did any memory manufacturers tell you
18 their views or beliefs about the scope of Rambus'
19 patent coverage?

20 A. Not in that time.

21 Q. I want to ask you one specific question about
22 it to see if I can jog your recollection at all.

23 In 1997, were you having conversations with
24 people at Micron?

25 A. It's quite possible, yes.

1 Q. Did anyone at Micron in 1997 tell you that it
2 was their understanding that Rambus patents covered
3 dual-edged clocking in whatever type of DRAM you put it
4 in?

5 A. I don't recall that conversation.

6 Q. Okay. When you changed the interface on a
7 DRAM, I think you talked a little bit today about what
8 changes that necessitates; correct?

9 A. Yes.

10 Q. When you made a change from SDRAM to DDR, did
11 that cause some changes to be made in the motherboard?

12 A. It requires a new memory controller in the
13 motherboard, yes.

14 Q. Does it also require a new chipset or do you
15 include that --

16 A. That's what I call a memory controller,
17 chipset.

18 Q. And when you told us it was important for
19 things to be backward compatible, what does "backward
20 compatible" mean as you used it earlier today?

21 A. Well, that relates to being able to plug a
22 next-generation technology into an existing socket.

23 Q. And can you plug DDR into an SDRAM socket?

24 A. You cannot.

25 Q. Are there examples in the DRAM field of

1 products that are backward compatible, as you've
2 defined it?

3 A. Of course.

4 Q. What are those?

5 A. Well, for every product family, for example,
6 synchronous DRAM, there have been a multiplicity of
7 standards like you referred to earlier, PC100, PC133,
8 which are, generally speaking, backwards compatible.
9 This means you can take a PC133 and plug it into a
10 PC100 socket.

11 Q. And hasn't it been true that, for example --
12 you're aware of PC266?

13 A. Yes.

14 Q. You can't plug a PC266 into a PC100 socket, can
15 you?

16 A. Yeah, in some respects this backward
17 compatibility was not met.

18 Q. So the only instances you're aware of of
19 backward compatibility are within a particular family
20 of DRAM?

21 A. Correct.

22 Q. And in some instances, as I just pointed out to
23 you, even within that family it's not backward
24 compatible?

25 A. Yes.

1 Q. And the cost of the changes when you go from
2 SDRAM to DDR -- you talked earlier today with
3 Mr. Royall about 500,000 to a million dollars and
4 engineers and opportunity costs -- those are the costs
5 that are incurred then as well; right?

6 A. Correct.

7 Q. And when you went to SDRAM from EDO at Sun, did
8 you incur those same costs, maybe lower because it
9 was --

10 A. Lower at the time but in general the same kind
11 of costs.

12 Q. Okay. In the development of products at Sun,
13 was the general time to develop a product at Sun two to
14 three years?

15 A. Yes, it was.

16 Q. And one of the things in developing a product
17 you would do is you'd meet with various other
18 manufacturers to see their road maps; correct?

19 A. Correct.

20 Q. That wasn't limited to just memory, was it; you
21 would look at other components as well?

22 A. Yes.

23 Q. Did, at any point in time when you were at Sun,
24 did the memory manufacturers in showing you their road
25 maps ever show you anything on their road map other

1 than EDO SDRAM and DDR?

2 A. I don't recall DDR while I was at Sun. So that
3 may have been at the very end of my tenure there but
4 more likely not yet. There was some other exotic
5 memory technologies that some had proposed, but they
6 didn't get main coverage, so I don't recall their names
7 of them, but there were some other exotic techniques
8 people had.

9 Q. And either at Sun or at Cisco, did anyone ever
10 propose to you SLDRAM on their road map?

11 A. Well, that was one of the technologies I was
12 referring to in the SyncLink. There was other
13 consortiums trying to develop interface standards, but
14 typically they would not have the background or the
15 credibility to actually deliver such a standard in a
16 successful fashion.

17 Q. And were you familiar with who the -- who
18 comprised the SLDRAM consortium?

19 A. Not today. But I was at that time. And
20 again, it was a group of -- it wasn't clear to me at
21 the time what problem they were exactly trying to
22 solve.

