No. 23-1035

United States Court of Appeals for the Federal Circuit

REALTIME ADAPTIVE STREAMING LLC,
Plaintiff-Appellant

v.

SLING TV, L.L.C., SLING MEDIA, L.L.C.,
DISH NETWORK L.L.C., DISH TECHNOLOGIES L.L.C.,
Defendants-Appellees

SLING MEDIA, INC., ECHOSTAR TECHNOLOGIES LLC,
Defendants

Appeal from the United States District Court for the District of Colorado in Case No. 1:17-cv-02097-RBJ, Judge R. Brooke Jackson

CORRECTED PRINCIPAL BRIEF OF PLAINTIFF-APPELLANT REALTIME ADAPTIVE STREAMING LLC

Reza Mirzaie
rmirzaie@raklaw.com
Brian D. Ledahl
bledahl@raklaw.com
RUSS AUGUST & KABAT
12424 Wilshire Boulevard, 12th Floor
Los Angeles, California 90025
Telephone: (310) 826-7474
Facsimile: (310) 826-6991

Philip X. Wang
pwang@raklaw.com
Paul A. Kroeger
pkroeger@raklaw.com
RUSS AUGUST & KABAT
12424 Wilshire Boulevard, 12th Floor
Los Angeles, California 90025
Telephone: (310) 826-7474
Facsimile: (310) 826-6991

Counsel for Plaintiff-Appellant Realtime Adaptive Streaming LLC

January 26, 2023

CLAIMS AT ISSUE FROM U.S. PATENT NO. 8,867,610

Claim 1 (Appx60)

1. A method, comprising:

determining, a parameter or an attribute of at least a portion of a data block having video or audio data;

selecting one or more compression algorithms from among a plurality of compression algorithms to apply to the at least the portion of the data block based upon the determined parameter or attribute and a throughput of a communication channel, at least one of the plurality of compression algorithms being asymmetric; and

compressing the at least the portion of the data block with the selected compression algorithm after selecting the one or more, compression algorithms.

Claim 9 (Appx60)

9. An apparatus, comprising:

a controller configured to:

determine a parameter or an attribute of at least a portion of a data block having video or audio data, and

select one or more compression algorithms from among a plurality of compression algorithms to determine a plurality of compression algorithms to apply to the at least the portion of the data block based upon the determined parameter or attribute and a throughput of a communication channel, at least one of the plurality of compression algorithms being asymmetric; and

a data compression system configured to compress the at least the portion of the data block with the selected one or more compression algorithms.

UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

CERTIFICATE OF INTEREST

Case Number 23-1035

Short Case Caption Realtime Adaptive Streaming LLC v. Sling TV, L.L.C.

Filing Party/Entity Realtime Adaptive Streaming LLC

Instructions: Complete each section of the form. In answering items 2 and 3, be specific as to which represented entities the answers apply; lack of specificity may result in non-compliance. **Please enter only one item per box; attach additional pages as needed and check the relevant box**. Counsel must immediately file an amended Certificate of Interest if information changes. Fed. Cir. R. 47.4(b).

I certify the following information and any attached sheets are accurate and complete to the best of my knowledge.

Date: 01/26/2023

Signature: */s/ Philip X. Wang*

Name: Philip X. Wang

1. Represented Entities. Fed. Cir. R. 47.4(a)(1).	**2. Real Party in Interest.** Fed. Cir. R. 47.4(a)(2).	**3. Parent Corporations and Stockholders.** Fed. Cir. R. 47.4(a)(3).
Provide the full names of all entities represented by undersigned counsel in this case.	Provide the full names of all real parties in interest for the entities. Do not list the real parties if they are the same as the entities. ☑ None/Not Applicable	Provide the full names of all parent corporations for the entities and all publicly held companies that own 10% or more stock in the entities. ☐ None/Not Applicable
Realtime Adaptive Streaming LLC		Realtime Data LLC

☐ Additional pages attached

4. Legal Representatives. List all law firms, partners, and associates that (a) appeared for the entities in the originating court or agency or (b) are expected to appear in this court for the entities. Do not include those who have already entered an appearance in this court. Fed. Cir. R. 47.4(a)(4).

☐ None/Not Applicable ☑ Additional pages attached

See Attachment		

5. Related Cases. Provide the case titles and numbers of any case known to be pending in this court or any other court or agency that will directly affect or be directly affected by this court's decision in the pending appeal. Do not include the originating case number(s) for this case. Fed. Cir. R. 47.4(a)(5). See also Fed. Cir. R. 47.5(b).

☐ None/Not Applicable ☐ Additional pages attached

Realtime Adaptive Streaming LLC v. Sling TV, L.L.C., No. 21-2268 (Fed. Cir.)		

