

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PELOTON INTERACTIVE, INC.,
Petitioner,

v.

NEC CORPORATION,
Patent Owner.

Case IPR2023-01239
U.S. Patent No. 8,752,101

PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE

TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	CLAIM CONSTRUCTION	2
A.	“ <i>Based On</i> ” Merely Requires that “Remaining Time” and “Available Time” have <i>Some</i> Influence in Determining Code Rate.....	3
B.	The Intrinsic Record Does Not Warrant “Examining” or “Calculating” Values that are “Directly Used to ‘Determine the Code Rate’”	5
III.	CHOU DISCLOSES LIMITATON 1(d).....	6
A.	Chou Discloses Determining Code Rate Based On an “Available Time.	6
1.	Chou’s “Client Buffer Duration” is Available Time, and Chou Determines Code Rate Based On That Time.	6
2.	The Board did not Equate “Target Buffer Duration” with Available Time.....	9
3.	NEC’s Focus on Equation 18 is Misplaced, But also Neglects Chou’s Broader Disclosure Regarding Code Rate Determination.	10
4.	Petitioner’s Available Time Accounts for Chou’s “One Frame Delay.”	16
B.	Chou Discloses Determining Code Rate Based On a Remaining Time.....	18
1.	Chou Discloses a Remaining Time, and Determines Code Rate Based On That Time.....	19
2.	Petitioner did not Map Remaining Time to Chou’s “Target Buffer Duration.”	20
3.	Chou’s Equations Confirm that Its Code Rate Determination is Based On Remaining Time.	21

C.	NEC's Other Arguments Regarding Chou are Equally Meritless	23
1.	NEC's Exemplary Table Confirms Peloton's Identification of Remaining Time and Available Time.....	23
2.	NEC Mischaracterizes the Board's Analysis Regarding Chou's Fast Startup Technique.....	26
3.	NEC's Arguments Regarding Dropped Frames is Irrelevant.	26
IV.	DR. READER'S OPINIONS ARE RELIABLE	27

EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No. 8,752,101 B2 (“the ’101 patent”)
1002	File History of U.S. Patent No. 8,752,101 B2 (U.S. Application No. 13/508,025) (“’101 FH”)
1003	Lee, Chiang, and Zhang, <i>Scalable Rate Control For MPEG-4 Video</i> , IEEE Transactions on Circuits and Systems for Video Technology, Vol. 10, No. 6, pp. 878 – 894 (Sept. 2000)
1004	U.S. Publication No. US 2006/0143678 A1 (“Chou”)
1005	File History of corresponding European Patent No. 2498492
1006	SEALED Revised Dr. Clifford Reader Declaration (“Reader Decl.”)
1007	International Publication No. WO 2006/108435 (“Kampmann”)
1008	Japanese Unexamined Patent Application Publication No. 2005-191786
1009	Japanese Unexamined Patent Application Publication No. 2007-13705
1010	U.S. Patent No. 8,909,809 (the ’809 patent”)
1011	Japanese Unexamined Patent Application Publication No. 2004-172830
1012	Certified English Translation of Japanese Unexamined Patent Application Publication No. 2004-172830
1013	Certified English Translation of Japanese Unexamined Patent Application Publication No. 2005-191786
1014	Certified English Translation of Japanese Unexamined Patent Application Publication No. 2007-13705
1015	Kozamernik, <i>Webcasting - The Broadcasters’ Perspective</i> , EBU Technical Review (Mar. 2000) (“Kozamernik”)
1016	U.S. Patent No. 7,606,928 (“Wang”)
1017	U.S. Patent No. US 6,637,031 B1 (“Chou ’031”)
1018	Cen, Pu, and Walpole, <i>Flow and Congestion Control for Internet Streaming Applications</i> , Multimedia Computing and Networking (1998)
1019	Lu, <i>Signal Processing for Internet Video Streaming: A Review</i> , Proceedings of SPIE, Vol. 3947, p. 246-259 (Jan. 2000) (“Lu”)
1020	Haskell, Puri, and Netravali, <i>Digital Video: An Introduction to MPEG-2</i> , ch. 8, pp. 156-182 (“Haskell”)
1021	ITU H.262 (07/95)

Exhibit No.	Description
1022	Ebrahimi, <i>MPEG-4 natural video coding – An overview</i> , Signal Processing: Image Communication, Vol. 15, Issue 4-5, pp. 365-385 (Jan. 2000) (“Ebrahimi”)
1023	ITU H.261 (03/93)
1024	ITU H.222.0 (07/95)
1025	Rui, <i>An Overview of MPEG-2</i> , The 1997 Digital Video Test Symposium
1026	Huang, Chou, Klemets, <i>Optimal Coding Rate Control for Scalable Streaming Media</i> (“Huang”)
1027	U.S. Publication No. US 2004/0128396 A1 (“Patrick”)
1028	U.S. Patent No. US 7,711,841 B2 (“Desphande”)
1029	van Beek and Demircin, <i>Delay-Constrained Rate Adaptation for Robust Video Transmission Over Home Networks</i> , IEEE International Conference, Vol. 2, (“van Beek”)
1030	U.S. Patent No. 5,822,524 (“Chen”)
1031	SEALED NEC’s Infringement Contentions served in <i>NEC Corp. v. Peloton Interactive, Inc.</i> , No. 1:22-cv-00987-CFC (D. Del., filed July 28, 2022)
1032	Reader C., <i>Intraframe and Interframe Adaptive Transform Coding</i> , SPIE Vol. 66 (1975)
1033	Reader C, “MPEG4: Coding for Content, Interactivity, and Universal Accessibility”, Optical Engineering, Vol. 35, No. 1, pp. 104-108 (Jan. 1996)
1034	“MPEG Video Compression Standard”, Edited by J. L. Mitchell et al, Chapter 16, “MPEG Patents”, pp.357-362
1035	Proposal and Consideration of Buffer Size, NTT, KDD, NEC, Fujitsu, CCITT SG IV Working Party XV/1 Specialist Group on coding for Visual Telephony, Doc. #287 (Jan. 1988)
1036	Scheduling Order filed on March 20, 2023 in <i>NEC Corp. v. Peloton Interactive, Inc.</i> , No. 1:22-cv-00987-CFC (D. Del., filed July 28, 2022)
1037	REDACTED PUBLIC version of revised Reader Declaration
1038	U.S. Patent No. 5,867,230 (“Wang ’230”)
1039	Declaration of Michael J. Hopkins (Oct. 31, 2023)
1040	Supplemental Declaration of Dr. Clifford Reader
1041	Jeremy Cooperstock Deposition Transcript (Aug. 22, 2024)

I. INTRODUCTION

Petitioner demonstrated, and the Board agreed, that the prior art Chou reference renders obvious the challenged claims of the '101 Patent. In response, Patent Owner NEC largely retreads the same arguments that the Board already considered but rejected. In doing so, NEC mischaracterizes the claim requirements, Chou's disclosure, Petitioner's arguments regarding Chou, and the Board's Institution Decision ("DI").

