

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PELOTON INTERACTIVE, INC.,
Petitioner,

v.

NEC CORPORATION,
Patent Owner.

IPR2023-01239
Patent 8,752,101 B2

Before MICHAEL J. STRAUSS, CHARLES J. BOUDREAU, and
CHRISTOPHER L. OGDEN, *Administrative Patent Judges*.

STRAUSS, Administrative Patent Judge.

JUDGMENT
Final Written Decision
Determining No Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

Peloton Interactive, Inc. (“Petitioner”) filed a Petition (Paper 2) under 35 U.S.C. §§ 311–319 requesting *inter partes* review of claims 1, 2, 4, 5, 7, 11, 12, 14–18, 20–23, and 25–29 (“the challenged claims”) of U.S. Patent No. 8,752,101 (Ex. 1001, “the ’101 patent”). In support of the Petition, Petitioner filed confidential sealed and redacted public versions of a declaration of Dr. Clifford Reader (Exhibits 1006 and 1037, respectively). With the Board’s authorization, Petitioner filed a Motion to Correct Petition Under 37 C.F.R. § 42.104(c), seeking to “correct certain clerical errors in the Petition and [both versions of] the [Reader] declaration” (Paper 11), which NEC Corporation (“Patent Owner”) opposed (Paper 12). The Board granted Petitioner’s Motion (*see* Paper 13, Order Granting Motion to Correct Clerical or Typographical Mistakes), and Petitioner filed a Revised Petition (Paper 15, hereinafter, “Petition” or “Pet.”) and revised confidential and public versions of the Reader declaration (reusing Exhibit numbers 1006 and 1037, respectively). Patent Owner filed a Preliminary Response (Paper 14, “Prelim. Resp.”). We instituted an *inter partes* review of the challenged claims. Paper 16 (“Institution Decision” or “Dec.”).

After institution, Patent Owner filed a Response to the Petition (Paper 21, “PO Resp.”), Petitioner filed a Reply (Paper 25, “Pet. Reply”), Patent Owner filed a Sur-reply (Paper 28, “PO Sur-reply”), and, with the Board’s authorization, Petitioner filed a Sur-sur-reply (Paper 32).

We held an oral hearing in this proceeding on November 22, 2024, and the transcript is entered into the record. Paper 42 (“Tr.”).

This is a final written decision under 35 U.S.C. § 318(a) as to whether the claims challenged in the *inter partes* review are unpatentable. For the reasons below, we conclude that none of the challenged claims has been shown to be unpatentable.

II. BACKGROUND

A. *The '101 Patent (Ex. 1001)*

The '101 patent, titled “Distribution System,” issued June 10, 2014, from U.S. Patent Application No. 13/508,025 (“the '025 application”), filed May 3, 2012. Ex. 1001, codes (21), (22), (45), (54). The '025 application was filed as International Application No. PCT/JP2010/006067 on October 13, 2010. *Id.* at codes (22), (86). The '101 patent claims priority to Japanese Patent Application No. 2009-253581, filed November 5, 2009. *Id.* at code (30).

The '101 patent relates generally to a content (e.g., video, audio) distribution system that transmits content data encoded with a certain code rate to a reception device that, while receiving the content data, both stores the received data and reproduces the content. Ex. 1001, code (57). As technical background, the parties explain that a number of different approaches were being employed at the time of the November 2009 priority date to provide content to consumers over a communications network such as the Internet. *See* Pet. 18–19; Ex. 2012 ¶ 43. As an alternative to requiring the entirety of a content file to be completely downloaded to a device prior to start of reproduction of the content (i.e., “download-first-and-then play”), systems including coding standards and streaming protocols were developed to stream content to users so that content could be reproduced as the content

file was being transferred. *See* Pet. 18; Ex. 2012 ¶¶ 44–45. Streaming systems encode and packetize content (e.g., audio and video) and use a communication network such as the Internet to deliver the encoded content to a user device that plays the content (e.g., reproduces the encoded audio and/or video content) as packets of content data are received and decoded. *See* Pet. 18; Ex. 2012 ¶¶ 46–47.

According to the parties, a problem with streaming systems is caused by, among other things, changing network conditions including bandwidth and transmission medium degradations. *See* Pet. 20; Ex. 2012 ¶ 45. Systems attempt to mitigate problems caused by communication degradations and/or interruptions by buffering content at the user device and controlling the transmission or code rate of content data based on changing network conditions (i.e., adaptive (bitrate) streaming). *See* Pet. 20; Ex. 2012 ¶ 47. “In this approach, the video content [is] encoded at multiple bitrates and the encoded video stream [is] divided into multiple smaller segments, just like progressive video. Individual video segments at various bitrates [are] selected by the receiver based on the network and buffer conditions and transmitted by the server to the receiver.” Ex. 2012 ¶ 47 (internal citations omitted) (citing Ex. 2007, 148 (James F. Kurose & Keith W. Ross, *Computer Networking* (7th ed. 2017))); *see also* Pet. 20.

The ’101 patent relates to selecting a code rate for encoding content (e.g., video, audio) wherein “[t]he code rate represents the data amount (the data size, e.g., the number of bytes) of content data for reproducing content at constant speed (reproducing content at $1\times$ speed) for a unit time (e.g., one second).” Ex. 1001, 7:8–11. It is understood that employing a higher code rate (i.e., using more data or bits to encode a given time period of content)

enables a higher quality of content reproduction than does a lower code rate. *See, e.g.*, Ex. 1004 ¶ 8. The invention purportedly addresses a problem wherein, due to variations in communication speed (e.g., during periods of reduced communication speeds), a higher code rate (i.e., requiring more data to reproduce a given duration of content) can cause a reproduction device to be unable to start reproducing content at a set reproduction time. Ex. 1001, 1:54–64, 2:23–25. More particularly, a content distribution system and corresponding method include “a transmission device and a reception device configured to be capable of communicating with each other.” *Id.* at 2:26–29.

The transmission device is equipped with a content transmitting means for transmitting content data, which is one content coded with any one code rate of a plurality of code rates different from each other, to the reception device.

The reception device is equipped with a content reproducing means for, while receiving the content data transmitted by the transmission device, storing received data of the content data into a storage device and also reproducing the content based on the stored data.

The distribution system comprises a code rate determining means for determining the code rate based on a remaining time before reproduction start time set as time at which the reception device starts reproduction of the content from a present moment, and based on an 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. The content transmitting means is configured to change the code rate of the content data to be transmitted to the reception device to the determined code rate.

Id. at 2:30–49.

B. Challenged Claims and Grounds

Of the challenged claims, claims 1, 11, 16, 21, 22, and 26–29 are independent claims. Claims 2–10 depend from claim 1, claims 12–15

depend from claim 11, claims 17–20 depend from claim 16, and claims 23–25 depend from claim 22. Claim 1, reproduced below with bracketed element identifiers corresponding to those used in the Petition,¹ is illustrative of the challenged claims.

[1a] A distribution system, including a transmission device and a reception device configured to be capable of communicating with each other,

[1b][i] the transmission device being equipped with a content transmitting unit for transmitting content data, which is

[ii] one content coded with any one code rate of a plurality of code rates different from each other, to the reception device, and

[1c] the reception device being equipped with a content reproducing unit for, while receiving the content data transmitted by the transmission device, storing received data of the content data into a storage device and also reproducing the content based on the stored data,

[1d][i] the distribution system, comprising a code rate determining unit for determining the code rate [ii] based on a remaining time before reproduction start time set as time at which the reception device starts reproduction of the content from a present moment [iii] and based on an available

¹ To avoid confusion, rather than adopting the Petition’s convention of using lower case letters to label both major claim limitations (i.e., claim elements) and their subparts (i.e., constituent sub-elements), we use lower case Roman numerals to label the limitation’s subparts.

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, wherein:

[1e] the content transmitting unit is configured to change the code rate of the content data to be transmitted to the reception device to the determined code rate; and

[1f] the content reproducing unit is configured to start reproduction of the content at the set reproduction start time.

Ex. 1001, 24:38–63.

Petitioner asserted, and we instituted *inter partes* review on, three grounds of unpatentability, as summarized in the following table:

Claims Challenged	35 U.S.C. § ²	Reference(s)/Basis
1, 2, 4, 5, 7, 11, 12, 14–18, 20–23, 25–29	103(a)	Chou ³
1, 2, 4, 5, 7, 11, 12, 14–18, 20–23, 25–29	103(a)	Chou, Wang ⁴
5, 7, 15	103(a)	Chou, Nobuyoshi ⁵

² The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), amended 35 U.S.C. §§ 102 and 103 (2006), effective March 16, 2013. Because U.S. Application No. 13/508,025 from which the ’101 patent issued was filed on May 3, 2012, which is before the effective date of the AIA, the pre-AIA versions of §§ 102 and 103 apply. *See* Ex. 1001, codes (21), (22), (30), (86), (87).

³ Chou et al., US 2006/0143678 A1, published June 29, 2006, filed December 10, 2004 (Ex. 1004, “Chou”).

⁴ Wang et al., US 7,606,928 B2, issued October 20, 2009, filed March 21, 2003 (Ex. 1016, “Wang”).

⁵ Certified English-language translation of Japanese Laid-Open Application 2007-13705, published January 18, 2007 (Ex. 1014, “Nobuyoshi”).

Pet. 6. Petitioner asserts that all references are prior art under 35 U.S.C. §§ 102(a) and 102(b) (2006). Pet. 7, 10, 13.

C. Testimonial Evidence

Petitioner submits two declarations by Clifford Reader, Ph.D. Exs. 1006, 1040. Petitioner also submits two deposition transcripts of Patent Owner's expert, Dr. Schonfeld. Exs. 1041, 1042.

Patent Owner submits two declarations⁶ by Jeremy Cooperstock, Ph.D. (Exs. 2012, 2016). Patent Owner also submits a deposition transcript of Petitioner's expert, Dr. Reader. Ex. 2015.

D. Related Proceedings

The parties identify as related matters involving the '101 patent *NEC Corp. v. Peloton Interactive, Inc.*, No. 1:22-cv-00987 (D. Del.); *NEC Corp. v. Our Body Electric Inc.*, No. 1:22-cv-00986 (D. Del.); and *NEC Corp v. Tone It Up Inc.*, No. 1:22-cv-00988 (D. Del.). Pet. 4, Paper 6, 2.