6. Organizational Victims and Bankruptcy Cases. Provide any information required under Fed. R. App. P. 26.1(b) (organizational victims in criminal cases) and 26.1(c) (bankruptcy case debtors and trustees). Fed. Cir. R. 47.4(a)(6).

☑ None/Not Applicable ☐ Additional pages attached

ATTACHMENT

FORM 9 – Certificate of Interest

4. Legal Representatives

Reza Mirzaie of Russ August & Kabat	Marc A. Fenster of Russ August & Kabat	Brian D. Ledahl of Russ August & Kabat
Philip X. Wang of Russ August & Kabat	James N. Pickens of Russ August & Kabat	James S. Tsuei of Russ August & Kabat
Paul A. Kroeger of Russ August & Kabat	Adam S. Hoffman of Russ August & Kabat	Christian W. Conkle of Russ August & Kabat
Timothy T. Hsieh formerly of Russ August & Kabat	Jay C. Chung formerly of Russ August & Kabat	Eric B. Fenster of Eric B. Fenster, LLC
Andrew John Gibbs of Tueller & Gibbs LLC		

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STATEMENT OF RELATED CASES

A prior appeal from the same civil action, CAFC No. 21-2268, is currently pending before this Court. That appeal concerns the validity of United States Patent No. 8,867,610 ("'610 patent") under 35 U.S.C. § 101. There are no other cases pending in this or any other court or agency that will directly affect or be directly affected by this Court's decision in this appeal.

JURISDICTIONAL STATEMENT

The district court had jurisdiction over this patent case pursuant to 28 U.S.C. §§ 1331 and 1338. Realtime timely appealed on October 14, 2022 from the district court's orders awarding attorney fees to Defendants-Appellees and the Second Amended Final Judgment entered on September 20, 2022. This Court has jurisdiction under 28 U.S.C. § 1295(a)(1).

STATEMENT OF THE ISSUES

This appeal presents the following issue for review:

Did the district court err in awarding $3.9 million in attorney's fees based on a patentee's "exceptionally meritless" § 101 position where: (1) the asserted patent had never been found ineligible by another court; (2) the district court denied a motion to dismiss under § 101; (3) the patentee consistently and plausibly argued that the court's claim constructions supported patent-eligibility; (4) another district

court upheld the eligibility of three related patents; and (5) the patentee plausibly argued that the other court's rulings and reasoning regarding related patents supported the eligibility of the asserted patent?

INTRODUCTION

This was not an exceptional case, but it is exceptionally important that this Court reverse the district court's $3.9 million fee award. This case concerns the district court's improper use of § 285 to award the DISH defendants $3.9 million in attorney's fees for roughly six months of work after the '610 patent, which relates to digital data compression, was found to be invalid under § 101 at the summary judgment stage. But nothing about this case supported such an award.

Realtime had every reason to believe in the eligibility of its presumptively valid patent, including because (1) the district court had initially *denied* DISH's motion to dismiss under § 101, relying heavily on prior district court decisions upholding the validity of similar digital data compression patents owned by Realtime's parent; (2) a concurrent district court decision concerning related patents with substantially similar specifications and claim language likewise denied a § 101 motion to dismiss, finding that the patents were firmly rooted in computer technology; (3) the district court adopted Realtime's proposed claim constructions for key terms "compression" and "data block," which supported that the '610 claims

were directed to specific improvements in computer technology; (4) this Court vacated a district court judgment of invalidity under § 101 for still other digital data compression patents owned by Realtime's parent in *Realtime Data LLC v. Reduxio Sys.*, Inc., 831 Fed. Appx. 492 (Fed. Cir. 2020); (5) the PTAB issued two IPR final written decisions upholding the novelty and non-obviousness of a limitation nearly identical to the district court's construction of the '610 patent's "throughput" limitation; and (6) Realtime's expert provided detailed, well-supported opinions that the disclosed methods for digital data compression were not well-understood, routine, or conventional at the time of the invention. All of this evidence, and more, reasonably supported Realtime's position that its claims were patent-eligible under § 101. And it was largely ignored without substantive analysis by the district court.

While this district court ultimately disagreed with Realtime's position, that is not enough to make this case exceptional. Indeed, nothing in the district court's summary judgment order or fee order even remotely suggests that Realtime's arguments were frivolous or objectively meritless—because they were not. Instead, the district court conjured up a handful of "red flags" that purportedly should have alerted Realtime that the '610 claims were "likely invalid," such as a non-precedential decision from this Court regarding different, unrelated patents; a demand letter from DISH's counsel; a declaration submitted by DISH's paid expert;

and final written decisions finding a different patent invalid on § 102 and § 103 grounds. But to the extent these "red flags" were even relevant to the § 101 analysis, none of them, alone or together, conclusively established that Realtime's '610 patent was invalid under § 101 such that Realtime should have simply given up and dismissed its case outright. Realtime was entitled to defend the validity of its presumptively valid patent and have the issue decided by a court of law.