Tellingly, NEC all but concedes at the outset that its patentability arguments hinge on claim construction—what it means to determine a code rate “*based on*” certain factors—here, Remaining Time and Available Time.¹ NEC urges that this language requires “*direct use*” of calculated “values” as “as input” to the code rate determination. POR at 1; Cooperstock-Decl., ¶64.² This is a classic attempt to avoid

¹ As used herein, the shorthand “Remaining Time” refers to the claimed “remaining time before reproduction start time set as time at which the reception device starts reproduction of the content from a present moment,” and “Available Time” refers to “available reproduction time, which is a time available for reproducing the content based on the content data stored in the storage device of the reception device.”

² Unless stated otherwise, all emphases herein are added.

unpatentability by injecting new language into the claims. NEC’s arguments readily prove baseless.

As Petitioner explained, and the Board recognized, DI 36, Chou makes clear that its feedback system “involves dynamically adjusting the coding bit rate of the streaming media data to control the client buffer duration.” Chou, [0019]. As to the disputed limitation 1(d), this teaching (which NEC completely ignores), along with Chou’s other disclosures, make clear that Chou determines code rate based on the claimed Available Time and Remaining Time. NEC’s tenuous arguments fail to demonstrate otherwise: they hinge on numerous strawman arguments, misapplying the law, flawed timing diagram hypotheticals, and myopic focus on an isolated equation in Chou—to the exclusion of its broader disclosures that NEC’s expert admittedly had not considered. As it did in the Institution Decision, the Board should conclude that Chou renders the challenged claims unpatentable.

II. CLAIM CONSTRUCTION

Puzzlingly, NEC asserts that it “does not contend that any claim terms need construction.” POR 11; Pet. 17. Yet, NEC’s arguments clearly hinge on a particular construction of “*based on*,” appearing in limitation 1(d). NEC argues that the term “is used to signify *a direct use of the values* representing” Available Time and Remaining Time, Cooperstock-Decl., ¶64, and further, that these two values must be first “*examined, acquired, or determined*” before they are used to determine the

code rate. POR 13. If the Board is inclined to construe the term, it should reject NEC's effort to rewrite the claims to avoid Chou.

A. “*Based On*” Merely Requires that “Remaining Time” and “Available Time” have *Some* Influence in Determining Code Rate

Limitation 1(d) specifies that code rate determination be “*based on*” two factors: Remaining Time and Available Time. NEC argues that the “based on” language requires that Remaining Time and Available Time are “values that need to be [*directly*] *used* as an input to the determination process,” which in turn requires that these values “must be first be determined (examined, acquired, etc.)” [*sic*]. POR 1-2; Cooperstock-Decl., ¶64 (“‘based on’ is used to signify a *direct use* of the[se] values.”). As reflected in its analysis of the cited art, NEC’s apparent position is that in order to disclose this limitation, the prior art must showcase a mathematical equation having values that directly correspond to Remaining Time and Available Time.

Notably, NEC’s preliminary response suggested that the limitation 1(d) requires “examining” or “calculating” Available Time, POPR 22, to which the Board responded that such arguments “do not appear to be commensurate in scope with claim 1.” DI, 41. NEC now criticizes the Board’s analysis as “incomplete,” POR 13, but this argument lacks merit. “[T]he plain meaning of ‘*based on*’ [is] ‘broad.’” *Masimo Corp. v. Sotera Wireless, Inc.*, 2023 WL 6307959, at *2 (Fed. Cir. 2023)

(citation omitted). For some event (A) to be “based on” some factor (B), it merely requires that (B) have some impact or influence on (A)—*even if indirectly* rather than directly, as NEC asserts. *See, e.g., Koninklijke Phillips N.V. v. Zoll Lifecor Corp.*, 2014 WL 5088863 at *14, *18 (W.D. Pa. Jul. 31, 2014) (Special Master Report and Recommendation) (finding, as to the limitation “adjusting the tilt of the waveform based on the value of the monitored electrical parameter,” that “‘based on’ is not limited to ‘as a direct and immediate consequence of’ or ‘as a direct and uninterrupted consequence of’”). Additionally, “based on” does not create a mutual exclusivity; thus, contrary to NEC’s arguments regarding Chou, (A) being based on (B) does not preclude (A) from *also* being “based on” other factors (e.g., C, D, etc.). *See, e.g., Masimo Corp.*, 2023 WL 6307959, at *2-3 (explaining, as to the “based on” requirement of the claim term “trigger a second alarm ***based on*** ... exceeding [the] second alarm threshold,” that “this broad claim language does not exclude the use of *additional* alarm thresholds or *other conditions* to trigger an alarm.”).

Further, the claims themselves specify that the Available Time is *itself* “***based on***” the data in the buffer. Thus, for example, the data in the buffer could have some impact or influence on the available time, thereby meeting this second “based on” requirement, without necessarily examining the data in the buffer. And, the Board correctly observed, the claims do not require that the buffer be examined.

B. The Intrinsic Record Does Not Warrant “Examining” or “Calculating” Values that are “Directly Used to ‘Determine the Code Rate’”

Here, the plain language of the claims says nothing about “examining” or “calculating” “values that need to be used as an input,” POR 1, let alone “direct use of th[ose] values.” Cooperstock-Decl., ¶¶62, 64. NEC’s reliance on dependent claims 2 and 3—which explicitly recite “determine a value” and/or “acquire”—is likewise to no avail. Claim 1 (like the other independent claims) is not limited by the requirements of the dependent claims. The applicant, clearly aware of such language, chose to not employ them in claim 1.

Further, nothing in the specification or file history warrants construing “based on” to require “*values that need to be [directly] used as an input to the [code rate] determination process.*” POR 1; Cooperstock-Decl., ¶64. NEC cites equation (5) of the ’101 patent to support its construction, but as NEC itself concedes, equation (5) is part of an “*exemplary embodiment.*” ’101 Patent, 13:62-67; *see* POR 16. Indeed, in its *Markman* briefing, NEC itself urged that reading limitations from the specification into the claims—as it now does—is a “cardinal sin.” Ex.2014 at 3.

Accordingly, the Board should reject NEC’s narrowing constructions for limitation 1(d).