III. ANALYSIS

A. Legal Standards

"In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (2012) (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim"))). Except in limited

⁶ Patent Owner's expert declaration of Dan Schonfeld, Ph.D. (Ex. 2001; *see also* Ex. 2002 (Dr. Schonfeld's curriculum vitae)) is withdrawn. PO Resp. 3.

circumstances not present here, this burden of persuasion never shifts to the patent owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

A patent claim is unpatentable for obviousness if the differences between the claimed subject matter and the prior art are “such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” 35 U.S.C. § 103(a) (2006).⁷

“The ultimate determination of obviousness is a question of law, but that determination is based on underlying factual findings.” *In re NuVasive, Inc.*, 842 F.3d 1376, 1381 (Fed. Cir. 2016).

The underlying factual findings include (1) “the scope and content of the prior art,” (2) “differences between the prior art and the claims at issue,” (3) “the level of ordinary skill in the pertinent art,” and (4) the presence of secondary considerations of nonobviousness such “as commercial success, long felt but unsolved needs, failure of others,” and unexpected results.

Id. (quoting *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966)).

“To satisfy its burden of proving obviousness, a petitioner cannot employ mere conclusory statements” but “must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016). Furthermore, in assessing the prior art, the Board must consider whether a person of ordinary skill would have been motivated to combine the prior art to achieve the claimed invention. *NuVasive*, 842 F.3d at 1381

⁷ *See supra* note 2.

(citing *In re Warsaw Orthopedic, Inc.*, 832 F.3d 1327, 1333 (Fed. Cir. 2016)).

As the Supreme Court has held, “because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known,” “it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418–19 (2007).

B. Level of Ordinary Skill in the Art

Factors pertinent to a determination of the level of ordinary skill in the art include (1) educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of workers active in the field. *Envtl. Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 696–697 (Fed. Cir. 1983) (citing *Orthopedic Equip. Co. v. All Orthopedic Appliances, Inc.*, 707 F.2d 1376, 1381–82 (Fed. Cir. 1983)). Not all such factors may be present in every case, and one or more of these or other factors may predominate in a particular case. *Id.* Moreover, these factors are not exhaustive but are merely a guide to determining the level of ordinary skill in the art. *Daiichi Sankyo Co. v. Apotex, Inc.*, 501 F.3d 1254, 1256 (Fed. Cir. 2007).

In determining a level of ordinary skill, we also may look to the prior art, which may reflect an appropriate skill level. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). Additionally, the Supreme Court informs

us that “[a] person of ordinary skill is also a person of ordinary creativity, not an automaton.” *KSR*, 550 U.S. at 421.

Petitioner, supported by the testimony of Dr. Reader, argues that a person of ordinary skill in the art (“POSITA”) “would have a bachelor’s degree, or equivalent, in electrical engineering, computer science, a related field, and 2–3 years’ experience researching, designing, or developing content delivery systems and related hardware, software, and firmware, or equivalent experience.” Pet. 14 (citing Ex. 1006 ¶¶ 67–69). Petitioner further argues “[o]ne having less education but more practical experience, or more education and less experience, might also meet this standard.” *Id.* Patent Owner does not dispute Petitioner’s definition or offer an alternative level or skill in the art. PO Resp. 12 (citing Pet. 14; Ex. 2012). Instead, “[f]or the purposes of this PO Response only, Patent Owner applies Petitioner’s definition of POSITA.” *Id.*

Thus, on this record, the parties agree upon the proposed level of ordinary skill in the art, and this level is consistent with our review and understanding of the technology and descriptions in the ’101 patent and the prior art references that disclose content delivery systems. For purposes of this Decision, we rely on Petitioner’s proposed level of ordinary skill in the art.

C. Claim Construction

In an *inter partes* review, we apply the same claim construction standard as would be used by a district court to construe a claim in a civil action involving the validity or infringement of a patent. 37 C.F.R. § 42.100(b). Under that standard, claim terms are given their ordinary and customary meaning, as would have been understood by a person of ordinary

skill in the art at the time of the invention, in light of the language of the claims, the specification, and the prosecution history of record. *Id.*; *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–19 (Fed. Cir. 2005) (en banc); *Thorner v. Sony Comput. Entm’t Am. LLC*, 669 F.3d 1362, 1365–66 (Fed. Cir. 2012). “The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’” *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (quoting *Vivid Techs., Inc. v. Am. Sci. Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

In the claim construction section of the Petition, Petitioner states that it “interprets the Challenged Claims according to *Phillips*,” giving “all terms . . . their plain and ordinary meaning.” Pet. 17. Nonetheless, Petitioner further argues, even if deemed to be means-plus-function limitations, the prior art teaches (i) the “content transmitting unit” of limitation [1b] (*id.* at 29–30); (ii) the “content reproducing unit” of limitation [1c] (*id.* at 32–33); and (iii) and the “code rate determining unit” of limitation [1d] (*id.* at 40).

In its Response, Patent Owner “does not contend that any claim terms need construction and applies the ordinary and customary meaning.” PO Resp. 11.

We agree that no express claim construction is necessary for purposes of this Decision. *See Realtime Data*, 912 F.3d at 1375.

D. Asserted Prior Art

1. Overview of Chou

Chou, titled “System and Process for Controlling the Coding Bit Rate of Streaming Media Data Employing a Linear Quadratic Control Technique and Leaky Bucket Model,” was filed on December 10, 2004, as U.S. Patent

Application No. 11/010,114, naming Phillip A. Chou, Anders E. Klemets, and Cheng Huang as inventors. Ex. 1004, codes (21), (22), (54), (75). The reference describes a system for controlling the coding bit rate of streaming media data. *Id.* at code (57).

As background, Chou discloses buffering streaming media data, i.e., packets, to compensate for jitter, provide time for lost packet recovery, and continue playback during lapses in network bandwidth. Ex. 1004 ¶ 7. Chou explains client buffer size “can be expressed as the number of seconds of content in the buffer, called the buffer duration,” which “tends to increase as content enters the buffer and . . . decrease as content leaves the buffer.” *Id.* Chou further discloses compensating for decreased network capacity and resultant reduced content arrival rate by reducing the coding bit rate (i.e., the amount of data needed to represent a corresponding amount of media content) to prevent a rebuffering event. *Id.* ¶ 8.

Chou discloses a system that controls a coding bit rate of streaming media data by “dynamically adjusting the coding bit rate of the streaming media data to control client buffer duration” using a linear quadratic optimal control method. Ex. 1004, code (57), ¶ 19. This method is claimed to yield a smooth average bit rate over consecutive frames when deciding whether to change the coding bit rate by using a “leaky bucket model in[] the control loop so that the changes in buffer duration due to natural variations in the instantaneous coding bit rate are not mistaken for changes in buffer duration due to network congestion.” *Id.* ¶ 19. Chou further states “[i]t is noted that in the present system and process, it is not the actual fullness of the client buffer that is controlled, but an upper bound on the time of arrival of bits

into the client buffer to a target level. The upper bound is based on the leaky bucket model of the coding bit rate.” *Id.*

Chou describes a leaky bucket model with reference to its Figure 3, which is reproduced below.