The law is clear. "[F]ee awards are not to be used 'as a penalty for failure to win a patent infringement suit.'" *Gaymar Indus., Inc. v. Cincinnati Sub-Zero Prod., Inc.*, 790 F.3d 1369, 1373 (Fed. Cir. 2015). But that is precisely what the district court did here. It penalized Realtime simply for defending the validity of its patent and ultimately losing that fight. This Court should reverse.

STATEMENT OF THE CASE

This is not an exceptional case, but it is exceptionally important that this Court reverse the district court's $3.9 million fee award. The sole basis of the district court's attorney's fee award is that Realtime's position that the '610 patent is patent-eligible was exceptionally meritless as of January 2021.

A. Denial of DISH's Motion to Dismiss Under § 101

On August 31, 2017, Realtime filed a patent infringement complaint against DISH and related Sling entities (collectively, "DISH") in the District of Colorado. Appx111. On November 6, 2017, Realtime filed a second amended complaint (the

operative complaint) asserting the '610 patent and U.S. Patent No. 8,934,535 ("'535 patent"), which generally relate to digital data compression. Appx189.

On December 6, 2017, DISH filed a Rule 12(b)(6) motion to dismiss, arguing that the asserted patents claim the abstract idea of "selecting a compression scheme based on a characteristic of the data requiring compression," and thus are ineligible under 35 U.S.C. § 101. Appx256–257. Realtime opposed, setting forth evidence and argument demonstrating that the claims are not abstract, but rather are aimed at solving technological problems specific to digital data compression and improving computer functionality. Appx277–279. This evidence included multiple written decisions from different judges in different districts finding similar digital data compression patents by the same inventor (owned by Realtime's parent, Realtime Data LLC), to be patent-eligible.[1] Appx282–283. Realtime also argued that claim

[1] In *Realtime Data v. Actian Corp.*, No. 6:15-CV-463-RWS-JDL, 2016 WL 259581 (E.D. Tex. Jan. 21, 2016) ("*Actian*"), Judge Schroeder adopted the report and recommendation of Magistrate Judge Love and denied defendants' motion to dismiss the patents-in-suit under § 101. In the order, Judge Schroeder rejected the defendants' "oversimplification of Plaintiffs' patents" and expressly found that under Realtime Data's proposed constructions, the patents are "more analogous to those in *DDR Holdings* because they provide technological solutions to problems arising specifically in the realm of computer technology." *Id.* at *1. In *Realtime Data, LLC v. Carbonite, Inc.*, No. 6:17-CV-00121, 2017 WL 4693969 (E.D. Tex. Sept. 20, 2017), Magistrate Judge Love issued a detailed report and recommendation finding that the claims disclose specific improvements in computer capabilities and recommending denial of defendant's motion to dismiss under § 101. The *Carbonite* case was later transferred to the District of Massachusetts, where the district judge,

construction would further confirm the eligibility of the claims because it would "demonstrate that the claims are limited to digital data compression and cannot be performed with pen and paper." Appx293.

On March 7, 2018, the district court conducted a hearing on DISH's motion to dismiss. Appx374–376, Appx378–414. The district court denied the motion on the ground that claim construction was necessary before ruling on § 101 eligibility, relying in part on Judge Schroeder's prior § 101 decision upholding the eligibility of Realtime Data's patents. Appx386–391. The district court noted that Judge Schroeder "actually explains his decision" and that it was "satisfied with the merits of Judge Schroeder's view." Appx386, Appx391.[2]

B. The Central District of California's § 101 Order on Related Patents

Meanwhile, in October 2018, the Central District of California issued an order on the patent-eligibility of three patents related to the '610 patent: the '535 patent

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Judge Young, after "careful consideration," adopted Magistrate Judge Love's report and recommendation in full. *Realtime Data, LLC v. Carbonite, Inc.*, No. 1:17-cv-12499-IT, Dkt. 97 (D. Mass. Mar. 7, 2018) ("*Carbonite*").