III. CHOU DISCLOSES LIMITATION 1(d)

As to claim 1 of the '101 Patent, except for limitation 1(d), NEC does not dispute that Chou discloses all other limitations. NEC's arguments regarding limitation 1(d) lack merit.³

A. Chou Discloses Determining Code Rate Based On an “Available Time.”

As demonstrated in the Petition, and as the Board agreed, Chou discloses an Available Time and, furthermore, determines code rate based on that Available Time. Pet. 28-40; DI, 41-43.

1. Chou's “Client Buffer Duration” is Available Time, and Chou Determines Code Rate Based On That Time.

First, as the Board correctly found, Chou's *client buffer duration* corresponds to the claimed Available Time. Specifically, Chou discloses a system in which the client buffer's size (in bits) “can be expressed as the number of seconds of content in the buffer, called the buffer duration.” Chou, [0007]; DI, 35. As reflected in Figure 5, frames arrive at the client according to an “arrival schedule,” t_a , and are played back at a “playback deadline,” t_d . Chou, [0067]. Petitioner explained that Chou's client buffer duration at the time of frame arrival—which corresponds to “the gap

³ As to Ground III, NEC does not provide any unique arguments for the Chou-Nobuyoshi combination.

between the frame's arrival time and its playback deadline"—is Available Time. Chou, [0067]. Specifically, it is "a time available for reproducing content based on the content data stored in the storage device of the reception device." Pet. 34-37; Chou, [0067].

Second, Chou further discloses adjusting the coding bit rate based on Available Time. As the Board determined, Chou explicitly states that its system involves "***dynamically adjusting the coding bit rate*** of the streaming media data to control the client buffer duration"—specifically, to "control[] [it] as closely as possible to a target level." Chou, [0019]; Pet. 38-39; DI, 36, 41. Chou does so "to prevent the client buffer from underflowing," and thereby achieving "uninterrupted playback." Chou, [0019], [0070]. Thus, Chou operates by "examin[ing] the current buffer duration to determine whether arrival of a subsequent frame needs to be accelerated (increasing buffer duration) or delayed (decreasing buffer duration)." Pet. 39. This understanding is consistent with Chou's subsequent descriptions of its proposed technique as being a "***feedback*** control system...us[ing] a control-theoretic approach to regulate the coding bit rate," Chou, [0069], *see also id.*, [0081] ("a feedback loop can send a message to the server to adjust the coding bit rate."), and that code rate is determined "in order to keep the client buffer at approximately the

desired duration level,” *id.*, [0025]. These disclosures sufficiently demonstrate that Chou determines code rate ***based on*** client buffer duration.⁴

Notably, NEC omits any reference to Chou’s statement regarding “dynamically adjusting the coding bit rate,” or of the Board’s analysis regarding it. During his deposition, Dr. Cooperstock suggested that the sentence was describing prior art to Chou, rather than *Chou’s* system. Cooperstock-Tr. 167:3-168:7. That interpretation is implausible; the statement appears in the “Summary” of the invention, right after the sentence addressing “[t]he ***present invention*** is directed toward a system and process for controlling a coding bit rate...,”; the dynamic coding rate adjustment statement is made in reference to “***this*** coding bit rate control.” Chou, [0019]. Further, the stated goal of the adjustment—preventing underflow—is reiterated later in Chou’s paragraph [0070]. Dr. Cooperstock avoided opining on Chou’s feedback loop altogether when asked about it. Cooperstock-Tr. 153:22-155:15.

⁴ Intuitively, Chou’s disclosures that it examines buffer duration make sense. To maintain a target buffer duration, Chou has to consider the current buffer size in order to increase or decrease the coding rate to achieve the target duration. Chou cannot accomplish that without considering the status of the buffer.

NEC argues that “Chou teaches away” from basing its code rate determination on Available Time, seizing onto its statement that “it is not the actual buffer fullness of the client buffer that is controlled.” POR 35-36. NEC already attempted this “teaching away” argument in its preliminary response, POPR 24. However, the Board correctly reasoned that the cited statement in Chou does not mean that the buffer fullness is *not affected* by controlling the upper bound to the target. DI, 43. NEC’s flawed claim construction for “based on” provides no basis to deviate from this conclusion.

2. The Board did not Equate “Target Buffer Duration” with Available Time.

NEC allocates several pages to argue that Chou’s “target buffer duration” is not Available Time, and accuses the Board of improperly adopting arguments on Petitioner’s behalf. *See* POR 17-18, 19-25. NEC mischaracterizes both the Petition and the Board’s decision. In fact, the Board repeatedly acknowledged Petitioner’s mapping of Chou’s *actual* client buffer duration to “Available Time.” *See* DI, 35-36 (“[A]ccording to Petitioner, ‘the gap between the ‘arrival schedule’ and ‘playback deadline’ is the ‘buffer duration,’ equivalent to the ‘available reproduction time.’” (citing Petition)), 41 (referencing “client buffer duration (i.e., available reproduction time)”). NEC has misread the Institution Decision. While the Board mentioned that Chou’s disclosure “target buffer duration” “*represents*” or “*teaches*” Available

Time, (DI, 41), it did not *equate* these terms.⁵ Instead, the Board referenced Chou’s “target buffer duration” to merely make the point, on the following page, that “Chou’s disclosed control of an upper bound” (i.e., to match that target schedule) “result[s] in also controlling (albeit indirectly) buffer duration.” DI, 42. Accordingly, NEC’s §VI.B.1 arguments are a red herring.

3. NEC’s Focus on Equation 18 is Misplaced, But also Neglects Chou’s Broader Disclosure Regarding Code Rate Determination.

The Board correctly concluded that Chou determines code rate based on the claimed Remaining Time and Available Time. DI, 41-42. In response, NEC isolates Chou’s Equation 18, which can be used to calculate the code rate $r_c(n)$, to argue that the equation does not use a calculated value for Petitioner’s identified Available Time. POR 32-33. NEC also asserts that “Chou does not suggest ever using an available time in its calculation of the new code rate [because] *[i]nstead*, equation (18) of Chou teach[ing] using an update equation to approximate an ‘upper bound’

⁵ Moreover, such an interpretation is illogical, particularly in view of Chou’s disclosure. The “*target* buffer duration” specifies the primary goal of Chou’s code rate determination technique. Chou, [0070]. That is different from the *actual* buffer duration (i.e., the claimed Available Time), which Chou references in paragraph [0067].

to an approximated ‘target schedule.’” POR 34. Such arguments fail for several reasons.