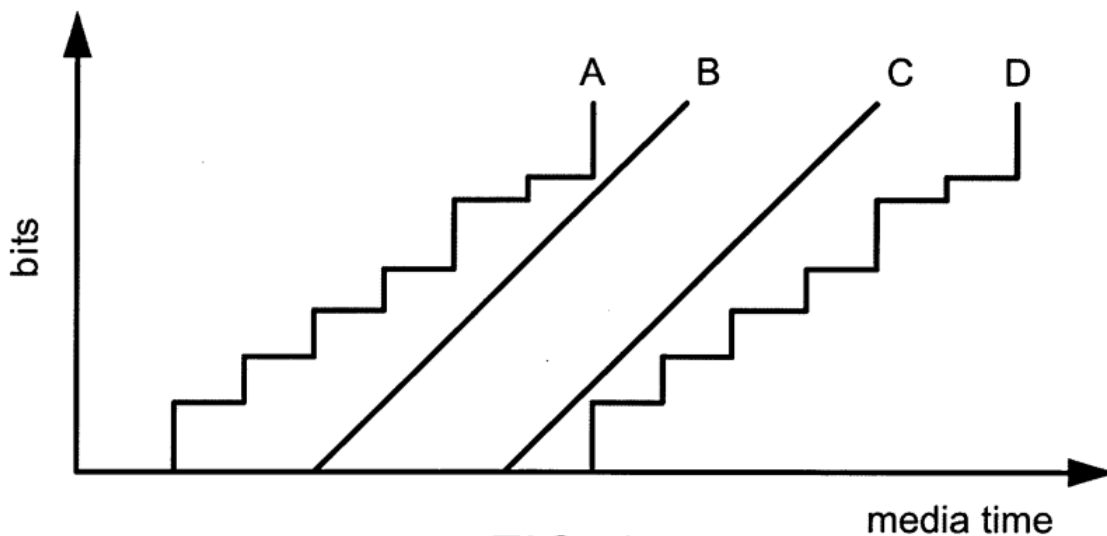


FIG. 3

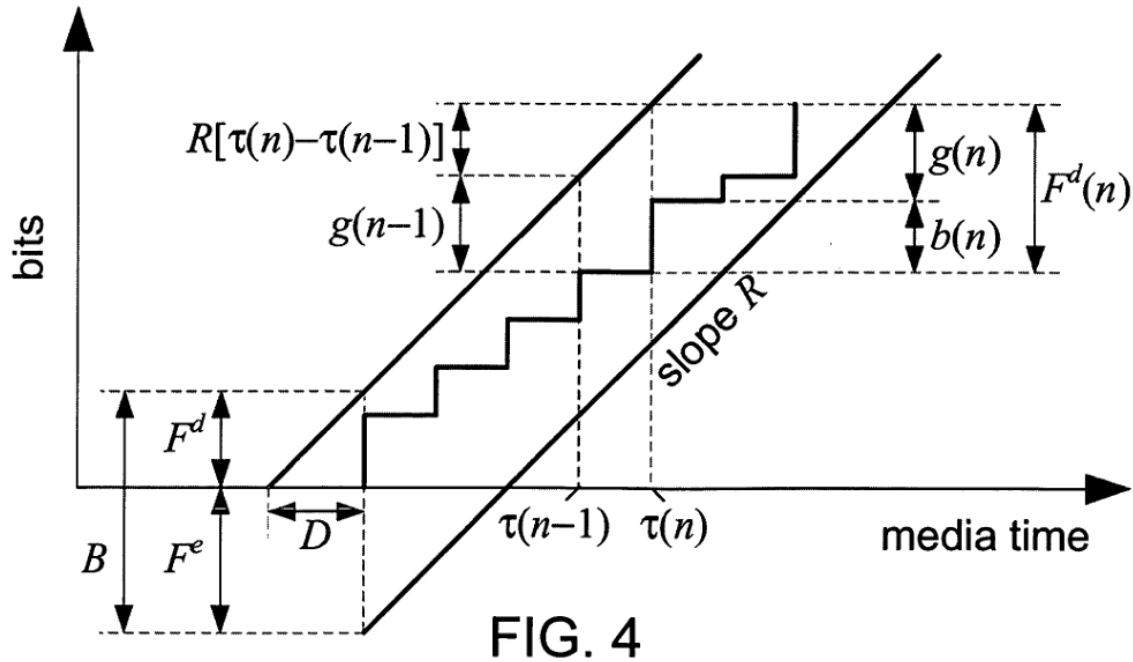
Chou’s Figure 3, reproduced above, is a graph of schedules at which bits in a coded bit stream are put into an encoder buffer (Schedule A), are output from the encoder buffer and enter a communication channel (Schedule B), are delivered by the communication channel to a decoder buffer (Schedule C), and are removed from the decoder buffer and instantaneously decoded for presentation (Schedule D). Ex. 1004 ¶¶ 37, 60. Chou discloses Schedule B is a lower bound to Schedule A, i.e., that it limits the number of bits available to be output from the encoder buffer (Schedule B) to the number of bits put into the buffer (Schedule A) such that encoding of bits cannot fall behind the subsequent transfer of encoded bits to the communication network. *Id.* Similarly, Chou describes Schedule C (provision of bits by the communication network to a decoding buffer) as an upper limit to Schedule

D (removal of frames from the decoding buffer). Chou explains “the gap between Schedules A and B represents, at any point in time, the size in bits of the encoder buffer.” *Id.* Likewise, “the gap between Schedules C and D represents the size of the decoder buffer.” *Id.*

Chou describes the leaky bucket model incorporated into the control loop as a “metaphor for the encoder buffer,” where “[t]he encoder dumps $b(n)$ bits into the leaky bucket at [media] time $\tau(n)$, and the bits leak out at rate R .” Ex. 1004 ¶ 61. Chou explains “[i]f R is sufficiently low, then the bucket will never run dry (underflow), but if R is too low the bucket will eventually overflow,” and “[t]he largest R such that the buffer will never run dry is taken to be the average coding bit rater of the bit stream.” *Id.*

In addition to using the leaky bucket model, Chou further discloses a fast startup technique that controls the target level size of the client buffer over time, starting small to allow for a shorter startup delay, and growing the buffer over time to enhance system robustness. Ex. 1004 ¶¶ 20, 90. At the end of the startup process during which media data is streamed to the client at an initial coding bit rate, the client requests streaming media data be supplied at a new, optimal coding bit rate. *Id.* ¶ 115. Chou further discloses stabilizing code bit rate changes by limiting client requests for an increased coding bit rate to a rate that does not exceed the current moving average arrival rate of the frames except “if the current client buffer duration exceeds the desired duration level by an amount that it is estimated will not be expended at the higher coding bit rate prior to the passing of a prescribed period of time (e.g., 60 seconds).” *Id.* ¶ 29.

Figure 4 of Chou, reproduced below, “is a graph showing a buffer tube containing a coding schedule in terms of bits vs. media time.” Ex. 1004 ¶ 38.



Chou’s Figure 4 reproduced above is a graph of bits representing frames of media content (e.g., video images) arriving and being stored in a receiver’s decoder buffer, the arrival schedule depicted as a step function, “in terms of bits vs. media time.” Ex. 1004 ¶ 38. Labeled parameters and quantities include:

<u>Label</u>	<u>Description</u>	<u>Chou Reference</u>
B	Minimum buffer size/ buffer tube height	¶¶ 60, 62
$b(n)$	Number of bits dumped into leaky bucket – frame size	¶ 61
D	Startup delay between time first bit arrives at the receiver and first frame is decoded	¶¶ 60, 62
$F^d(n)$	Buffer tube offset from top of buffer tube – decoder buffer fullness	¶¶ 60, 66
$F^e(n)$	Buffer tube offset from bottom of tube	¶ 60

<u>Label</u>	<u>Description</u>	<u>Chou Reference</u>
$g(n)$	Gap at frame n between buffer tube upper bound and coding schedule	¶ 66
R	Leaky bucket leak rate	¶¶ 60, 61
$\tau(n)$	Media time	¶ 59

Chou describes “the decoder buffer fullness $F^d(n)=B-F^e(n)$ can also be expressed as

$$F^d(n) = b(n) + g(n) = g(n - 1) + \frac{r_c(n)}{f(n)} \quad (10)$$

where $r_c(n)$ is the coding bit rate of the buffer tube” (Ex. 1004 ¶¶ 66–67 (eq. 10)), $b(n)$ is the frame size, $g(n)$ is the gap at frame n between buffer tube upper bound and coding schedule, and

$$f(n) = \frac{1}{\tau(n+1)-\tau(n)} \quad (4)$$

(*id.* ¶¶ 61, 66 (eq. (4))).

Chou further describes a frame arrival schedule at the decoder with reference to a graph depicted in Chou’s Figure 5 reproduced below.

<u>Label</u>	<u>Description</u>	<u>Chou Reference</u>
$\tau(n)$	Media time	¶ 59

Chou states that “the gap between a frame’s arrival time $[(t_a(n))]$ and its playback deadline $[(t_d(n))]$ is the client buffer duration at the time of the frame arrival. This must be non-negative to allow continuous playback.” Ex. 1004 ¶ 67. Chou further describes using state transition equation 18, reproduced below, to update a buffer tube upper bound $t_b(n)$ by which each frame n is guaranteed to arrive:

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

where $\tilde{r}_a(n)$ is a moving average of bit-arrival rates from the client and $w(n-1)$ is “an error term that captures variations around a locally constant arrival rate.” *Id.* ¶ 68.

According to Chou, by using equation 18, “uninterrupted playback can be achieved by regulating the coding bit rate $[(r_c(n))]$ so that the client buffer does not under flow.” *Id.* ¶ 70. Moreover, Chou discloses that,

[t]o introduce a margin of safety that increases over time, a target schedule is introduced, as illustrated in FIG. 5, whose distance from the playback deadline grows slowly over time. By regulating the coding bit rate $[(r_c(n))]$, it is attempted to control the buffer tube upper bound $[(t_b(n))]$ so that it tracks the target schedule $[(t_T(n))]$. If the buffer tube upper bound $[(t_b(n))]$ is close to the target schedule $[(t_T(n))]$, then the arrival times $[(t_a(n))]$ of all frames will certainly be earlier than their playback deadlines $[(t_d(n))]$ and thus uninterrupted playback will be ensured.

Id.

In addition to the primary goal of controlling upper bound $t_b(n)$ to target schedule $t_T(n)$, Chou teaches a secondary goal to “minimize quality

variations due to large or frequent changes to the coding bit rate.” *Id.* ¶ 71. To achieve both goals, Chou introduces in equation 20 a cost function I , which is to be minimized:

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

Id. ¶ 72. The first term of equation 20 “penalizes the deviation of the buffer tube upper bound $[t_b]$ from the target schedule $[t_T]$ and the second term penalizes the relative coding bit rate difference $[r_c]$ between successive frames.” *Id.*

2. Overview of Wang

Wang relates to “multimedia streaming and, more particularly, to receiver buffer fullness management of the multimedia streaming client.” Ex. 1016, 1:8–10. Wang discloses “provid[ing] to a sender of RTP [(real-time transport protocol)] packets the actual receiver buffer fullness level in a receiver of the RTP packets at a certain time instant represented as the remaining playout duration in time.” *Id.* at 2:50–53. Wang further discloses an implementation by “providing the sender the sequence number of any RTP packet in the receiver buffer and the time difference between the scheduled playout time of this packet and the current time.” *Id.* at 2:53–57. According to Wang, based on the remaining playout duration in time in the receiver buffer, a “server [changes] the transmission characteristic by bitstream switching, transmission rate decoupling where the transmission rate is different from the designated rate in order to increase or decrease the receiver buffer level.” *Id.* at 6:28–35.

3. *Overview of Nobuyoshi*

Nobuyoshi relates to simultaneous reproduction of media by multiple terminals that provides for a terminal to start participating in a playback session already in progress, i.e., midway through audio/visual media reproduction by and in synchronous reproduction with terminals already participating in the session. Ex. 1014 ¶ 8. In particular, Nobuyoshi describes a transmitter terminal connected to one or more player terminals by a communication network, the transmitter terminal providing requested media content to each of the player terminals. *Id.* ¶ 15. The player terminals simultaneously process the content, i.e., synchronously with each other reproduce audio/visual content. *Id.* A nonparticipating player terminal can join the session by “obtaining the playback elapsed time information indicating the elapsed time since the start of the playback of the content data from each player terminal or the transmitter terminal.” *Id.* The terminal requesting to join the session then “determines the playback start time of playback of the content data based on the elapsed time information based on the delay time required for data communication with the transmitter terminal.” *Id.* The joining terminal requests and receives the content data based on the determination. *Id.*

E. Obviousness of Claims 1, 2, 4, 5, 7, 11, 12, 14–18, 20–23, and 25–29 over Chou (Petitioner’s Ground 1)

Petitioner alleges claims 1, 2, 4, 5, 7, 11, 12, 14–18, 20–23, and 25–29 would have been obvious over Chou. Pet. 24–61. Petitioner also relies on the

Reader Declaration in support of its arguments. *Id.* (citing Ex. 1006 ¶¶ 109–243).⁸

We determine that Petitioner has not shown by a preponderance of the evidence that claims 1, 2, 4, 5, 7, 11, 12, 14–18, 20–23, and 25–29 are unpatentable as obvious over Chou, for the reasons explained below.