[2] In a separate colloquy after the motion to dismiss was denied, the court asked Realtime's counsel about his trial experience and for a non-technical description of the asserted patents. Appx383–384. ("You're speaking techie talk. Talk to me in English. How do they compress data?"). And in the context of giving counsel advice for trial presentation, the court noted that "Maybe this is just an abstract concept." Appx386 ("You're going to have to do a better job explaining this to get your case to a jury and then to win your case. That's my advice for you for the day.").

and US patents 9,769,477 ("'477 patent") and 7,386,046 ("'046 patent"). *Realtime Adaptive Streaming LLC v. Google LLC*, No. 2:18-cv-03629-GW-JC (C.D. Cal. Oct. 25, 2018) ("*Google*"). Appx1332–1345. The court granted the motion to dismiss solely for claims 15–30 of the '535 patent and *denied* the motion to dismiss for the vast majority of the challenged claims, including claims 1–14 of the '535 patent and all claims of the '477 and '046 patents. Appx1341–1342, Appx1345. Notably, the court found that "it would be inappropriate to conclude that Claim 15 of the '535 Patent is representative as to Claims 1–14." Appx1345.

As to the claims that survived dismissal, the Central District found that there is evidence the challenged claims "are tied to specific computer systems that 'improve[] computer functionality in some way' rather than being drawn to purely abstract concepts." Appx1340. The court explained that the claims are "related to compression/ decompression systems, an area firmly rooted in computer technology," and "relate to improvements to such compression/decompression technology." *Id.* The court also rejected defendants' primary argument that the claims are directed to "selecting the most optimal among conventional alternatives." Appx1340–1341. On *Alice* step 2, the court noted that even assuming the patents are drawn to an abstract idea, "there would be a question of fact as to whether the ordered

combination of multiple encoders selected from a system as claimed" was conventional. Appx1342 n.3.

C. Claim Construction of the '610 Patent

In January 2019, the district court issued its claim construction order construing disputed terms of the '610 and '535 patents. Appx1184. The court's constructions for the '610 patent included the following:

'610 Claim Term	District Court's Construction
"throughput of a communication channel"	"number of pending transmission requests over a communication channel"
"asymmetric" compression algorithm	"a compression algorithm in which the execution time for compression and decompression differ significantly"
"compressing / compressed / compression"	"[representing / represented / representation] of data with fewer bits"
"data block"	"a single unit of data, which may range in size from individual bits through complete files or collection of multiple files"

Appx1209–1210.

D. Case Stayed Pending IPR and Stay Lifted

On February 25, 2019, after IPRs on the '610 and '535 patents were instituted, the parties filed a joint motion to stay pending IPR. Appx1211. The district court

granted the motion the following day. Appx1215. DISH's IPR on the '610 patent was subsequently terminated as untimely, and its petition for rehearing was denied. DISH appealed the PTAB's termination decision to this Court, and that appeal was dismissed for lack of jurisdiction. *Sling TV, L.L.C. v. Realtime Adaptive Streaming LLC*, 840 F. App'x 598 (Fed. Cir. 2021).

In January 2021, there were no pending IPRs on the '610 patent, so Realtime requested to lift the stay and to litigate the case that had been filed more than three years earlier. Appx1222–1232. On January 15, 2021, the district court conducted a hearing on the request and lifted the stay. Appx97 (Dkt. 179). The district court noted that "defendants have done everything they can so far to put off the date of reckoning in terms of a court case." Appx1236–1237. Indeed, DISH sought to continue the stay pending its appeal of the PTAB's termination decision. The court, however, found "the odds that's going to be overturned on that appeal are probably slim to none," and lifted the stay. Appx1237. At that point, the '610 patent was the only remaining asserted patent in the case.[3]

[3] During the stay, claims 1–14 of the '535 patent had been found unpatentable on obviousness grounds in another IPR. Accordingly, Realtime withdrew its '535 claims against DISH while the stay was still in place, and before the attorney fees that are the subject of this appeal began to accrue. Appx1219.

Shortly after the stay was lifted, on February 11, 2021, DISH sent a letter demanding that Realtime either "(1) stipulate to dismiss its claims regarding the '610 patent" or "(2) jointly seek to stay the litigation." Appx2146. Realtime promptly responded on February 23, 2021. Appx2149–2154. Regarding dismissal, Realtime explained that "DISH already moved to dismiss [under § 101], which Realtime opposed and the Court denied." Appx2149. Realtime further noted that "DISH has never filed any other motion to dismiss, motion for judgment on the pleadings, or summary judgment motion on [the § 101] issue," and reiterated Realtime's good faith belief that its "claims are strong." *Id*.

Regarding a stay, Realtime explained that "whether the case should remain stayed was the identical issue the parties briefed and argued a little over a month ago." *Id.* It noted that the court had considered and rejected DISH's arguments to continue the stay and therefore Realtime "will not agree to stay the case contrary to the Court's order." *Id.* DISH never responded to Realtime's February 23 letter.