As a threshold matter, as discussed in §II above, NEC’s arguments hinge on its flawed claim construction for “based on,” which does not require an explicit mathematical equation that *directly uses* a calculated value for Available Time. In addition, the “based on” requirement does not create mutual exclusivity; thus, the fact that Chou’s code rate determination *may also be based on* “additional” factors, including minimizing $t_l(n) - t_b(n)$, does not preclude basing code rate determination on client buffer duration as well. *See Masimo*, 2023 WL 6307959 at *2.

While that should end the inquiry, NEC’s suggestion that Equation 18 does not consider an Available Time that is based on the contents of client buffer is plainly incorrect. While the disclosures of Chou set forth in §II.A.1 sufficiently demonstrate that Chou determines code rate based on Available Time (which, in turn, is based on the contents of the client buffer), this is also reflected in Equation 18.

Specifically, Equation 18 considers the variable “**gap $g(n)$** ,” that denotes the size of the decoder (client) buffer. Chou, [0060], [0066]; [0021] (referring to the “decoder buffer of the client”). As Dr. Reader explains, Equations 18 and 19 (below) are used to calculate coding rate $r_c(n)$ for frame (n):

$$t_b(n) = t_b(n-1) + \frac{r_c(n)}{f(n)\tilde{r}_a(n)} + w(n-1), \text{ where} \quad (18)$$

$$w(n-1) = \frac{g(n-1)}{\tilde{r}_a(n)} - \frac{g(n-1)}{\tilde{r}_a(n-1)} + v(n). \quad (19)$$

Reader-Supp.-Decl., ¶¶6-7; Chou, [0068]. In Equation 18, $t_b(n)$ provides the upper bound on the arrival time for frame (n), whereas $t_b(n-1)$ is the upper bound for frame (n-1). With Chou’s feedback system, “the client can control the coding bit rate $r_c(n)$ so that $t_b(n)$ reaches a desired value.” Chou, [0069]. Further, “[u]sing Eq. 16, the client can compute $t_b(n-1)$.” *Id.* Applying Equation 16 to frame (n-1) yields the following relationship between $t_b(n-1)$ and the $g(n-1)$:

$$t_b(n-1) = t_a(n-1) + \frac{g(n-1)}{\tilde{r}_a(n-1)}$$

Reader-Supp.-Decl., ¶8. According to Chou, gap $g(n-1)$ denotes the amount of data in the decoder buffer when frame (n-1) arrives at the decoder. *Id.*; Chou, [0060], [0066].⁶

For context, Chou’s “leaky bucket” streaming system is illustrated in Figures 2-4 (annotated below). Figure 3 depicts four schedules (e.g., points A–D) at which

⁶ Dr. Cooperstock agrees that [0060]’s disclosed “gap” representing the decoder buffer size in is the same gap $g(n-1)$ referenced in [0066]. Cooperstock Tr., 101:1-102:10.

bits in the coded bit stream pass through the communications pipeline of Figure 2. Chou, [0037]. The encoder buffer (blue) is between Schedules A and B whereas the decoder buffer (red) is between Schedule C and D. Reader-Supp.-Decl., ¶¶9-12; Chou, [0060].

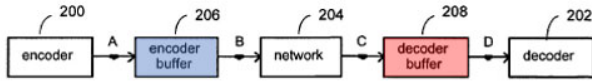


FIG. 2

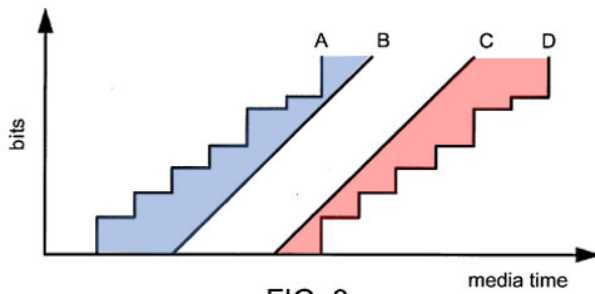


FIG. 3

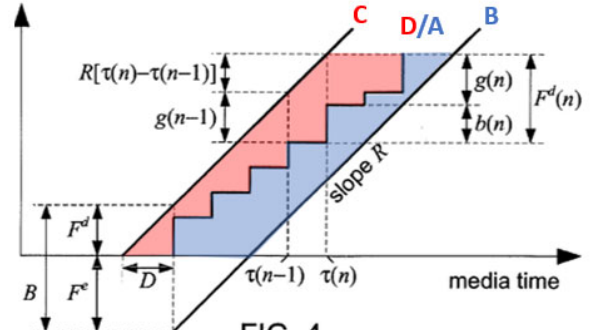
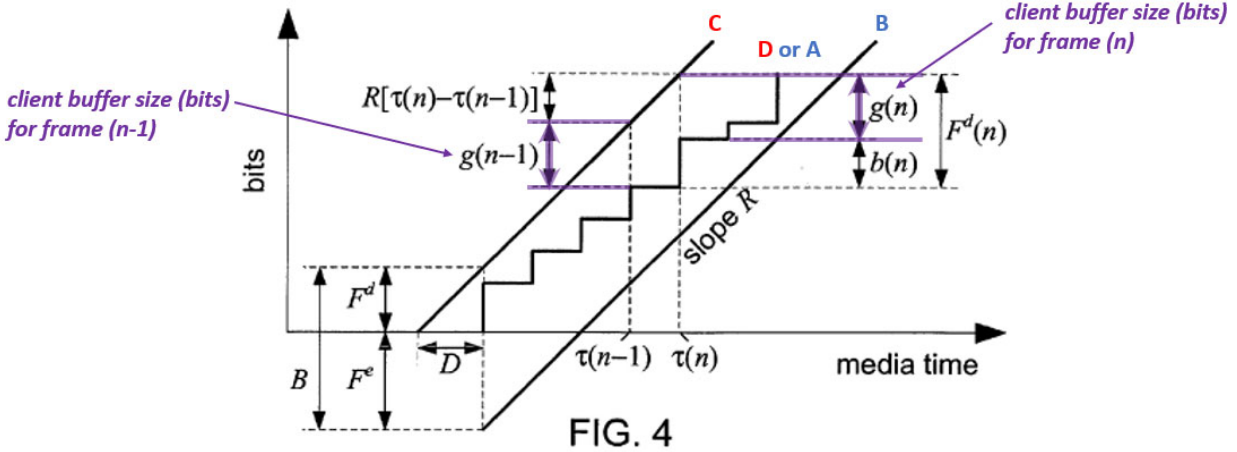


FIG. 4

Schedule C represents when bits enter the decoder buffer and Schedule D represents when frames leave the buffer and are instantaneously decoded for playback. Chou, [0060]. Chou states that because the encoder and decoder buffers are “complementary” (i.e., mirror each other), they can be placed in a “buffer tube,” as shown in Figure 4. *Id.*

According to Chou, the gap between Schedules C and D represents, at any point in time, the size (in bits) of the decoder buffer. *Id.* Thus, as Chou shows in Figure 4, the gap $g(n)$ —the difference between the buffer tube upper bound (Schedule C) and the coding schedule (Schedule D)—denotes the number of bits in

the decoder (client) buffer for frame (n). Likewise, $g(n-1)$ denotes the number of bits in the buffer for frame (n-1):



While gaps $g(n)$ and $g(n-1)$ are denoted in bits in Figure 4, the decoder buffer size can be readily converted to the corresponding client buffer *duration* (in seconds). See Cooperstock-Tr. 40:12-41:6; Chou, [0007].