23 Q. And did they share with you what problem they
24 were trying to solve?

25 A. Well, they actually explained it, but it didn't

1 make any sense to me, so...

2 Q. Okay. I'm correct, aren't I, that Cisco today
3 uses products which are not JEDEC standardized?

4 A. Yeah, I'm actually not the expert of which
5 chips we're using that is either standardized or not,
6 but I will assume there are some components that are
7 not formally standardized to JEDEC.

8 Q. You were asked by Mr. Royall about RLD RAM. Do
9 you recall?

10 A. Yes.

11 Q. And so far as you know, that's not a JEDEC
12 standardized product, is it?

13 A. Not currently. I believe it was presented at
14 JEDEC, but I do not know the level of standardization
15 that it achieved.

16 Q. And was the other product -- is it FCD RAM or
17 FCRAM?

18 A. It's actually FCRAM. Fast cycle RAM.

19 Q. And is FCRAM, so far as you know, standardized
20 at JEDEC?

21 A. I'm not familiar with that.

22 Q. Does FCRAM use different interfaces?

23 A. Yes, it does.

24 Q. And the design of FCRAM that makes it unique or
25 different is the memory core?

1 A. Both the core -- well, the interface is similar
2 to conventional SDRAM, but the core is substantially
3 different.

4 Q. And you were involved, were you not, in helping
5 come up with the initial specifications for both of
6 those products?

7 A. Yes, I was.

8 Q. And you began work on that in 1999; is that
9 right?

10 A. Or earlier. I think it was as early
11 as '98. '98-99.

12 Q. Were the specifications of FCRAM worked on
13 before you turned to RLDRAM?

14 A. Yes.

15 Q. And let me just show you a document. You saw
16 this at your deposition I think. It's RX-1380.

17 May I approach, Your Honor?

18 JUDGE McGUIRE: Yes.

19 BY MR. STONE:

20 Q. And directing your attention just to the top
21 part of this document, the to, from, subject, and so
22 on, do you recognize the names here?

23 A. Yes.

24 Q. And does this relate -- then go down and pick
25 up the first paragraph, if you would, of the document.

1 Sorry.

2 And does this document refer to your work in
3 connection with developing the specifications for
4 FCRAM?

5 A. Correct.

6 Q. Using the time we looked at earlier -- the date
7 of this February 10, 1999 -- does that help you at all
8 in placing the time period when you were working on the
9 specifications for FCRAM?

10 A. Yes. So I had contact with Fujitsu around this
11 time and I think actually sometime prior to this
12 meeting or this record.

13 Q. So with this document, RX-1380, to help jog
14 your memory, if it does, is it your testimony that you
15 began work on specifying the FCRAM in late '98 and
16 continued on into '99?

17 A. Correct.

18 Q. And then you started on RLDRAM sometime later?

19 A. Yes.

20 Q. One of the interfaces that is used with FCRAM
21 is the SDRAM interface, isn't it?

22 A. It uses an SDRAM-style interface, yes.

23 Q. And it can also use a DDR-style interface?

24 A. Correct.

25 Q. Did you, in specifying the design of FCRAM,

1 propose that programmable CAS latency not be included?

2 A. I don't recall that topic today, but my general
3 recollection is that we tried to focus on a
4 high-performance mode of the device which would only be
5 achieved at the highest clock rate, and thus the need
6 for programmability of CAS latency went away.

7 So in other words, what I was looking for was a
8 higher-performance specification that did not require
9 this variable CAS latency.

10 Q. So if at the time you -- if at the time in
11 1998 and 1999 that you were working on the
12 specifications for FCRAM you had wanted to design it
13 with fixed CAS latency, you could have?

14 A. I believe so.

15 Q. And could you also at that time have designed
16 it with fixed burst length?

17 A. Correct.

18 Q. Was any effort made to do either of those two
19 things?

20 A. I don't recall.

21 One thing is that the FCRAM had an existing
22 prototype specification when I got involved with it, so
23 then I provided the feedback to the vendor on their
24 proposal at that time. It was not my original work.