1. *Independent Claim 1*

Patent Owner disputes that Chou teaches limitation [1d] and, in particular, determining a code rate based on (a) a remaining time before reproduction start time (limitation [1d][ii]) and (b) an available reproduction time (limitation [1d][iii]). PO Resp. 12–46. Because we find Patent Owner’s arguments for limitation [1d][ii] dispositive, we confine our analysis to that limitation and do not reach the parties’ other arguments. Limitation [1d][ii] refers to the portion of claim 1 that requires determining the code rate: “based on a remaining time before reproduction start time set as time at which the reception device starts reproduction of the content from a present moment.”

a) *Petitioner’s Contentions*

Petitioner contends that Chou teaches “setting the coding bit rate to control frame arrival time to achieve [a desired] target buffer duration [(i.e., amount)],” where the “buffer duration is the difference between the reproduction start time ([Chou’s] playback deadline) and the target buffer

⁸ Neither party argues that there are objective indicia of obviousness or non-obviousness, so this factor is not part of our analysis. *See* Pet. 76 (stating that Petitioner “is unaware of any secondary considerations of non-obviousness”); PO Resp. (not raising any objective indicia of non-obviousness).

duration.” Pet. 34–35 (quoting Ex. 1004 ¶ 19 (“[C]oding bit rate control is formulated as a standard problem . . . in which the client buffer duration is controlled as closely as possible to a target level.”)) (citing Ex. 1004 ¶¶ 27–29, 70–75; Ex. 1006 ¶ 143). Petitioner contends Chou discloses providing sufficient time between a target arrival time of a frame and its playback to adjust for network delays and avoid late frame arrival, e.g., the frame arriving after its scheduled playback time. *Id.* at 35 (citing Ex. 1004 ¶ 27). According to Petitioner,

a POSITA would have understood that selection of a code rate for encoding the frame at the present time in Chou, which determines the number of bits to be transmitted for the frame, is done such that the frame’s arrival time is as close to the target arrival time as possible under current network conditions.

Id. (quoting Ex. 1004 ¶ 19).

According to Petitioner, “[b]ecause ‘the amount of time between the target time of a frame and its playback time’ is known, the code rate is selected based on the ‘remaining time before reproduction start time set as time at which the reception device starts reproduction of the content from a present moment.’” Pet. 35–36 (citing Ex. 1004 ¶ 27). In particular, Petitioner maps Chou to limitation [1d][ii], arguing

Chou teaches that at the time of determining the code rate for a subject frame (the present moment), the code rate determining unit determines a playback deadline for the subject frame (the time reproduction will start from the present moment) and adjusts the code rate so that the subject frame arrives at the decoder buffer at or near its target scheduled arrival time.

Pet. 36 (citing Ex. 1004 ¶¶ 27–29, 70–75; Ex. 1006 ¶ 145). According to Petitioner, “[t]his target scheduled arrival time is selected to achieve a desired target buffer duration (or fullness), which is the difference between

the determined reproduction start time and the target scheduled arrival time.”
Id. (citing Ex. 1004 ¶¶ 27–29, 70–75, Ex. 1006 ¶ 145). Petitioner provides the following annotated version of Chou’s Figure 6, asserting the figure “describes frame playback deadlines and a target arrival schedule used to achieve a desired target buffer duration.” Pet. 36–37 (citing Ex. 1004 ¶¶ 70–75; Ex. 1006 ¶ 146).

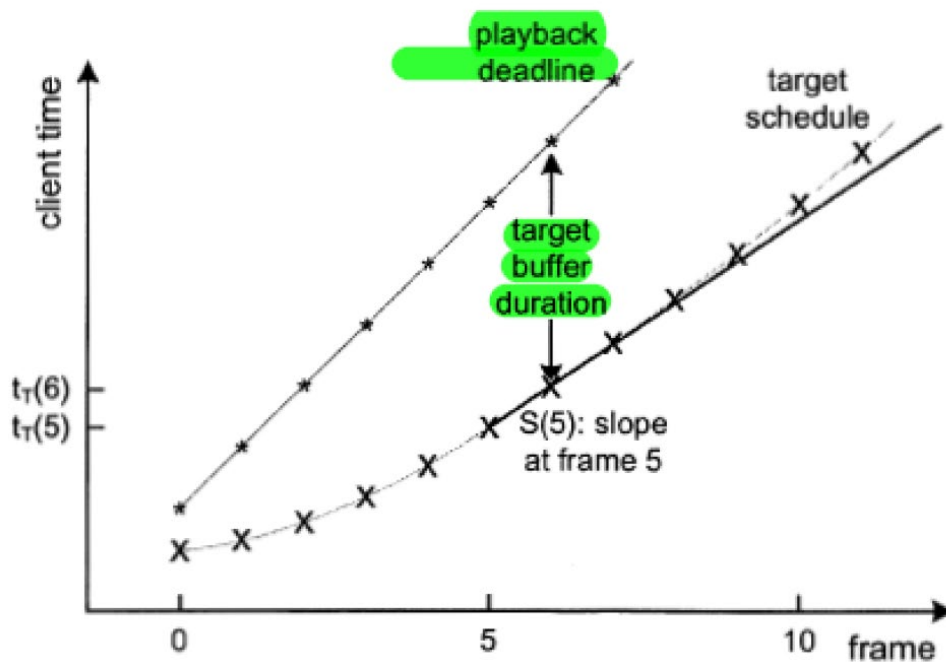


FIG. 6

Annotated Figure 6, depicted above, is a graph showing a target arrival design. Ex. 1004 ¶ 40. Petitioner argues “*Chou* discloses that “[t]he gap between the playback deadline and the target schedule is the desired client buffer duration (in client time).” Pet. 36 (quoting Ex. 1004 ¶ 74). Petition further argues,

This 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, is the claimed “remaining time before reproduction start time set

as time at which the reception device is to start reproduction of the content from a present moment.” Thus, *Chou* teaches controlling coding rates based on the time available for reproducing the content based on the content data stored in the buffer.

Id. at 37 (citing Ex. 1004 ¶¶ 70–75; Ex. 1006 ¶ 147).

Petitioner further argues that “at the moment *Chou*’s system is determining the new coding bit rate, it examines the desired target arrival time based on the target schedule for that frame (e.g., by looking at the slope) and adjusts the coding rate accordingly.” Pet. 38 (citing Ex. 1006 ¶ 148).

b) Patent Owner’s Responses and Petitioner’s Replies

In response to Petitioner’s contentions, Patent Owner contends a complete reading of the claim requires using the available reproduction time in determining the code rate. PO Resp. 12–13. Patent Owner argues “a POSITA would understand that if an available reproduction time is not examined, acquired or determined, then no determination could be made on the basis of the available reproduction time.” *Id.* at 13 (citing Ex. 2012 ¶ 57). According to Patent Owner, claims 2 and 3 further support argument “the ‘available reproduction time’ is an actual value.” *Id.* at 14 (citing Ex. 1001, Claims 2, 3; Ex. 2012 ¶ 58). Thus, Patent Owner argues “a POSITA would understand that Claim 1 requires the available reproduction time that was first determined, acquired, or ‘examined’ using the content data stored in the storage device of the reception device and be used as an input when determining the code rate.” *Id.* at 15 (citing Ex. 1001 9:60–10:18, 10:65–11:3, Claim 1).

Patent Owner directs our attention to the Specification of the '101 patent in support of its argument that “‘based on’ means that a value of ‘the available reproduction time’ and ‘remaining time’ are used in the determination.” PO Resp. 15 (formatting altered). For example, Patent Owner argues the '101 patent describes acquisition of an available reproduction time by an available reproduction time transmission part and that “after the value is received the system ‘determines a code rate for the terminal device having transmitted the available reproduction time information.’” *Id.* at 15–16 (citing Ex. 1001, 9:60–65, 10:7–18; Ex. 2012 ¶ 62). According to Patent Owner, equation (5) of the '101 patent demonstrates that remaining time is used as an input: “Exemplary equation (5) shows determining ‘a code rate r_{n+1} ’ by using the ‘remaining time’ calculated as ‘ $t_s - t_n$,’ which is the ‘reproduction start time’ subtracted from ‘time at the present moment’ and ‘ T_n ,’ which ‘denotes the available reproduction time received this time (i.e., at the present moment).’” *Id.* at 16 (citing Ex. 1001, 10:33–59; reproducing Eq. 5 ($r_{n+1} = B_n \cdot (t_s - t_n) / (T_d - T_n)$)). Thus, Patent Owner argues, “the claimed term ‘based on’ requires use of the values representing the ‘available reproduction time’ and the ‘remaining time’ when determining the code rate, which are both values of time.” *Id.* at 17 (citing Ex. 1012 ¶ 64).

Petitioner replies, contending “‘based on’ merely requires that ‘remaining time’ and ‘available time’ have some influence in determining code rate.” Pet. Reply 3 (formatting altered). Petitioner advances a broader meaning of the term, arguing that “[f]or 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.” *Id.* at 3–4 (citing *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)). Petitioner further argues “‘based on’ does not create a mutual exclusivity; thus, contrary to [Patent Owner]’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.).” Pet. Reply 4 (citing *Masimo Corp. v. Sotera Wireless, Inc.*, 2023 WL 6307959, at *2–3 (Fed. Cir. 2023)). Finally, Petitioner argues “the claims themselves specify that the Available Time is *itself* ‘**based on**’ the data in the buffer.” *Id.*

Patent Owner replies, contending Petitioner mischaracterizes Patent Owner’s “explanation of how a POSITA would understand the claims under a plain and ordinary construction.” PO Sur-reply 1. According to Patent Owner

[t]he plain and ordinary meaning of “based on,” in the context of these claims, would be interpreted by a POSITA to mean that two time variables (i.e., “remaining time” and “available time”) – the details of which are defined by the claims themselves – are used as inputs to the determination of the code rate in Claim [1d].

Id. at 1–2 (citing Ex. 2012 ¶¶ 57, 60, 63, 83).