E. DISH's Motion for Summary Judgment

In June 2021—five months after the stay was lifted and 2.5 years after the court's claim construction order—DISH filed a motion for summary judgment for patent-ineligibility under § 101. Appx1386. For *Alice* step one, DISH asserted that the '610 claims are "directed to" selecting a compression algorithm based on data characteristics. Appx1389, Appx1939. To support its assertion, DISH analogized

data compression to "stuffing items into a suitcase," which oversimplified both the relevant technology (digital data compression) and asserted claims:

> Compression is analogous to stuffing items into a small suitcase. A traveler has many options when faced with the challenge of fitting clothes into a suitcase of fixed size, just like a programmer selecting a compression algorithm. The traveler could sit on the suitcase to compress its contents, and then zipper the suitcase. Or, the traveler could more efficiently arrange the suitcase's contents. . . .
>
> Returning to the suitcase analogy, it is inevitable for the traveler to choose how to pack. It would be natural to base that decision on characteristics of the traveler's items and the suitcase itself. A traveler is more likely to use the sitting technique if the suitcase is packed with casual clothes and less likely if it contains fragile items. Similarly, the traveler is more likely to sit on a soft suitcase and less likely with a hard-shell suitcase.

Appx1390–1391.

Realtime submitted a 20-page opposition. Appx1755–1774. It provided a detailed discussion of the '610 patent's claimed invention and improvements over the prior art. Appx1755–1758. On *Alice* step 1, Realtime relied on the court's claim constructions and argued that the '610 claims are directed to computer-specific improvements in digital data compression, i.e., compressing video/audio data by selecting an "asymmetric" algorithm based on both (1) a determined data parameter and (2) the number of pending transmission requests over a communications channel. Appx1759–1760. Realtime also relied on and discussed three Federal Circuit cases: *Visual Memory*, *Enfish*, and *DDR*. Appx1760–1762. Realtime also

argued that DISH's "directed to" assertion—analogizing data compression to "stuffing items into a suitcase"—was incorrect under Federal Circuit law. Appx1763–1766.

On *Alice* step 2, Realtime argued that the intrinsic and extrinsic evidence showed that the '610 claims recite an unconventional combination of elements. Appx1769–1772. Realtime relied on four exhibits: opinions from its expert Dr. Rhyne (Appx1820); deposition admissions from DISH's expert Dr. Bovik (Appx1843); and two IPR final written decisions upholding the novelty and non-obviousness of a limitation nearly identical to the court's construction of the '610 patent's "throughput" limitation (Appx1854, Appx1898).[4]

F. The District Court Grants Summary Judgment Under § 101

On July 31, 2021, the district court issued an order finding the asserted claims of the '610 patent ineligible under § 101 and granting DISH's motion for summary judgment. *Realtime Adaptive Streaming LLC v. Sling TV L.L.C.*, No. 17-CV-02097-RBJ, 2021 WL 3888263 (D. Colo. July 31, 2021); Appx2001–2015. Under *Alice* step 1, the district court adopted DISH's contention that the claims are directed to "selection of a data compression technique based on characteristics of the data in

[4] Those IPR decisions were subsequently upheld by this Court in two Rule 36 affirmances. *See Comcast Cable Comms., v. Realtime Adaptive Streaming LLC,* No. 2020-2281, Dkt. 62 (Fed. Cir. June 15, 2022); *Google*, *LLC v. Realtime Adaptive Streaming LLC,* No. 2021-1545, Dkt. 48 (Fed. Cir. June 15, 2022).

order [to] more efficiently to transmit or store the data." Appx2004. The district court also discussed the cases relied on by DISH under *Alice* step one, including *Adaptive Streaming Inc. v. Netflix, Inc.*, 836 F. App'x 900 (Fed. Cir. Dec. 14, 2020) (unpublished), as well as the *Google* and *Netflix* rulings concerning claim 15 of the '535 patent.

The district court's analysis of these arguments and cases was limited. For example, the district court in its step 1 analysis concluded that "use of 'throughput of the communication channel' to select a compression algorithm is itself an abstract concept," and that, "[m]ost importantly, neither the claim nor the reference to the term 'throughput of the communication channel' in the Specification explains how the system tracks the number of pending transmission requests to determine throughput of the communication channel." Appx2011. The court also simply "agree[d] with Dish that a mechanism for determining the number of requests might not be abstract, but no such mechanism is found in the patent." *Id.* The district court then dismissed Realtime's arguments distinguishing claim 15 of the '535 patent, which does not recite the key limitation "throughput of a communication channel," on the ground that this term "did not render the '610 patent eligible." *Id.*

At *Alice* step 2, the district court heavily relied on the opinions of DISH's expert, Dr. Alan Bovik, in concluding that the '610 claims lack an inventive concept.