25 Q. And it was later in time then, it was 1999 or

1 2000, was it not, when you got involved in helping
2 specify RLDRAM?

3 A. Correct.

4 Q. And part of your work on specifying RLDRAM
5 occurred after you had seen the article in EETimes
6 about Rambus' lawsuit?

7 A. I am not certain of the timing. I think most
8 of the interaction was prior to that. In any event, I
9 did not correlate the Rambus lawsuit with the RLDRAM in
10 my memory.

11 Q. And in working on RLDRAM, you worked with
12 people at Infineon and then later with people at
13 Micron?

14 A. Correct.

15 Q. And did any of them ever say to you that their
16 understanding was that the RLDRAM specifications that
17 you were helping develop were going to lead to a
18 product that infringed on Rambus patents?

19 A. No.

20 Q. Even though -- I'm correct, am I not, that
21 RLDRAM has programmable CAS latency?

22 A. I believe so, yes.

23 Q. And it has programmable burst length?

24 A. Yes.

25 Q. And it uses dual-edged clocking?

1 A. Correct.

2 Q. And the RLDRAM II that is proposed will also
3 have a PLL, will it not?

4 A. Yeah, I'm not current on that specification.

5 Q. At any point in time did anyone from Micron or
6 Infineon say to you that based on their understanding
7 of the Rambus patents, the RLDRAM that they were
8 providing to you at Cisco might infringe on Rambus'
9 patents?

10 A. I never heard that comment.

11 Q. Even as of today?

12 A. Even as of today, yes.

13 Q. Okay. And is the same true for FCRAM, that no
14 one at Toshiba or Fujitsu, or whatever the current name
15 of their corporate entities are, shared with you that
16 that product might infringe on Rambus patents?

17 A. Correct.

18 Q. This morning, a couple minutes before
19 10:00 a.m., you said there's a number of suppliers
20 which are fiercely competing for the memory business
21 and the cost or prices for memories in the market
22 behave very much like a commodity-type market.

23 Do you recall that testimony?

24 A. Correct.

25 Q. Have you investigated the pricing of DRAM to

1 determine whether that statement is correct?

2 A. Well, I'm familiar with the profits and losses
3 of some of our suppliers that are public companies that
4 are losing money manufacturing DRAM, so I'm somewhat
5 familiar with the fact that it has been a very
6 challenging business environment for them to sell these
7 parts at a profit.

8 Q. Some years they've been very profitable and
9 some years they haven't?

10 A. Correct. And I was going to say in some years
11 the profitability was quite positive and more recently
12 was essentially a loss.

13 Q. And the years in which they were most
14 profitable were the years in which their prices were
15 the highest I take it?

16 A. Correct.

17 Q. Have you made any investigation to determine
18 whether prices either when they were high or when they
19 were low were the result of what you called fierce
20 competition?

21 A. My general understanding is that it is in fact
22 a supply-and-demand situation where the fixed cost they
23 have in their plants, in the manufacturing plants, is
24 so large that they have to run these plants at as high
25 a capacity as possible to achieve a positive return on

1 investment and that is only possible if they can in
2 fact fill up the plant.

3 So the competition is really to both have
4 sufficient capacity but then have enough customers to
5 fully utilize the plant investment that has been made.

6 Q. And my question was a little bit beyond that,
7 which is, have you made an investigation to determine
8 whether the prices that they charge are the result of
9 competition or, for example, collusion?

10 MR. ROYALL: Your Honor, I object to this line
11 of questioning.

12 JUDGE McGUIRE: Sustained.

13 MR. ROYALL: On relevance grounds.

14 MR. STONE: Your Honor, may I be heard, because
15 this goes to the heart of one of the issues.

16 Mr. Royall brought out this morning, asked a
17 question that directly intended to elicit from this
18 witness his testimony that the price of DRAM was the
19 result of fierce competition.