Rather than adding limitations to the claims, Patent Owner asserts it “is merely insisting that the plain language of the claims requires the time variables, as described, be used as an input in the process of determining the code rate.” PO Sur-reply 3. According to Patent Owner, its position is consistent with cases cited by Petitioner. For example, Patent Owner argues “‘based on’ has been found to mean a condition must first be present for something (e.g., an alarm) to be based on the condition. *Id.* (citing *Masimo Corp. v. Sotera Wireless, Inc.*, No. 2022-1415, 2023 WL 6307959 (Fed. Cir.

Sept. 28, 2023)). Patent Owner further argues, in *Masimo* “[t]he Board cited to a dictionary definition of ‘base on’ . . . noting it defines ‘the verb ‘base on’ to mean ‘to use particular . . . facts to make a decision [or] do a calculation.’” *Id.* (quoting *Masimo* *3 n.1). Patent Owner distinguishes the claims of the ’101 Patent over those considered in *Koninklijke*, cited by Petitioner:

In *Koninklijke* . . . the Court adopted a plain meaning and rejected “as a direct and immediate consequence” because the specification, nor the prosecution history suggested such a limited meaning. . . . In contrast, here, the ’101 Patent (and the plain meaning of “based on”) does support the plain and ordinary meaning of “as an input.”

Id. at 3 n.1 (citing Ex. 2012 § V.A.1, internal citations omitted).

Patent Owner disputes “Petitioner’s position (i.e., that ‘based on’ merely means that a ‘factor’ has some ‘impact or influence’ on the ‘event’).” PO Sur-reply 4 (quoting Pet. Reply 4). Patent Owner argues “[f]or the ‘factor[s]’ (i.e., the available time or the remaining time) to have some ‘impact or influence’ on the ‘event’ (i.e., determining the code rate), the ‘factors’ must be used as inputs in the process of determining the code rate.”

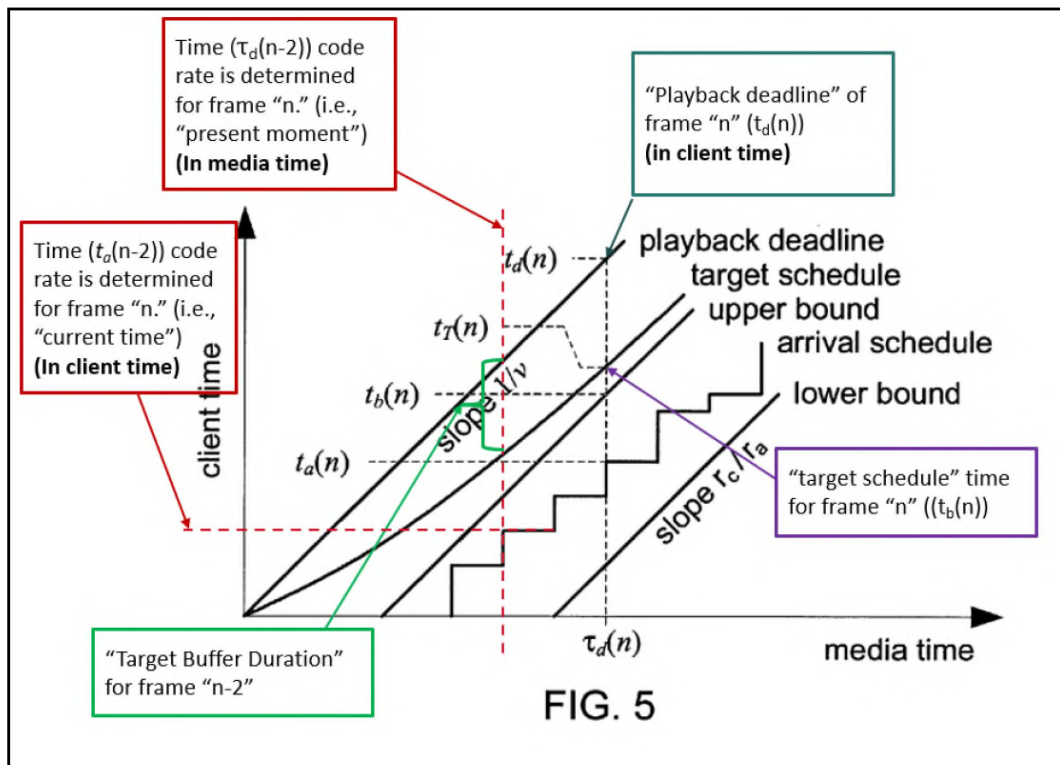
Id. According to Patent Owner,

even adopting Petitioner’s apparent claim construction position, Chou fails to disclose limitation 1[d] because Chou never discloses that the “factor[s]” (i.e., the available time or the remaining time) are used to “impact or influence” the determination of the code rate, as evidenced by Chou’s failure to disclose that the factors are ever determined (much less used) for the determination of the code rate.

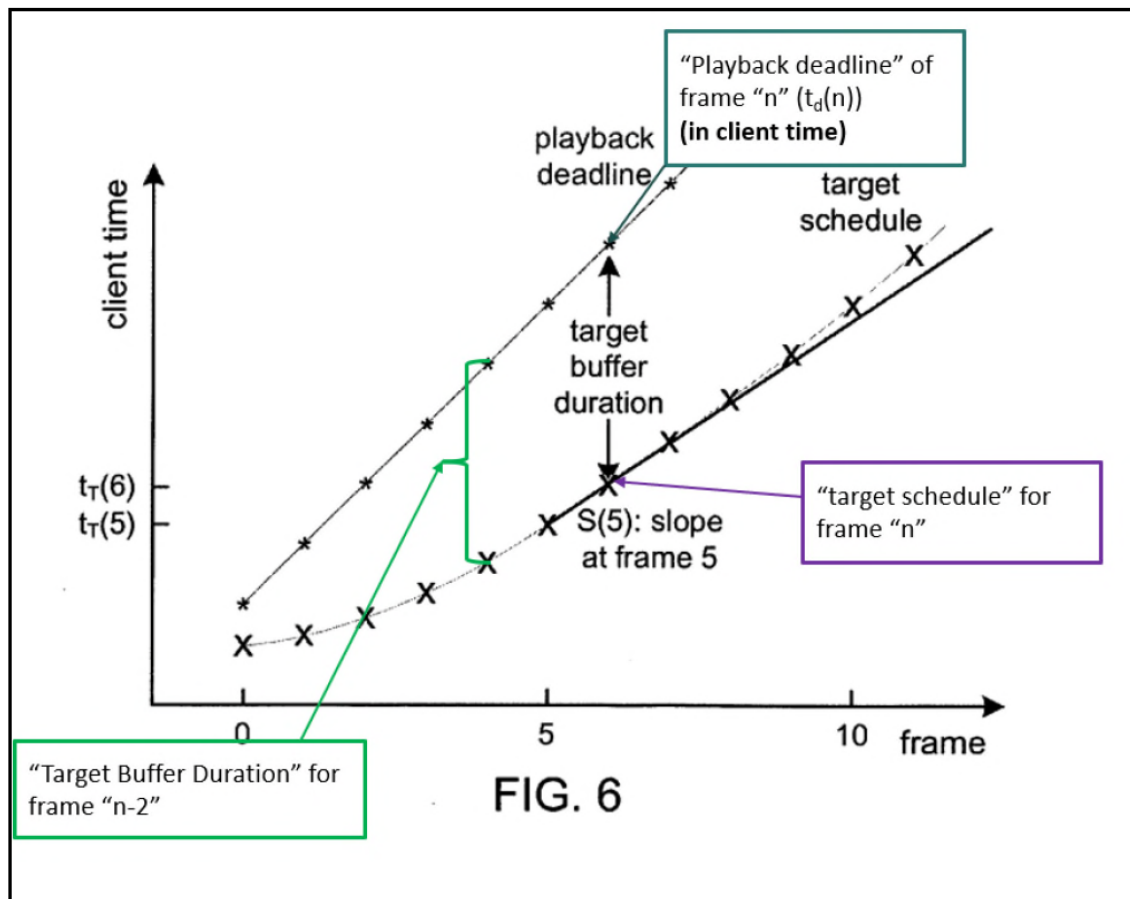
PO Sur-reply 4 (citing Ex. 2012 §§ V.B.2–4).

Patent Owner further contends Petitioner errs in assuming that “*Chou*’s approximation of the ‘upper bound’ to the ‘target schedule’ to control the bit rate is somehow based on a remaining time that is set as time at which the reception device starts reproduction of the content from a present moment.” PO Resp. 41 (citing Ex. 2012 ¶ 110 (citing Pet. 35–36)). Patent Owner argues a lack of support for Petitioner’s position. *Id.* Instead, Patent Owner argues “*Chou*’s rate control is not based on the claimed “remaining time,” which is a measure of how long the reception device will take, from the present moment, to begin the playback of the frame to be transmitted at the new code rate. *Id.* (citing Ex. 2012 ¶ 110).

Patent Owner argues “*Chou* teaches that its primary goal is to ‘control the buffer tube upper bound so that it tracks the target schedule.’” PO Resp. 42 (citing Ex. 2012 ¶ 113, Ex. 1004 ¶ 70). Referring to annotated versions of *Chou*’s Figures 5 and 6, reproduced below, Patent Owner argues *Chou*’s target buffer duration is shown as the gap between the target schedule and playback deadline for a particular frame “*n*,” while claim 1’s remaining time is the difference between a present moment (e.g., $t_a(n)$) and a reproduction start time for content for which a code rate is determined, i.e., content corresponding to future frame $t_d(n+2)$ yet to be transmitted and having a playback deadline two frames from the present moment $t_a(n)$.



Reproduced above is Chou's Figure 5, annotated by Patent Owner to identify the arrival, target and playback deadlines of frame $n-2$ (PO Resp. 42).



Reproduced above is Chou's Figure 6, annotated by Patent Owner to identify the target buffer duration for frame $n-2$ (PO Resp. 43).