The district court recited Dr. Bovik's opinions that "compression is a well-known concept; that the patent did not invent a new compression algorithm; . . . that it did not invent the concept of algorithms having parameters that can be varied to change the performance of the algorithm," and that "the '610 Patent provides no technical details as to *how* the number of pending transmission requests would be monitored." Appx2013, Appx2014. The district court further concluded that Realtime did "not come forward with any evidence that raises a genuine dispute of material fact about whether consideration of the number of pending transmission requests was a new or inventive concept." Appx2013–2014. The court did not address the testimony of Realtime's expert, Dr. Rhyne, regarding the validity of the '610 patent under § 101, which Realtime submitted with its opposition brief. Appx1820–1842. In fact, the court's order did not mention Dr. Rhyne or his expert testimony at all.

Realtime timely appealed the district court's § 101 order and judgment of invalidity on August 25, 2021. Appx107. That appeal (CAFC No. 21-2268) is fully briefed and oral argument will soon be scheduled.

G. The District Court Grants Attorney's Fees Under § 285

On August 13, 2021, DISH filed a motion for attorney fees under 35 U.S.C. § 285. Appx2022. DISH requested an award of over $5 million in fees all incurred in about seven months after the was lifted on January 15, 2021. DISH asserted that Realtime "knew or should have known of the eligibility problem with the '610

patent" in light of the *Google* and *Netflix* orders finding claim 15 of the '535 patent ineligible, and this Court's non-precedential decision in *Adaptive Streaming*. Appx2022–2023, Appx2026–2031. Realtime opposed, explaining that its § 101 arguments were reasonable and well-supported by intrinsic and extrinsic evidence and Federal Circuit authority, and distinguishing DISH's authority, including the *Google* and *Netflix* orders. Appx2353–2354, Appx2358–2363.

On January 20, 2022, the district court issued a written order granting DISH's fees motion. Appx1–10. The district court found that the "case was 'exceptional' because Realtime disregarded repeated indicators that the '610 patent was likely invalid [under § 101] and pressed on at great expense to the defendants (and itself)." Appx3. According to the district court, "[w]hile the stay was in effect certain events bearing somewhat on this case took place." Appx5. Those "events" or "red flags" were (1) the *Google* and *Netflix* decisions finding claim 15 of the '535 patent ineligible; (2) two final written decisions finding claims 1–14 of the '535 patent invalid on *obviousness* grounds; (3) the Federal Circuit's unpublished decision in *Adaptive Streaming*; (4) DISH's letter "reiterat[ing] their position on invalidity [and] not[ing] that substantial litigation expense would be incurred if the case continued"; (5) two non-final office actions on February 4, 2021 and June 9, 2021 finding certain

claims of the ’610 patent invalid on *prior art* grounds; (6) and the opinions of DISH’s expert, Dr. Bovik, that the ’610 claims are ineligible. Appx4–7.

Notably, the district court did not make any finding that Realtime’s § 101 arguments were unreasonable or exceptionally meritless. Nor did the district court find that Realtime had engaged in any litigation misconduct or otherwise litigated the case in an unreasonable manner. Instead, the district court based its “exceptionality” finding on the fact that Realtime did not simply accept DISH’s arguments and dismiss its case in the face of purported “danger signals or red flags,” thereby “accept[ing] the risk of having to reimburse defendants’ reasonable attorney’s fees.” Appx8.

The district court deferred its ruling on the reasonableness of the $5 million amount request by DISH, finding that there was “no indication that the time entries have been reviewed and culled to eliminate inefficiency and assure that the time was necessarily and productively recorded.” Appx9. After additional submissions and a hearing, the district court awarded DISH attorney fees in the amount of $3,911,002.79. Appx11–24. The court entered a second amended final judgment the following day on September 20, 2022. Appx25–26.

Realtime timely appealed the district court’s order awarding attorney fees and final judgment on October 7, 2022. Appx2875.

SUMMARY OF ARGUMENT

The district court never found that Realtime committed litigation misconduct or asserted the '610 patent in bad faith. Rather, the only basis for the court's fee award was the supposed substantive weakness of Realtime's patent-eligibility position. But Realtime's arguments that the '610 claims are patent-eligible under § 101 were not exceptionally weak, and the district court never made sufficient findings to support such a determination. To the contrary, the record shows that Realtime's § 101 position was objectively reasonable for three independent reasons.

First, the district court denied DISH's motion to dismiss under § 101 and Realtime reasonably relied on the court's denial and subsequent claim constructions as supporting its § 101 position. *Second*, Realtime reasonably disputed DISH's *Alice* step one assertion—that the '610 patent claims are directed to "selecting compression based on data characteristics"—as incomplete and incorrect. *Third,* Realtime reasonably relied on § 101 orders from the Central District of California and this Court as supporting its § 101 position.

As an independent basis for reversal, the district court's exceptionality finding rested on legal error and a clear error in judgment in weighing relevant factors. The district court found this was an exceptional case solely based on alleged "red flags" that affected the validity of the '610 claims.