20 Now, either that issue is in the case, in which
21 case we should be permitted to explore it, or it's not
22 in the case. But complaint counsel brought it out from
23 this witness, and this witness I think on
24 cross-examination is going to concede that he doesn't
25 know whether that's true or not.

1 JUDGE McGUIRE: Mr. Royall?

2 MR. ROYALL: Well, first of all, it simply is
3 not true, as Mr. Stone has now represented to you, that
4 I asked a question deliberately intended to elicit such
5 testimony. All he's referring to is an answer that was
6 given earlier where the witness referred to this being
7 a commodity product and he referred to competition. I
8 did not deliberately intend to elicit any such
9 testimony.

10 And I think this is very --

11 JUDGE McGUIRE: We can always go back and
12 check in fact what the testimony was if you can't
13 agree.

14 MR. STONE: I can pull it up, Your Honor.

15 JUDGE McGUIRE: All right.

16 MR. STONE: The question was, first, "Is there
17 a reason why Sun did not choose to design a proprietary
18 memory?"

19 "ANSWER: Well, design of memory is a very
20 complicated, difficult, complicated task and the
21 challenge is to arrive at the most cost-effective
22 design. The system memory market is known to be a very
23 cost-competitive commodity-type market."

24 The question then was: "When you use the term
25 'commodity' in reference to memory, what specifically

1 are you referring to?"

2 And he says, "Well, the nature of the memory
3 market is that there's a number of suppliers which are
4 fiercely competing for the memory business and the cost
5 or prices for memories in the market behave very much
6 like a commodity-type market."

7 So having heard that it was first a very
8 cost-competitive commodity-type market, he then went on
9 and asked, on page 23 of the rough, he then went on and
10 asked, Tell us exactly what "commodity" means. At that
11 point having heard that it was cost at issue, he had to
12 know the testimony he was going to elicit. If he had
13 thought the answer was not responsive to his question,
14 he could have moved to strike.

15 JUDGE McGUIRE: What's the question you have
16 now?

17 MR. STONE: The question I want to ask is
18 whether he has any basis in fact for his statement
19 that it's a fiercely competitive market, and I want to
20 ask him whether he's aware of certain things. Because
21 I --

22 JUDGE McGUIRE: When you say "certain things,"
23 that's probably at the heart of the objection. I will
24 allow you to go into his personal knowledge as to the
25 competitive market.

1 MR. STONE: I will be brief, I can assure you.

2 JUDGE McGUIRE: And if we have any other
3 opposition to the questions -- and at this point I'm
4 not sure where he's going -- then I'll entertain them
5 at that time.

6 So at this point you may proceed on that
7 point.

8 MR. STONE: Thank you, Your Honor.

9 MR. ROYALL: Could I make a brief statement,
10 Your Honor?

11 JUDGE McGUIRE: Go ahead.

12 MR. ROYALL: I believe that what Mr. Stone has
13 done has just demonstrated that what I said is true,
14 that his earlier representation as to me deliberately
15 eliciting such testimony is not true. All I asked is
16 what he meant by a commodity.

17 JUDGE McGUIRE: All right. Statement noted.

18 All right. Go ahead, Mr. Stone.

19 BY MR. STONE:

20 Q. With that argument, Mr. Bechtelsheim, you sort
21 of know where I'm going with my question, so let me try
22 to jump ahead.

23 Do you have -- and I asked you whether you've
24 done any investigation, but let me put it differently.

25 Have you taken into account in the statement

1 you made today about it being fiercely competitive,
2 have you taken into account reports, which I'm sure
3 you've seen in the press, of Department of Justice
4 allegations of price-fixing among the DRAM
5 manufacturers?

6 A. No, I have not.

7 Q. Have you, in coming to the statements you made
8 earlier today, taken into account the fact that private
9 class actions have been filed of which you're a class
10 member challenge -- go ahead.