Patent Owner presents the following argument:

At time $\tau_d(n-2)$ (in media time), which corresponds to frame "n-2," the earliest that the bit rate can be changed according to Chou is the bit rate for frame "n." EX1004, ¶81 ("Indeed, at time $t_a(n)$, frame $n+2$ is the earliest frame for which the controller can determine the coding bit rate. Hence at time $t_a(n)$, the controller's job must be to choose $r_c(n+2)$."). Accordingly, *in media time*, time $\tau_d(n-2)$ is the "present moment" (e.g., the present moment of when the bit rate is being determined for frame "n") and the "reproduction start time" corresponds to the "playback deadline" (in media time) of frame "n," $\tau_d(n)$. EX2012, ¶113. Moreover, *in client time*, time $t_a(n-2)$ is the "present moment" (e.g., the present moment of when the bit rate is being determined for frame "n") and the "reproduction start time" corresponds to the

“playback deadline” (in client time) of frame “n,” $t_d(n)$. EX2012, ¶113.

PO Resp. 43–44.

Thus, according to Patent Owner, “to be determined based on a ‘remaining time,’ the bit rate would need to be determined based on the value of the ‘reproduction start time from a present moment’ or $(t_d(n) - t_d(n-2))$ (in media time) or $(t_d(n) - t_a(n-2))$ (in client time).” PO Resp. 44 (citing Ex. 2012 ¶ 114). Thus, according to Patent Owner, Chou’s target buffer duration fails to teach a remaining time before reproduction start time because, as shown in the figures, it “is not a ‘remaining time’ that would be the ‘present moment’ of $t_d(n-2)$ subtracted from the time at which frame ‘n’ begins playback $t_d(n)$.” *Id.*

Patent Owner further argues Chou’s “‘playback deadline’ is not sufficient to disclose this element because the ‘playback deadline’ is merely a value expressed in client time or media time that alone is not ‘from a present moment,’ as required by Claim 1.” PO Resp. 45 (citing Ex. 2012 ¶ 116). Patent Owner provides the following annotated table of example frame arrival and playback deadlines in support of its argument that “a value of playback deadline is not equal to the ‘remaining time’ without the reference frame of the ‘current time’ (i.e., a present moment).” *Id.*

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)**.

Patent Owner’s table reproduced above lists exemplary frame arrival and playback deadline media and client times with corresponding remaining and available reproduction times calculated (PO Resp. 45–46).

Patent Owner further argues “Chou does not consider the ‘remaining time’ because there is no value in equation (18) (or any of the equations) that suggest considering (i.e., basing the bit rate determination on) a ‘remaining time.’” PO Resp. 46 (citing Ex. 2012 ¶ 117).

Petitioner replies, arguing with reference to an annotated Figure 5 of Chou reproduced below that the present moment is when frame $n-2$ arrives and the frame rate for frame n is calculated: “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 $t_a(n-2)$.” Pet. Reply 19 (citing Ex. 1040 (Supplemental Declaration of C. Reader) ¶ 21). Petitioner argues “[t]he

playback deadline $t_d(n)$ for frame (n) is the claimed ‘reproduction start time.’” *Id.* Chou’s Figure 5, annotated by Petitioner to identify a “Remaining time” as the client time interval between the scheduled arrival time $t_a(n-2)$ of frame (n-2) and the playback deadline $t_d(n)$ for frame (n), is reproduced below.

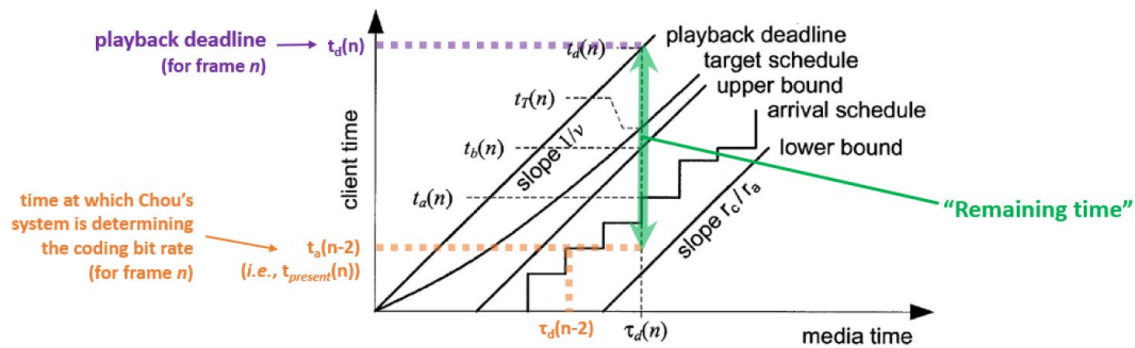


FIG. 5

Reproduced above is Chou’s Figure 5, annotated by Petitioner to identify a “Remaining time” as the client time interval between the scheduled arrival time $t_a(n-2)$ of frame (n-2) and the playback deadline $t_d(n)$ for frame (n) (Pet. Reply 20).

Petitioner disputes Patent Owner’s assertion that the Petition maps remaining time to Chou’s target buffer duration. Pet. Reply 20 (citing PO Reply 41–44). Instead, “[t]he 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.’” *Id.* at 20–21 (citing Pet. 37). Petitioner notes “[t]he Board, relying upon that statement, agreed that Chou discloses remaining time.” *Id.* at 21 (citing Dec. 34–35).

Patent Owner replies, arguing that although Petitioner “agrees with [Patent Owner’s] identification of what a ‘remaining time’ in Chou would be,” Petitioner nonetheless “fails to address PO’s argument that such a

‘remaining time’ is never taught to be used to determine the code rate, as evidenced by at least the fact that Chou never suggests determining that value.” PO Sur-reply 20. Instead, Patent Owner further argues, Petitioner introduces a new variable, $t_{\text{present}}(n)$, in redrawing and annotating Figure 5 to indicate the “remaining time” gap referenced in the Petition. *Id.* (citing Pet. Reply 19–20). Patent Owner further asserts that, “in its reply, Petitioner introduces new arguments that equation (18) of Chou supports its position, but . . . fails to show how [e]quation (18) considers the ‘present moment’ relative to the ‘reproduction start time.’” *Id.* (citing Pet. Reply 22).

Patent Owner further argues, even if Chou’s equation (18) compares the present moment $t_{\text{present}}(n)$ for frame (n) to an upper bound $t_b(n)$, it nonetheless fails to compare the present moment $t_a(n-2)$ to $t_b(n)$. PO Sur-reply 21. According to Patent Owner “[t]his is fatal to Petitioner’s position because Petitioner’s conclusion assumes that [upper bound] $t_b(n)$ is (or becomes) equal in a hypothetical situation to [target schedule] $t_T(n)$.” *Id.* (citing Pet. Reply 23). In particular, Patent Owner asserts, “Petitioner fails to provide any evidence or rationale that a comparison between the arrival time of frame (**$n-2$**), $t_a(n-2)$ (i.e., the present moment), is compared to (or even considered by) the upper bound of frame (**n**), $t_b(n)$.” *Id.* at 21–22.

c) Analysis

We do not agree with Petitioner that “based on” merely requires there be “some influence” in determining the code rate. *See* Pet. Reply 3. Neither party has pointed to any intrinsic evidence that sheds dispositive light on the ordinary and customary meaning of “based on” within the context of the ’101 patent. Therefore, we look to a general-purpose dictionary for guidance in determining the ordinary and customary meaning of “based on” as viewed

by one of ordinary skill in the art at the time the invention was made. *See Phillips*, 415 F.3d at 1322–23. A common meaning of “based on” is to use particular facts or ideas, e.g., to make a decision.⁹ As Patent Owner argues, the ’101 patent describes the existence of values representing a remaining time and an available reproduction time as recited by claim 1’s limitation 1[d]. PO Resp. 15–16. The term “based on” as used by claim 1 is not a mere aspirational goal of controlling a bit-coding rate to avoid buffer underflow or overflow. Instead, the “based on” relationships require that values representing the remaining time before reproduction start time and an available reproduction time exist and be used in determining the code rate of limitation [1d].

Accordingly, as we explain in more detail below, we agree with Patent Owner that Petitioner has not shown by a preponderance of the evidence that Chou teaches or suggests limitation [1d][ii]’s determining the code rate based on a remaining time before reproduction start time set as time at which the reception device starts reproduction of the content from a present moment. PO Resp. 43–44; Pet. Reply 19–21.

Petitioner argues that Chou discloses controlling the coding rate $r_c(n)$ to reach a desired buffer tube upper bound $t_b(n)$. Pet. Reply 22. According to Petitioner, “when attempting to identify the desired value of the upper bound $t_b(n)$, Chou considers the duration from the present moment $t_{\text{present}}(n)$ to the upper bound $t_b(n)$.” *Id.* Petitioner further argues that “for a given frame (n),

⁹ “[B]ase something on something: *phrasal verb* with base *verb* “If you base something on facts or ideas, you use those facts or ideas to develop it” *Base Something on Something*, Cambridge Business English Dictionary, <https://dictionary.cambridge.org/us/dictionary/english/base-on> (last visited Feb. 27, 2025) (Ex. 3004).

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.* at 22–23 (quoting Chou ¶ 74). Petitioner also argues that “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 $t_d(n)$.” Thus, it appears Petitioner assembles three separate and distinct time intervals from Chou’s timing diagrams and equations to construct one contiguous time interval equivalent to claim 1’s remaining time. However, Chou does not recognize the time interval that Petitioner posits, and Petitioner has not persuasively shown that this combined time interval exists as a teaching in the prior art and is used as part of any step or decision involved in determining the code rate.

As admitted by Petitioner’s expert, Dr. Reader, Petitioner’s analysis “used the claims as a road map to find limitations in the prior art.” Ex. 2015, 76:4–9 (Reader Deposition Transcript). *See also* Tr. 28:20–31:2 (Petitioner’s response to whether identification of and integration of separate time ranges described by Chou is hindsight reconstruction, Petitioner argues Chou’s device operates such that code rate is based on remaining time). Under the circumstances, this is improper because Petitioner and Dr. Reader do not justify this combination of separately identified time ranges except based solely on hindsight reconstruction of the claimed invention. However, even if that were not the case, we are not persuaded that Chou or the other asserted prior art references suggest using the combined time interval $t_d(n) - t_a(n)$ as the basis for any decision related to determining the code rate.

Furthermore, as argued by Patent Owner, Petitioner’s reconstruction is based on Chou’s upper bound merging into and becoming equal to the target

schedule whereby $t_b(n) = t_T(n)$. PO Sur-reply 21 (citing Pet. Reply 22).