This was erroneous. There is no "red flags" exception to the American Rule. Realtime was entitled to advocate for the '610 patent, which was presumptively patent-eligible and had not been invalidated by any court (for any reason). Realtime may have accepted the risk that it would not win the lawsuit—as all parties do in hard-fought litigation. But it *never* accepted the risk that it would be forced to pay $3.9 million in the other side's attorney's fees.

Indeed, the district court's entire approach of enumerating certain "red flags"—while ignoring Realtime's counterarguments and affirmative arguments and evidence—was the wrong analysis. It is the same approach that the district court followed in *Munchkin* that this Court reversed. *Munchkin, Inc. v. Luv n' Care, Ltd.*, 960 F.3d 1373, 1377 (Fed. Cir. 2020). In *Munchkin*, as here, the district court needed to make a detailed, fact-based analysis of Realtime's litigating positions to establish they were wholly lacking in merit. *Id.* at 1379. And in *Munchkin*, as here, the district court's conclusory approach and failure to make specific findings to support frivolousness was an abuse of discretion. *Id.* at 1380–81.

This is confirmed by an evaluation of the alleged "red flags' identified by the district court. None of those "red flags"—either individually or together—rendered Realtime's § 101 position for the '610 patent exceptionally meritless.

ARGUMENT

I. Standard of Review

Whether the district court applied the correct legal standard under § 285 is reviewed *de novo*. *Gaymar Indus., Inc. v. Cincinnati Sub-Zero Prod., Inc.*, 790 F.3d 1369, 1372 (Fed. Cir. 2015). The district court's factual findings underlying an exceptional case determination are reviewed for clear error, and the determination of whether a case is "exceptional" is reviewed for an abuse of discretion. *Id.*

"A district court abuses its discretion when it makes 'a clear error of judgment in weighing relevant factors or in basing its decision on an error of law or on clearly erroneous factual findings.'" *Munchkin*, 960 F.3d at 1378. And while a district court's exceptional-case determination is entitled to deference, "a district court nonetheless must 'provide a concise but clear explanation of its reasons for the fee award.'" *Id.* To the extent that the district court relies on erroneous legal standards or principles, it abuses its discretion. *University of Utah v. Max-Planck-Gesellschaft zur Foerderung der Wissenschaften e.V.*, 851 F.3d 1317, 1322 (Fed. Cir. 2017).

II. Legal Standard for Fee Award Under § 285

The Supreme Court in *Octane Fitness* defined an exceptional case as "one that stands out from others with respect to the substantive strength of a party's litigating position (considering both the governing law and the facts of the case) or the unreasonable manner in which the case was litigated." *Octane Fitness, LLC v. ICON*

Health & Fitness, Inc., 572 U.S. 545, 554 (2014). The Court further noted that "a case presenting either subjective bad faith or exceptionally meritless claims may sufficiently set itself apart from mine-run cases to warrant a fee award." *Id.* at 555.

Following *Octane Fitness*, this Court has repeatedly held "fee awards are not to be used 'as a penalty for failure to win a patent infringement suit.'" *Gaymar*, 790 F.3d at 1373. "The legislative purpose behind 35 U.S.C. § 285 is to prevent a party from suffering a 'gross injustice,' not to punish a party for losing." *Munchkin*, 960 F.3d at 1378 (citing *Checkpoint Sys., Inc. v. All-Tag Sec S.A.*, 858 F.3d 1371, 1376 (Fed. Cir. 2017)). Accordingly, "a strong or even correct litigating position is not the standard by which we assess exceptionality." *Stone Basket Innovations, LLC v. Cook Med. LLC*, 892 F.3d 1175, 1180 (Fed. Cir. 2018).

When it comes to determining patent eligibility under 35 U.S.C. § 101, several courts, including this Court, have expressly acknowledged the "murky morass that is § 101 jurisprudence." *MySpace, Inc. v. GraphOn Corp.*, 672 F.3d 1250, 1260 (Fed. Cir. 2012); *Interval Licensing LLC v. AOL, Inc.*, 896 F.3d 1335, 1348 (Fed. Cir. 2018) (Plager, J., concurring in part and dissenting in part) (observing that the "incoherent body of doctrine" surrounding § 101 "renders it near impossible to know with any certainty whether the invention is or is not patent eligible" and that "the state of the law is such as to give little confidence" in the court's decisions); *DDR*