Notably, Equation 18, through Equations 19 and 16, directly uses the value $g(n-1)$. Accordingly, Chou determines code rate $r_c(n)$ for frame (n) based on gap $g(n-1)$, which represents the size of the decoder when frame (n) arrives or the **client buffer duration** at that time.

Chou then extends the “buffer tube” model of Figure 4 in order “[t]o introduce a margin of safety that increases over time,” by incorporating the “target schedule,” $t_T(n)$ (representing the time at which the frame would arrive under ideal conditions) and a “playback deadline,” $t_d(n)$. Chou, [0070], [0072]. Further, Chou divides the y-

axis (in bits) of Figure 4 by the arrival rate r_a to arrive at the upper bound and the “arrival schedule” of frames (in client time) in Figure 5, as shown below:

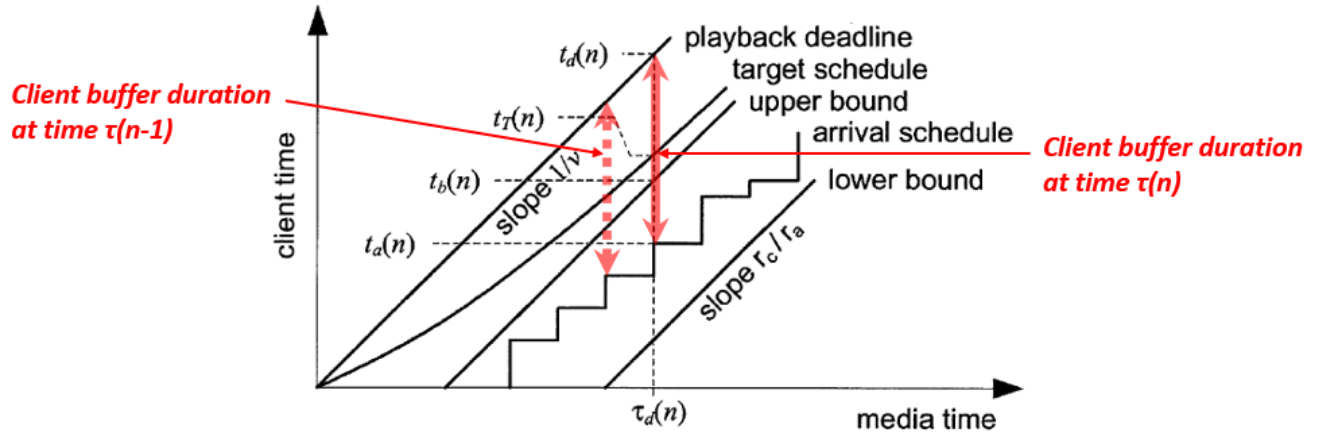


FIG. 5

Chou discloses that in Figure 5, with the target schedule and playback duration introduced, the client buffer duration is the difference between the playback deadline and the frame’s arrival time. Chou, [0067]. As annotated above, the dashed arrow represents the *client buffer duration* when frame (n-1) arrives, whereas the solid arrow represents the duration for frame (n). As discussed in §II.A.1 above, for a given frame, the client buffer duration is the claimed Available Time.

Notably, Chou only discusses the “target schedule” *after* presenting Equation 18. Chou, [0070] (“D. Control Objective”). Thus, a POSITA would have understood that when the Equation 18 accounts for the “playback deadline” and “target schedule” of Figure 5, it would factor in the client buffer size according to this model. Reader-Supp-Decl., ¶14; Chou, [0067]. Though the client buffer duration is in units of time, it can be readily converted to bits. *See* Chou, [0007]; Reader-Supp.-

Decl., ¶13. Thus, contrary to NEC’s suggestion, Chou uses Available Time (i.e., client buffer duration) to determine code rate, and that Time is based on the size of the decoder buffer.⁷

4. Petitioner’s Available Time Accounts for Chou’s “One Frame Delay.”

NEC argues that Chou’s gap between arrival time and playback deadline “is not the ‘time available for reproducing content based on the content data stored.’” POR 28-30. That is incorrect. Chou explains that its code rate determination technique must account for transmission delay when providing feedback from the client to the server. Chou, [0069] (disclosing “feedback”), [0081]. Specifically, Chou discloses that when frame (n-2) arrives at time $t_a(n-2)$, Chou can determine code rate $r_c(n)$ for frame (n). *See* Chou, [0081]. Thus, when determining $r_c(n)$, the

⁷ Dr. Cooperstock admittedly had not considered Chou’s broader disclosures regarding the variables used in Equation 18, including $g(n-1)$ —the decoder/client buffer size. Cooperstock-Tr. 107:1-9. Indeed, he struggled to explain the Schedules that define $g(n-1)$ shown in Figure 4. *Id.*, 87:15-92:2. He initially testified that Schedule B was on left of the “staircase” but then testified that Schedule B was on the right, and eventually conceded that he has not opined on the transition to Figure 4 from Figure 3. Evidently, even though Dr. Cooperstock opined on Equation 18, he had not considered the disclosures of Chou that inform Equation 20.

client buffer duration (i.e., the Available Time) will be the difference between playback deadline $t_d(n-2)$ for frame (n-2) and arrival schedule $t_a(n-2)$ for that frame, as depicted in annotated figure below:

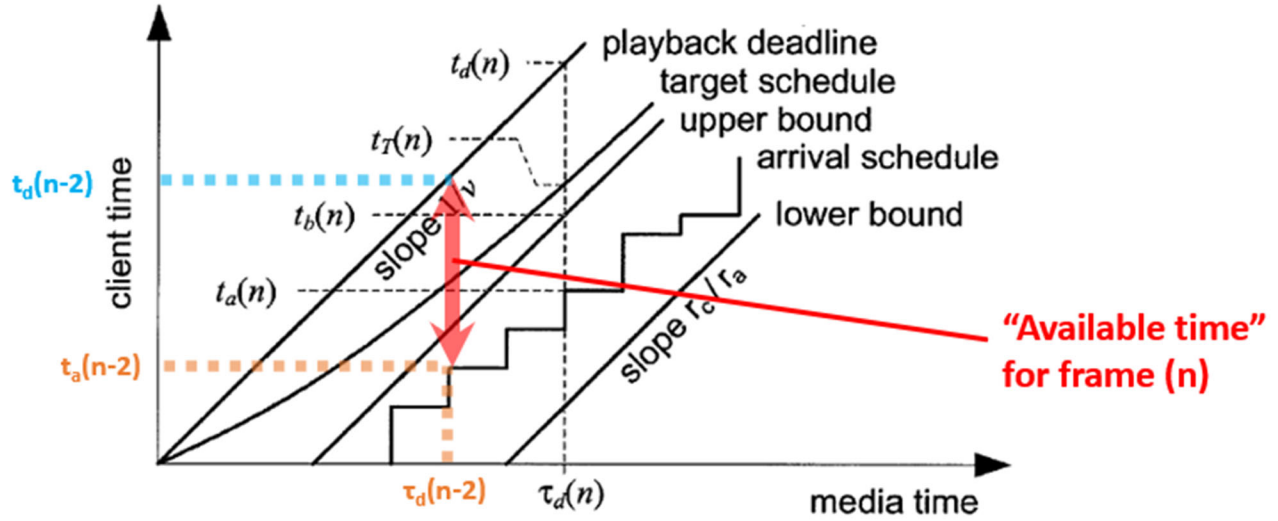


FIG. 5

NEC devotes considerable space to explain that the arrival time $t_a(n)$ for frame (n) is unknown when coding rate for frame (n) is being ascertained, POR 28-32, but that is unremarkable. As Dr. Reader readily admitted, before frame (n) arrives at the client, the arrival time $t_a(n)$ is an unknown future event that can only be estimated. Reader-Tr., 96:6-97:2. As described above, when determining code rate for frame (n), Chou relies upon the arrival times of prior frames, such as frame (n-1) and frame (n-2). Chou, [0069], [0081]; Reader-Supp.-Decl., ¶¶16-18.

In this regard, Chou's operation is no different than the server described in the '101 Patent. As reflected in Figures 3 and 6, for example, clients 20a and 20b

periodically transmit an Available Time to the server. *See* '101 patent, Fig. 3 (steps S107-S108). A certain amount of time lapses before the server employs the Available Time to determine the code rate. *See id.*, Fig. 3 (step S109), 15:35-39 (“[E]very time the transmission period (change period) *elapses*, the service device 10 determines a code rate for each of the terminal devices 20a and 20b[,] ... and changes the code rate.”). The server employs the value of Available Time that represents the client’s buffer status when the client acquired the Available Time. Further, the claims of the '101 Patent do not impose any temporal relationship between when the storage device of the reception device (on which Available Time is based) must be considered, versus when the code rate for subsequent frames must be determined. *See* '101 Patent, Cl. 1.

B. Chou Discloses Determining Code Rate Based On a Remaining Time.

The Board preliminarily concluded that Chou determines code rate based on a Remaining Time. Pet. 37; DI. 34-35. NEC’s arguments disputing this aspect of Limitation 1(d) are premised on both a misunderstanding of Petitioner’s argument, and its flawed “based on” construction.

1. Chou Discloses a Remaining Time, and Determines Code Rate Based On That Time.

As explained in the Petition, in Chou's system, the "Remaining Time" corresponds to "the gap between the *time at which Chou's system is determining the coding bit rate* for a given frame ... and *the playback deadline*." Pet. 37.

As discussed in §III.A.3 above, Chou teaches that it determine code rate $r_c(n)$ for frame (n) when frame (n-2) arrives at time $t_a(n-2)$. See Chou, [0081]. As shown in annotated Figure 5 below, when Chou determines the code rate $r_c(n)$ for frame (n), the claimed "*present moment*" $t_{present}(n)$ for the frame (n) is arrival time $t_a(n-2)$. Reader-Supp.-Decl., ¶21. The playback deadline $t_d(n)$ for frame (n) is the claimed "*reproduction start time*." *Id.* Accordingly, when determining the code rate for frame (n), the "gap" between these two—i.e., playback deadline, $t_d(n)$, and the present moment, $t_a(n-2)$ is the "remaining time before reproduction start time set as time at which the reception device"—Chou's client—"starts reproduction of content from a present moment." *Id.*

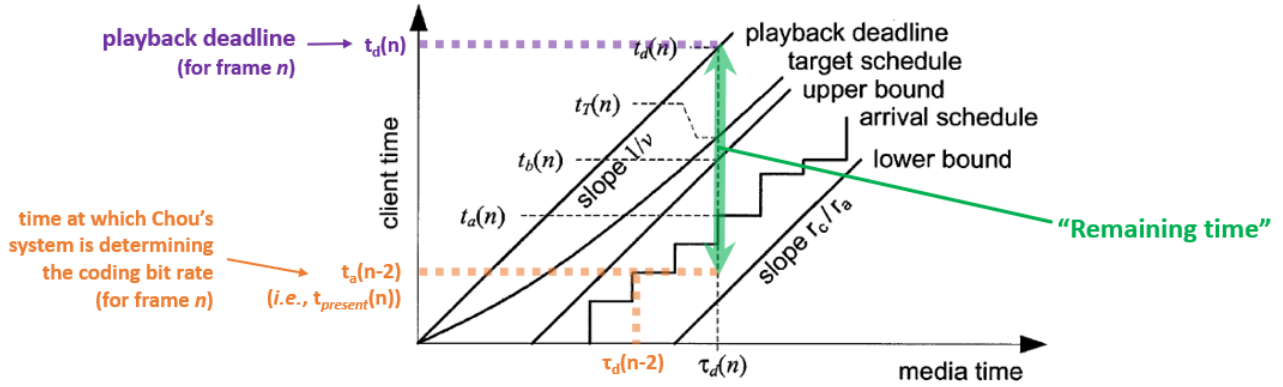


FIG. 5

NEC expressly admits that the gap indicated with green arrow in Figure 5 above is the claimed “Remaining Time. POR 44 (“a POSITA would understand that in order for the bit rate of Chou to be determined based on ‘remaining time,’ the bit rate would need to be determined based on ... $t_d(n) - t_a(n-2)$ (in client time).” That is consistent with the “gap” referenced in the Petition. Pet. 37.