Although we agree that Chou describes a cost function in which “controlling the upper bound to the target schedule is [a] primary goal,” Chou does not teach that $t_b(n)$ is ever necessarily equal to $t_T(n)$. Chou ¶¶ 71–72. Moreover, the tendency of $t_b(n)$ to approach $t_T(n)$ over time is counteracted by a penalizing term to effectuate a secondary goal of avoiding large or frequent changes to the coding bit rate. *Id.* This is understood to moderate or impede arriving at a condition whereby $t_b(n) = t_T(n)$. We also note that Chou’s Figure 5 depicts the buffer tube’s upper bound as a linear function with the target schedule shifting toward, but never merging with, the upper bound. That is, according to Figure 5, $t_b(n) \neq t_T(n)$. Thus, Petitioner’s reconstruction of the disputed remaining time is premised on an assumption that is not supported by sufficient evidence: that Chou teaches $t_b(n) = t_T(n)$.

Furthermore, Petitioner’s reliance on equation (18) as used to control the coding rate (Pet. Reply 22) is problematic because, as Patent Owner argues, “[e]quation 18 does not compare the present moment $t_a(n-2)$ to $t_b(n)$.” PO Sur-reply 21.

In summary, we agree with Patent Owner that Petitioner fails to show that Chou identifies a value equivalent to the disputed remaining time and that such a value is used, either directly or indirectly, in determining a code rate. Because resolution of this issue is dispositive of whether Chou teaches or suggests limitation [1d][ii], we do not address Patent Owner’s other arguments concerning this limitation.

d) Conclusion Regarding Claim 1

For the foregoing reasons, we determine that Petitioner has not shown by a preponderance of the evidence that independent claim 1 is unpatentable over Chou.

2. Independent Claims 11, 16, 21, 22, and 26–29 and dependent claims 2, 4, 5, 7, 12, 14, 15, 17, 18, 20, 23, and 25

Petitioner refers back to its arguments for claim 1 for all limitations of independent claims 11, 16, 21, 22, and 26–29. Pet. 50–61. With respect to claim 11, Petitioner contends the recited method is taught because “*Chou* further teaches a ‘process for controlling a coding bit rate of streaming media data being transmitted to a client from a server.’” *Id.* at 50 (quoting Ex. 1004 ¶ 19) (citing Ex. 1006 ¶ 192). With respect to claim 16, Petitioner contends it is “substantially similar to [1a]–[1b], [1d]–[1e], but is drafted from the perspective of a transmission device rather than the distribution system.” *Id.* at 52 (citing Ex. 1006 ¶ 201). Petitioner contends the recited transmission device is taught because “*Chou* teaches operation by a client/reception device and/or a server/transmission device for any of [16] and its dependents.” *Id.* (quoting Ex. 1004 ¶¶ 31, 130) (citing Ex. 1006 ¶ 201). With respect to the recitations in claims 21 and 26 of a non-transitory computer-readable storage medium that stores a program comprising instructions, Petitioner contends such embodiments are taught by Chou’s disclosure that “the disclosed process ‘may be described in the general context of computer-executable instructions, such as program modules, being executed by a computer’” and because Chou’s claim 46 is directed specifically to a computer-readable medium. *Id.* at 54, 57 (quoting Ex. 1004 ¶¶ 31, 50, 130) (citing Ex. 1004 ¶¶ 51–55, Ex. 1006 ¶¶ 210, 211, 222).

Patent Owner relies on the same arguments for claims 11, 16, 21, 22, and 26–29 as for claim 1. *See* PO Resp. 62–63. For the reasons discussed in Section III.E.1 above with respect to claim 1, we determine that Petitioner has not shown by a preponderance of the evidence that independent claims 11, 16, 21, 22, and 26–29 are unpatentable over Chou. For the same reasons, we also determine Petitioner has not proven by a preponderance of the evidence that dependent claims 2, 4, 5, 7, 12, 14, 15, 17, 18, 20, 23, and 25 are unpatentable over Chou.

F. Obviousness of Claims 1, 2, 4, 5, 7, 11, 12, 14–18, 20–23, and 25–29 over Chou and Wang (Petitioner’s Ground 2)

1. Independent Claim 1

a) Petitioner’s Contentions

Petitioner contends that Chou teaches [1a]–[1c] and [1e]–[1f] for the reasons given in Ground 1 (*see supra* Sections III.E.1.a–c, e–f). In the alternative, under Ground 2, Petitioner relies on Wang for teaching limitation [1d]. Pet. 62. According to Petitioner, “*Wang* discloses adjusting ‘the transmission rate and/or nominal playout rate of the different media to maintain the receive buffer fullness level.’” *Id.* Petitioner contends Wang’s buffer-stored RTP packets, each including “a sequence number and a timestamp known to the sender,” teach “a difference between a present moment and a scheduled playout time (i.e., reproduction start time) of the selected packet (i.e., remaining time).” *Id.* at 62–63 (quoting Ex. 1016, 5:8–19) (citing Ex. 1006 ¶ 251; Ex. 1016, 3:33–36, 5:8–19, 5:35–37, 6:39–44). Using this timing information, Petitioner contends Wang calculates a current actual receiver buffer fullness, T_{last} . *Id.* at 63 (quoting Ex. 1016, code (57), 5:35–37) (citing Ex. 1006 ¶ 252; Ex. 1016, 3:44–47, 5:57–59). Petitioner

further contends Wang's disclosure of using receiver buffer fullness level to adjust the transmission characteristic

teaches changing the code rate, based on receiver buffer fullness level (available reproduction time), and based on the sequence number of a selected RTP packet in the receiver buffer and the time difference between the scheduled playout time of this packet and the current time (remaining time before reproduction start time). That is, Wang teaches calculating a change in code rate based on both the remaining time before reproduction start time and an available reproduction time, as required by [1d].

Id. (quoting Ex. 1016, code (57), 6:31–37) (citing Ex. 1006 ¶¶ 253–257).

Finally, Petitioner further contends the “teachings of Wang can also be applied in situations where content is being received into the buffer but the initial content playback (i.e., the start of the content being played back) has yet to begin,” explaining how, according to Petitioner, Wang's teachings would provide “the requirements of [1d] in the situation where playback has yet to begin.” Pet. 64–65 (quoting Ex. 1016, 5:32–44) (citing Ex. 1006 ¶ 257).

Addressing motivation to combine, Petitioner contends “Chou, Wang, and the '101 patent all manage buffer duration/fullness (based on time) in order to prevent buffer underflow” and “all view buffer duration/fullness in terms of time.” Pet. 69–70 (emphasis omitted) (quoting Ex. 1004 ¶¶ 7, 19–20, Ex. 1016, code (57), 1:8–10, 1:21–27) (citing Ex. 1006 ¶¶ 271–273). Petitioner further contends “*Chou* and *Wang* both measure similar buffer characteristics to the '101 patent.” *Id.* at 70 (emphasis omitted). According to Petitioner “two factors *Chou* utilizes in determining whether to adjust the code rate to prevent underflow are (1) the amount of time between arrival of a frame and its playback time, and (2) the number of seconds of data

available on the buffer.” *Id.* at 71 (citing Ex. 1006 ¶ 274). Petitioner argues “*Wang* similarly discloses controlling code rate,” using “two factors . . . in determining whether to adjust the transmission rate to prevent underflow are (1) the time difference between a frame and its scheduled playout time, and (2) the amount of time available on the buffer to be played back.” *Id.* at 71–72 (quoting Ex. 1016, 2:50–66) (citing Ex. 1006 ¶ 275). According to Petitioner “Chou and Wang both disclose controlling code rate to control buffer duration/fullness to prevent buffer underflow.” *Id.* at 72 (emphasis omitted). Petitioner contends

Chou primarily focuses on managing buffer duration by controlling the code rate (which Chou describes as “the average number of bits needed to encode one second of content”) of the content being transmitted over the network. EX1004, ¶0007. However, Chou also recognizes that “the buffer duration can be increased by increasing r_a , decreasing r_c , and/or decreasing v (and vice versa for decreasing the buffer duration),” where r_a “is the arrival rate, or average number of bits that arrive at the client per second of real time,” r_c is the code rate, and v is the playback rate. EX1004, ¶0007. Wang manages buffer duration by controlling the transmission characteristics of content over the network (EX1016, Abstract), including the code rate. EX1006, ¶277.

Id. (emphasis omitted).

Petitioner argues “[a] POSITA would have been motivated to combine *Chou* and *Wang*” because incorporating Wang’s teaching of “additional precision in the timing information utilized to determine buffer fullness . . . would further advance *Chou*’s objective to provide optimum quality received content data within the available channel bandwidth.” Pet. 73 (citing Ex. 1004, code (57), ¶¶ 19–21; Ex. 1006, ¶ 278; Ex. 1016, code (57), 1:64–2:16, 2:50–3:9).

b) Patent Owner's Contentions

(i) Code Rate

Patent Owner contends Wang fails to teach limitation [1d]'s determining or changing a code rate. PO Resp. 48. According to Patent Owner, "Wang discloses adjusting 'the transmission rate and/or nominal playout rate . . . to maintain the receive[r] buffer fullness level[.]'" *Id.* (internal citations omitted; alterations in original) (quoting Pet. 62). However, according to Patent Owner, Wang's "'transmission rate' is the number of packets that the sender sends per unit of time" and "refers to the rate of packet transmission, not to changes to the code allowing for distinct code rates as required by the Challenged Claims of the '101 Patent." *Id.* at 48. Patent Owner further argues, because "[t]he 'nominal playout rate' is the rate the receiver reproduced the content per unit of time, . . . [it] is unrelated to the code rate of the data as required by the Challenged Claims." *Id.* Therefore, according to Patent Owner, "[n]either [Wang's] transmission nor playback rates suggest determining or changing *a code rate* of the underlying data." *Id.*; *see also id.* at 55–57.