11 MR. ROYALL: Are you finished?

12 MR. STONE: No.

13 JUDGE McGUIRE: Go ahead and finish your
14 question.

15 BY MR. STONE:

16 Q. -- challenging the pricing of DRAM by DRAM
17 manufacturers?

18 MR. ROYALL: Objection, Your Honor. Assumes
19 facts not in evidence. Lacks foundation. And again,
20 this entire line of questioning I submit has not been
21 established as relevant.

22 JUDGE McGUIRE: Sustained on that one,
23 Mr. Stone.

24 BY MR. STONE:

25 Q. Would it be relevant to you in determining

1 whether or not there is what you referred to as fierce
2 competition, would it be relevant to you to know
3 whether or not the DRAM manufacturers had in fact
4 agreed on prices to be charged?

5 MR. ROYALL: Your Honor, I would ask for
6 clarification. I object on vagueness grounds.
7 Relevant for what purpose?

8 MR. STONE:

9 Q. Let me rephrase.

10 If I showed you evidence that the memory
11 manufacturers had agreed on prices to be charged, would
12 that be consistent with your statement that they are
13 fiercely competing on price?

14 MR. ROYALL: Again, Your Honor, I object on
15 relevance grounds. Assumes facts not in evidence.
16 Again, lacks foundation.

17 JUDGE MCGUIRE: I'm going to let him -- if you
18 have an answer to that question, you may answer it.

19 THE WITNESS: In which time frame are you
20 referring to?

21 BY MR. STONE:

22 Q. Well, in any time frame that you felt there was
23 fierce competition on price, if I was able to show you
24 that the prices being charged were the result of
25 agreement among the manufacturers, would you still

1 consider that to be fierce competition?

2 A. Well, there were certainly time frames in
3 history where memory prices seemed artificially high.
4 More recently, I would claim that memory prices are
5 very competitive and there is in fact fierce
6 competition in the market where virtually no
7 manufacturer is returning a reasonable profit on their
8 fab investment.

9 Q. And help us when you say there was a point in
10 time when the prices seemed -- is it unusually high?
11 Whatever word you used -- can you give us the years
12 when that seems to you to have been the case?

13 A. I cannot give you the years today, but it
14 seemed to me that there was in fact a demand-and-supply
15 curve where manufacturers were literally not able to
16 make new investments in plant capacity while prices
17 were low, only then to face essentially a shortage on
18 plant capacity when demand was higher, at which point
19 they then invested in new plants and which then led to
20 an overcapacity situation.

21 So I'm not familiar with any of the
22 price-fixing issues you referred to earlier, but I do
23 believe there's an economic cycle to the memory
24 business.

25 MR. ROYALL: Your Honor, I would just say that

1 I understand that you've allowed this line of
2 questioning, but I do continue to object on relevance
3 grounds if he intends to go any further.

4 JUDGE McGUIRE: I allowed that question. I'm
5 not sure I'll allow the entire line of questioning.

6 MR. STONE: I understand, Your Honor.

7 BY MR. STONE:

8 Q. With respect to RDRAM prices, may I ask you
9 about that.

10 Did you make any determination at any point in
11 time as to whether the prices at which RDRAM was being
12 sold were the result of competition or other factors?

13 A. There was a sufficiently large number of
14 DRAM -- RDRAM suppliers that my assumption at that time
15 was that prices would be somewhat competitive; however,
16 I don't have an independent investigation of whether
17 that was true or not, so my assumption was based on the
18 number of suppliers that licensed the Rambus
19 technology.

20 Q. And were the prices that were actually being
21 charged by those number of suppliers the prices you
22 expected or were they higher or lower?

23 A. Well, at Sun we never purchased RDRAM, so I'm
24 not familiar with actual prices in the market.
25 However, the prices that were quoted to Sun were

1 substantially higher than synchronous DRAM or commodity
2 DRAM, for example.

3 MR. STONE: Thank you. I have no further
4 questions, Your Honor.

5 JUDGE McGUIRE: Okay. Mr. Royall?

6 MR. ROYALL: Your Honor, I have no further
7 questions for the witness.

8 JUDGE McGUIRE: Okay. Then, sir, thank you
9 very much for your testimony today. You're excused
10 from this proceeding.