2. Petitioner did not Map Remaining Time to Chou’s “Target Buffer Duration.”

NEC asserts that Petitioner equated Remaining Time to Chou’s “target buffer duration.” POR 41-44. That is incorrect. Chou’s “target buffer duration” is the difference between the playback deadline and the target schedule. Chou, Fig. 6. The Petition explicitly mentioned that the Remaining Time is the “gap between the *time at which Chou’s system is determining the coding bit rate* for a given frame (to

meet the target arrival schedule) and the *playback deadline* for that frame.” Pet. 37.⁸ The Board, relying upon that statement, agreed that Chou discloses remaining time. DI, 34-35. Because NEC’s and Cooperstock’s critiques are based on an incorrect view of Petitioner’s arguments, both should be ignored.⁹

3. Chou’s Equations Confirm that Its Code Rate Determination is Based On Remaining Time.

Chou’s equations also confirm the Board’s conclusion that Chou determines the code rate based on Petitioner’s identified Remaining Time.

⁸ Dr. Reader clarified during his deposition that in ¶147 of his opening declaration, “‘*This* gap” should read “‘*The* gap,” to avoid any suggestion that the “gap” referenced in ¶147 is the target buffer duration shown in Figure 6 of the preceding ¶146. EX2015 at 116:20-118:9.

⁹ Dr. Cooperstock reflects NEC’s flawed understanding of Petitioner’s assertion about Remaining Time. EX2012, ¶¶111, 112. He confirmed that his analysis hinges on the assumption that Peloton equated “target buffer duration” to Remaining Time, and confirmed that he did not review Dr. Reader’s deposition transcript. Cooperstock-Tr. 140:16-141:15. During his deposition, Dr. Cooperstock seemed to have realized that the time at which Chou determines the code rate for a frame is not the same as the target arrival time for that frame. Cooperstock-Tr. 127:7-128:10 (“Oh, but that’s not a target.”).

First, Equation 18 confirms that Chou considers the duration from the present moment $t_{present}(n)$ to the upper bound $t_b(n)$ for frame (n). Equation 18 is used to control the coding rate $r_c(n)$ to reach a desired value $t_b(n)$. Chou, [0069]. And, Equation 16 explains that the upper bound $t_b(n)$ is based on the estimated arrival time $t_a(n)$ for frame (n). Chou, [0068]. Importantly, the reference point for calculating the value of upper bound $t_b(n)$ for frame (n) is ***from the present moment*** discussed above—i.e., $t_a(n-2)$. Reader-Supp.-Decl., ¶¶22-23; Chou, [0081]. Thus, when attempting to identify the desired value of the upper bound $t_b(n)$, Chou considers the duration from the present moment $t_{present}(n)$ to the upper bound $t_b(n)$.

Second, when the upper bound $t_b(n)$ approaches the target schedule $t_T(n)$, Chou considers the duration between target schedule $t_T(n)$ and the playback deadline $t_d(n)$. Chou specifies that its primary objective is to “attempt[] to control the buffer tube upper bound,” t_b “so that it tracks the target schedule,” t_T . Chou, [0070]. As Dr. Reader explains, that objective is reflected in the first term of Equation 20 (*id.*, [0072]; Reader-Supp.-Decl., ¶22):

$$I = \sum_{n=0}^N \left((t_b(n) - t_T(n))^2 + \sigma \left(\frac{r_c(n+1) - r_c(n)}{\tilde{r}_a(n)} \right)^2 \right), \quad (20)$$

In addition, Chou teaches that different methods can be used to calculate the target schedule, t_T , from the playback deadline, t_d . *See* Chou, [0076]-[0078]. As reflected in Figure 6, for a given frame (n), the gap between the playback deadline

and the target schedule, $(t_d(n) - t_T(n))$, is the target buffer duration, i.e., “the desired client buffer duration (in client time).” *Id.*, [0074]. Thus, in efforts to match upper bound $t_b(n)$ to target schedule $t_T(n)$, Chou takes into consideration the time duration between target schedule $t_T(n)$ and the playback deadline $t_d(n)$.

Accordingly, the Remaining Time identified by Petitioner reflects the entire segment—i.e., it includes both (1) the present moment ($t_a(n-2)$) to $t_T(n)$, and (2) the desired/target client buffer duration (i.e., the gap between $t_d(n)$ and $t_T(n)$)—that forms the basis for the code rate. Thus, NEC’s assertion that “Chou does not consider [basing code rate determination on] ‘remaining time’ because there is no value in equation (18) (or any of the equations) that suggest considering (i.e., basing determination on) a ‘remaining time,’” POR 46, is incorrect. As with Available Time, this is true even if Chou does not explicitly recite a mathematical formula that directly uses a calculated value of Remaining Time, as this is beyond the scope of the claimed “based on” requirement.

C. NEC’s Other Arguments Regarding Chou are Equally Meritless

1. NEC’s Exemplary Table Confirms Peloton’s Identification of Remaining Time and Available Time

NEC presents the following table to argue that Chou does not disclose Remaining Time and Available Time. POR 46; Cooperstock-Decl., ¶117. The table

is irrelevant because, as explained below, NEC's and Dr. Cooperstock's analysis hinges on an incorrect understanding of Petitioner's position and Chou's disclosure.

Frame No.	Playback Deadline (Media Time)	Playback Deadline (Client Time)	Arrival Time (Media Time)	Arrival Time (Client Time)
N-3	0s	1:01:30 PM	-5s	1:01:25 PM
N-2	30s	1:02:00 PM	15s	1:01:45 PM
N-1	60s	1:02:30 PM	Unknown	Unknown
N	90s	1:03:00 PM	Unknown	Unknown
N+1	120s	1:03:30 PM	Unknown	Unknown

Frame N-2 has arrived, the system is calculating the code rate for frame N. Therefore, the "current time" (present moment for determining code rate of frame N) is the arrival time of frame N-2, which is 15s (media time) or 1:01:45 PM (client time).