(ii) Motivations to Combine

Patent Owner contends "[t]he Petition's arguments for motivations to combine fail because they are conclusory and change the principle of operation of the underlying references." PO Resp. 48 (emphasis omitted). Patent Owner argues a POSITA would not have been motivated to combine the teachings of Chou and Wang based on several arguments:

1. Chou teaches away from determining the code rate based on the available time. PO Resp. 48.

2. “Petitioner fails to show a reasonable expectation of success, as *Wang* and *Chou* are directed to different technologies, deployed at different network layers and operate independently to preserve efficiency and modularity in network system design.” *Id.* at 49 (citing Pet. 68–75, Ex. 2012 ¶ 122, Ex. 2006, 313); *see also id.* at 54.
3. “[T]he Petition fails to explain how a POSITA would have substituted or supplemented the proposed ‘linear quadratic formula’ disclosed by *Chou* (which specifically proclaims that ‘it is **not** the actual fullness of the client buffer that is controlled’) with the elements from *Wang*” and, if combined, “would not (and could not) accept the elements of *Wang* without substantial changes.” *Id.* at 52 (citing Ex. 2012 ¶ 127).
4. Combining the asserted element from *Wang* into *Chou* would defeat the purpose of *Chou* by controlling actual buffer fullness rather than using a linear quadratic function to control code rate. *Id.* (citing Ex. 1004 ¶¶ 19, 70, 128).
5. The “combination would change the principle of operation of *Chou* and not be possible without significant effort and experimentation.” *Id.* at 52–53 (citing Ex. 1004 ¶ 129). *See also id.* at 53–54.

(iii) *Scope of Wang’s Teaching vis-à-vis Limitation [Id]*

Patent Owner contends the Petition is unclear about what element of *Wang* is alleged to be incorporated into *Chou*. PO. Resp. 49–50 (citing Ex. 2012 ¶ 124). According to Patent Owner,

it is unclear whether the Petition is arguing that *Wang* could theoretically be combined with *Chou* to remedy *Chou*'s failure to disclose Claim Element [1d] in its entirety, or if the Petition is arguing that *Wang* could be combined with *Chou* to remedy only a portion of Claim Element [1d].

Id. (citing Pet. 69–75 (§IX.D.1); Ex. 2001 ¶ 72).

Patent Owner argues, “[a]s such, the Petition fails to articulate what combination it is proposing and is therefore deficient.” *Id.* at 50. According to Patent Owner “because the Petition does no more than simply point to various independent portions in *Wang* and *Chou* without explaining what is to be modified, why that modification would have been beneficial or motivated by anything other than hindsight, or how the combination would work, the Petition is deficient.” *Id.* (citing *Metalcraft of Mayville, Inc. v. Toro Co.*, 848 F. 3d 1358, 1367 (Fed. Cir. 2017)).

(iv) *Available Reproduction Time*

Patent Owner contends Wang's variable “ T_{last} ” fails to teach an available reproduction time because, in those cases in which the current last packet arrives before earlier packets in the bitstream, the “time available for reproducing the content based on the content data stored in the storage device” will be smaller than the “time difference between the current time and the scheduled playout time of the last packet in the buffer.” PO Resp. 57 (citing Ex. 2012 ¶ 138). Thus, Patent Owner argues, although “in some circumstances the value of ‘ T_{last} ’ may correspond to a value of ‘a time available for reproducing the content based on the content data stored in the storage device of the reception device,’ . . . it does not necessarily correspond to the same value.” *Id.* at 58 (citing Ex. 2012 ¶ 139). Patent Owner further argues a POSITA would not know how to determine those

situations that would result in a divergence of the values or how to correct for such errors. *Id*

(v) *Determining a Code Rate based on Remaining and Available Times*

Patent Owner contends “the Petition is deficient in its support and reasoning.” PO Resp. 59 (citing Ex. 2012 ¶ 143). Patent Owner argues, although Petitioner asserts Wang’s T_x reaches claim 1’s remaining time, T_x only represents the time difference between the current and scheduled playout time. *Id.* (citing Ex. 2012 ¶ 143, Pet. 62–63). Patent Owner further disputes Petitioner’s mapping of T_{last} for teaching available reproduction time. *Id.* (citing Ex. 2012 ¶ 143, Pet. 63). Patent Owner also asserts “[t]he Petition . . . presents a different theory [under which Wang teaches available reproduction time] via a hypothetical situation created by Petitioner” that lacks sufficient evidentiary support and “is conjecture made up by Petitioner and its expert” and is “nonsensical.” *Id.* at 60 (citing Ex. 2012 ¶ 144; Pet. 64–65). Moreover, Patent Owner argues Petitioner’s hypothetical relies on unrealistic assumptions such that T_{first} , applied by Petitioner for teaching remaining time, could not be calculated. *Id.* at 60–61.

Patent Owner further contends, even “accepting the assumptions presented by the hypothetical, the *Wang* reference itself contradicts the conclusions made in the Petition and demonstrates why T_{last} is **not** the claimed ‘available reproduction time.’” PO Resp. 61 (citing Ex. 2012 ¶ 145). In support, Patent Owner provides an example of timings that would result during playback of a first of five packets stored in a buffer asserted to “demonstrate that ‘ T_{last} ’ would produce a value that is not representative of

the time available for reproducing the content as the claims require.” *Id.* at 61–62 (citing Ex. 1012 ¶ 145, Pet. 64–65).

c) Petitioner’s Reply

Petitioner does not address the Wang reference or any other arguments presented by Patent Owner in connection with Petitioner’s obviousness assertions of claims 1, 4–6, 10–16, and 19–26 over the combined teachings of Chou and Wang, Petitioner’s Ground 2. Pet. Reply.

d) Analysis

In our Institution Decision, although expressing some uncertainty with respect to certain of Patent Owner’s arguments on the preliminary record then before us, “we [were] not persuaded by Petitioner’s contentions that [(1)] Wang teaches [1d]’s code rate” (Dec. 53 (citing Pet. 62–65) or (2) “a POSITA would have been motivated to combine the teachings of Chou and Wang” (*id.* at 54 (citing Pet. 74)). Petitioner does not dispute those determinations in its Reply or otherwise. Furthermore, Petitioner does not address or otherwise dispute Patent Owner’s arguments challenging the asserted obviousness of claims 1, 4–6, 10–16, and 19–26 over the combined teachings of Chou and Wang. Thus, for at least the reasons set forth in our Institution Decision, we agree with Patent Owner that Petitioner fails to show that (1) one skilled in the art would have combined the teachings of Chou and Wang or (2) the combined teaching of Chou and Wang renders limitation 1(d) obvious.

e) Conclusion Regarding Claim 1

For the foregoing reasons, we determine that Petitioner has not shown by a preponderance of the evidence that independent claim 1 is unpatentable over the combination of Chou and Wang.

2. Independent Claims 11, 16, 21, 22, and 26–29 and dependent claims 2, 4, 5, 7, 12, 14, 15, 17, 18, 20, 23, and 25

Petitioner refers back to its arguments for claim 1 for all limitations of independent claims 11, 16, 21, 22, and 26–29 and, in connection with dependent claims 2, 4, 5, 7, 12, 14, 15, 17, 18, 20, 23, and 25, to its reasons as in Ground 1. *See* Pet. 65. Similarly, Patent Owner relies on the same arguments for claims 11, 16, 21, 22, and 26–29 as for claim 1. *See* PO Resp. 62. Thus, for the reasons discussed in Section III.F.1 above with respect to claim 1, we determine that Petitioner has not shown by a preponderance of the evidence that independent claims 11, 16, 21, 22, and 26–29 are unpatentable over the combined teachings of Chou and Wang. For the same reasons, we also determine Petitioner has not proven by a preponderance of the evidence that dependent claims 2, 4, 5, 7, 12, 14, 15, 17, 18, 20, 23, and 25 are unpatentable the combined teachings of Chou and Wang.

G. Obviousness of Claims 5, 7, and 15 over Chou and Nobuyoshi (Petitioner’s Ground 3)

For dependent claims 5, 7, and 15, Petitioner argues with citations to Nobuyoshi and Dr. Reader’s testimony that Nobuyoshi teaches each of those claims’ additional limitations. Pet. 65–69. Patent Owner does not provide any arguments specifically for any of the challenged dependent claims, other than contending that Nobuyoshi “does not disclose, teach, or suggest the

elements of claim 1 (or the other independent claims),” relying instead on the arguments presented for the independent claims. PO Resp. 62.

Because, as argued by Patent Owner, Petitioner does not apply Nobuyashi for teaching or suggesting the elements of claim 1 and, in particular, limitation [1d], for the reasons discussed in Section III.E.1 above with respect to claim 1, we determine that Petitioner has not shown by a preponderance of the evidence that dependent claims 5, 7, and 15 are unpatentable over the combined teachings of Chou and Nobuyoshi.

IV. CONCLUSION

For the foregoing reasons, we conclude that Petitioner has not demonstrated by a preponderance of the evidence that any of claims 1, 2, 4, 5, 7, 11, 12, 14–18, 20–23, and 25–29 of the ’101 patent are unpatentable on the grounds presented.

In summary:

Claim(s)	35 U.S.C. §	Reference(s)/ Basis	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
1, 2, 4, 5, 7, 11, 12, 14–18, 20–23, 25–29	103(a)	Chou		1, 2, 4, 5, 7, 11, 12, 14–18, 20–23, 25–29
1, 2, 4, 5, 7, 11, 12, 14–18, 20–23, 25–29	103(a)	Chou, Wang		1, 2, 4, 5, 7, 11, 12, 14–18, 20–23, 25–29
5, 7, 15		Chou, Nobuyoshi		5, 7, 15
Overall Outcome				1, 2, 4, 5, 7, 11, 12, 14–18, 20–23, 25–29

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 1, 2, 4, 5, 7, 11, 12, 14–18, 20–23, and 25–29 of the '101 patent are not determined to be unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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Patent 8,752,101 B2

For PETITIONER:

Scott Weidenfeller
Anupam Sharma
COVINGTON & BURLING LLP
sweidenfeller@cov.com
asharma@cov.com

For PATENT OWNER:

Eliot Williams
Robert Maier
Jennifer Tempesta
Michael Knierim
Nicholas Palmieri
BAKER BOTTS L.L.P.
eliot.williams@bakerbotts.com
robert.maier@bakerbotts.com
jennifer.tempesta@bakerbotts.com
michael.knierim@bakerbotts.com
nick.palmieri@bakerbotts.com