11 Counsel, I'm going to suggest that we take a
12 break today and call it a day. I've got some other
13 issues I have to tend to in the office, so we will
14 convene tomorrow morning at 9:30.

15 MR. STONE: Before we go off the record, could
16 I just move in three exhibits?

17 JUDGE McGUIRE: Go ahead.

18 MR. STONE: CX-2838.

19 JUDGE McGUIRE: Objection?

20 MR. ROYALL: I'm sorry, Your Honor. I'm not
21 sure I have that in hand. Which one was that?

22 MR. STONE: I just want to do it before if I
23 can have this one minute before we lose -- it's the --
24 this one, the letter and the further specification of
25 SDRAM. It's on the screen.

1 MR. ROYALL: Your Honor, if I could have
2 overnight to consider that. As you may recall, there
3 were portions of this document that were not identified
4 by the witness. It was -- Mr. Stone did identify that
5 this was a mix of documents.

6 MR. STONE: No, no. Maybe I misspoke or it was
7 misheard. If I need to clarify with the witness,
8 that's fine. I wanted to move it in before he leaves,
9 if I could.

10 The pages are simply out of order on that
11 document, and so you can tell by the pages that are
12 numbered that they go together, but the cover page got
13 stuck at about page 5.

14 JUDGE MCGUIRE: Then let's take a minute and
15 get it straight so we don't have to go back --

16 MR. STONE: I thought the witness' testimony
17 was after he looked at it that CX-2838 was the -- he
18 recognized it to be the Sun specification with the
19 cover letter that we had looked at.

20 MR. ROYALL: And this is the reason that I had
21 asked for clarification as to Bates numbers because I
22 understood that that Sun specification started on Bates
23 number 46094, and I don't know that you established
24 that the earlier pages were part of the same
25 specification.

1 MR. STONE: I thought I had because I asked him
2 with the exception of page 5 of the document.

3 JUDGE McGUIRE: That's my recall of the
4 question. Other than page 5 is I think --

5 MR. STONE: But I don't want to -- I mean, if
6 the witness thinks there's any page in that document
7 that isn't part of it, I want to take it out.

8 MR. ROYALL: Your Honor, I've had just in this
9 last few moments a chance to look at it and I don't
10 think I have an objection.

11 JUDGE McGUIRE: So entered.

12 (CX Exhibit Number 2838 was admitted into
13 evidence.)

14 MR. STONE: Then CX-2405, the Infineon data
15 sheet.

16 MR. ROYALL: No objection.

17 JUDGE McGUIRE: Entered.

18 (CX Exhibit Number 2405 was admitted into
19 evidence.)

20 MR. STONE: And then RX-143, the notes from
21 Willi Meyer to JEDEC members showing they were
22 addressed to Bolo Cannataro.

23 MR. ROYALL: No objection.

24 JUDGE McGUIRE: All right. Entered.

25

1 (RX Exhibit Number 143 was admitted into
2 evidence.)

3 MR. STONE: Thank you, Your Honor.

4 JUDGE McGUIRE: All right. This hearing is
5 adjourned until 9:30 tomorrow morning.

6 (Time noted: 4:38 p.m.)

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1 C E R T I F I C A T I O N O F R E P O R T E R

2 DOCKET NUMBER: 9302

3 CASE TITLE: RAMBUS, INC.

4 DATE: June 18, 2003

5

6 I HEREBY CERTIFY that the transcript contained
7 herein is a full and accurate transcript of the notes
8 taken by me at the hearing on the above cause before
9 the FEDERAL TRADE COMMISSION to the best of my
10 knowledge and belief.

11

12 DATED: June 18, 2003

13

14

15

16 JOSETT F. HALL, RMR-CRR

17

18 C E R T I F I C A T I O N O F P R O O F R E A D E R

19

20 I HEREBY CERTIFY that I proofread the
21 transcript for accuracy in spelling, hyphenation,
22 punctuation and format.

23

24

25 DIANE QUADE

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