"Remaining Time" (for frame N) = 75s
(e.g., "90s – 15s" in media time; or 1:03:00PM – 1:01:45PM)
Thus, **playback deadline (90s) is not equal to remaining time (75s).**

"Available Reproduction Time" = 45s
(e.g., frame N-2 will play for 30s in addition to the 15s left of playback for N-2)
Thus, "playback deadline" minus "arrival time" (30s – 15s = 15s) is **not equal to available reproduction time (45s).**

First, NEC argues that Remaining Time is 75 seconds whereas the playback deadline is 90 seconds. But this is irrelevant; Peloton *never* argued that the playback deadline corresponds to Remaining Time. As NEC itself concedes, "‘playback deadline’ [is] merely a *timestamp* that is not measured ‘from a present moment.’" POR 45. On the other hand, Remaining Time corresponds to the *duration* between the playback deadline and the present moment. In NEC's table, the playback deadline for frame (n) is 90 seconds, whereas the code rate for frame (n) is determined at 15 seconds. NEC apparently concurs with Petitioner that the

difference between the two (75 seconds) is the Remaining Time. Reader-Supp-Decl., ¶¶25-27.

Second, NEC argues that the Available Time is 45 seconds whereas the difference of playback deadline and arrival time (Petitioner's identified Available Time) is 15 seconds. However, NEC's calculation of 45 seconds incorrectly assumes that Available Time includes both the amount of data in the buffer $g(n)$ and the frame $b(n)$ that was just added to the buffer. As explained §III.A.2 above, Chou's calculation of $g(n)$ (i.e., the client buffer duration), does not include the currently added frame $b(n)$. Chou, [0060], [0066].¹⁰ In NEC's exemplary table, excluding frame (n-2) from the calculation yields an Available Time of 15 seconds, not 45 seconds. Reader-Supp-Decl., ¶¶28-29. When Available Time is evaluated in accordance with Chou's disclosure, it mirrors Petitioner's contention.

¹⁰ Both NEC and Dr. Cooperstock commit the same error when they dispute Petitioner's assertion that duration (i.e., client buffer duration) between the playback deadline $t_d(n-2)$ and the arrival time $t_a(n-2)$ corresponds to Available Time. POR, 29-31, 37-39. In both instances, NEC and Dr. Cooperstock assume that frame (n-2) is part of the client buffer duration. However, when Chou evaluates gap $g(n-2)$ and client buffer duration, it includes the bits in the buffer when frame (n-2) arrived and does not include that frame.

Thus, NEC's exemplary table does not undermine Petitioner's identification of Remaining Time or Available Time.

2. NEC Mischaracterizes the Board's Analysis Regarding Chou's Fast Startup Technique.

NEC argues that contrary to the Board's assertion, Chou's "fast startup technique" does not disclose determining the code rate based on Available Time. POR 40-41 (criticizing the technique as "result[ing] in an unnecessarily low bit rate"). NEC's critique misapprehends the Board's Institution Decision. The Board cited Chou's fast startup technique as merely one of several examples of Chou disclosing monitoring the current state of the decoder buffer. DI, 42. As the Board correctly noted, Chou's disclosure of delaying start-up "until the buffer duration [is] sufficiently high to guarantee continuous playback," *Id.*, Chou, [0090], entails monitoring the client buffer size to ensure underflow does not occur. The Board's point is that Chou does not teach away from monitoring the actual fullness of the client buffer, as NEC incorrectly argues.

3. NEC's Arguments Regarding Dropped Frames is Irrelevant.

NEC argues that Chou's *client buffer duration* cannot be the claimed Available Time, because that duration does not account for (i) "frames [that] could have been dropped and thus not received" and (ii) frames that may be in the storage device at startup. POR 30-31. The Board already rejected NEC's suggestion that

Chou’s “special case[s] negate[] Chou’s ‘gap’ otherwise representing a time available for reproducing the content (i.e., during normal operations...).” DI 42-43. NEC now confuses the issue by citing case law regarding inherency, POR 32, but Petitioner’s argument on Available Time does not hinge on “probabilities or possibilities.” *See id.* Petitioner demonstrated that Chou determines code rate based on Available Time, at least during normal operations. That is sufficient. *See Power Integrations, Inc. v. Fairchild Semiconductor Int’l, Inc.*, 843 F.3d 1315, 1337 (Fed. Cir. 2016). Regardless, as shown in §II.A, Chou determines code rate based on the decoder buffer data, which eviscerates NEC’s arguments.

IV. DR. READER’S OPINIONS ARE RELIABLE

Dr. Reader has a wealth of experience in the field of streaming media systems, which spans six decades, and includes co-founding and chairing multiple MPEG standards. *See* Reader-First-Decl., ¶¶10-27. NEC either misinterprets Dr. Reader’s opinions or reads them out of context. Dr. Reader’s opinions are reliable and his deposition testimony was ultimately consistent with his declaration. None of NEC’s criticisms of Dr. Reader have any merit.

First, Dr. Reader specified in this declaration that he viewed the prior art from the perspective of a POSITA, Reader-Tr. 179:11-181:6, and clarified that he relied upon his education and work experience to evaluate the art. *Id.*, 41:16-42:2. NEC

does not identify any unique information that Dr. Reader relied upon in arriving at his opinions that was not accessible to a POSITA.

Second, Dr. Reader testified that he considered the claims as a whole to find limitations in the prior art. *Id.*, 44:6-24. That was his task. He analyzed the challenged claims and then identified where the limitations of those claims are present in Chou. NEC's claim of "gotcha" regarding Dr. Reader's agreement that he used the claims as a "map" (*id.*, 44:1-5) is unremarkable; NEC fails to identify any hindsight bias in his analysis.

Third, during his deposition, after NEC concluded cross-examination, Petitioner asked Dr. Reader questions regarding Available Time on re-direct. Upon reviewing a relevant passage in his declaration, he was able to recollect his prior analysis regarding how Chou discloses Available Time. There is nothing improper about such questioning; expert depositions are not intended to be a memory test. These circumstances provide no basis to question the reliability of Dr. Reader's analysis.

Dr. Cooperstock's testimony, on the other hand, raises significant questions regarding *his* reliability. As discussed above, he: (i) equated "Remaining Time" with Chou's "target buffer duration," before realizing during his deposition that this was not technically possible; (ii) had not analyzed Chou's Figure 4, and struggled to locate its various schedules that define the client buffer size; (iii) could not explain

gap $g(n)$; (iv) aside from Equation 18, had not meaningfully considered Chou's other equations; and (v) avoided offering any opinion on Chou's feedback system—all critical to disputed limitation 1(d).

The Board should determine that the challenged claims are unpatentable.

Date: August 27, 2024

Respectfully submitted,

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CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), I certify that the foregoing Petitioner's Reply contains 5595 words based on the word count indicated by the word-processing program used to generate the paper and excluding those portions exempted by 37 C.F.R. § 42.24(a).

Date: August 27, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6, I hereby certify that the foregoing Petitioner's Reply to Patent Owner's Response was served by electronic mail today on the following counsel of record for Patent Owner:

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