Holdings, LLC v. Hotels.com, L.P., 773 F.3d 1245, 1255 (Fed. Cir. 2014) ("Distinguishing between claims that recite a patent-eligible invention and claims that add too little to a patent-ineligible abstract concept can be difficult, as the line separating the two is not always clear."); *CareDx, Inc. v. Natera, Inc.*, 563 F. Supp. 3d 329, 337 (D. Del. 2021), *aff'd*, 40 F.4th 1371 (Fed. Cir. 2022) (collecting cases and explaining that "the state of § 101 law is, to use the words of various Federal Circuit judges, 'fraught,' 'incoherent,' 'unclear, inconsistent[,] . . . and confusing,' and 'indeterminate and often lead[ing] to arbitrary results'"); *California Inst. of Tech. v. Hughes Commc'ns Inc.*, 59 F. Supp. 3d 974, 980 (C.D. Cal. 2014) (explaining that "Supreme Court decisions on § 101 often confuse more than they clarify, as the cases "appear to contradict each other on important issues").

Given this this uncertainty, courts routinely decline to award attorney fees after a finding of patent ineligibility under § 101. *See, e.g.*, *Konami Gaming Inc. v. High 5 Games, LLC*, No. 2:14-cv-01483-RFB-NJK, 2021 WL 6497033, at *4 (D. Nev. Oct. 25, 2021) (while plaintiff "ultimately failed to demonstrate the presence of an inventive concept," its § 101 arguments were "not wholly unreasonable" so as to justify an award of attorney fees); *People.ai, Inc. v. SetSail Techs., Inc.*, No. C 20-09148 WHA, 2022 WL 1556416, at *3 (N.D. Cal. May 17, 2022) (plaintiff's § 101 position was not "so meritless that it warrants a conclusion this action was

exceptional"). This Court has also reiterated that "[i]n view of the evolving nature of § 101 jurisprudence," it is "particularly important to allow attorneys the latitude necessary to challenge and thus solidify the legal rules without the chill of direct economic sanctions." *Gust, Inc., v. Alphacap Ventures, LLC*, 905 F.3d 1321, 1329 (Fed. Cir. 2018) (reversing fee award where patentee's position on patent eligibility was "colorable").

III. Realtime's § 101 Arguments for the '610 Patent Were Reasonable and Not Exceptionally Meritless

The district court never found that Realtime committed litigation misconduct or asserted the '610 patent in bad faith. Appx3. Rather, the only basis for the court's fee award was the supposed substantive weakness of Realtime's patent-eligibility position. Appx1–3. But Realtime's arguments that the '610 claims are patent-eligible under § 101 were not exceptionally weak, and the district court never made sufficient findings to support such a determination.

Realtime's § 101 position was supported under the facts and law, as evidenced by its summary judgment opposition summarized above (Appx1755–1774) and briefing in co-pending appeal (Fed. Cir. No. 21-2268). The district court was not ultimately persuaded by Realtime's arguments. But that does not make this case exceptional. Nowhere did the court demonstrate that Realtime's § 101 arguments

were exceptionally meritless. Nor did the court ever find that Realtime's *entire* § 101 position, under both *Alice* steps, was baseless.

To the contrary, the record shows that Realtime's § 101 position was objectively reasonable for three independent reasons. Each of these reasons was raised below (Appx2353–2367) but glossed over by the district court without substantive analysis. For each of these reasons, the fee award should be reversed.

A. The district court *denied* DISH's motion to dismiss under § 101 and Realtime reasonably relied on the court's denial and subsequent claim constructions as supporting its § 101 position.

A striking aspect of the $3.9 million fee award is that DISH moved to dismiss the '610 patent for lack of patent-eligibility under § 101 and the district court *denied* that motion. The court's denial of DISH's § 101 motion provides strong evidence that Realtime's § 101 position was not frivolous. *See, e.g., Medtronic Navigation, Inc. v. BrainLAB Medizinische Computersysteme GmbH*, 603 F.3d 943, 966 (Fed. Cir. 2010) ("The district court's characterization of Medtronic's claims as frivolous is undermined by the fact that the court denied BrainLAB's motions for summary judgment[.]"); *Munchkin*, 960 F.3d at 1378 ("The ultimate problem with the district court's finding that the trademark claims were 'exceptional' under § 1117(a) is that it conflicts with the court's earlier order granting Munchkin's motion to amend the complaint.").

Indeed, "[a]bsent misrepresentation to the court, a party is entitled to rely on a court's denial of [a motion to dismiss] as an indication that the party's claims were objectively reasonable and suitable for resolution at trial." *Checkpoint*, 858 F.3d at 1376 (quoting *Medtronic*, 603 F.3d at 954). Here, Realtime did not make any misrepresentations and the § 101 issue was fully briefed and argued, and preliminarily resolved in its favor. It was therefore entitled to rely on the court's ruling as an indication that the '610 claims are patent-eligible. Realtime should not be penalized with a $3.9 million fee award for simply "litigating a claim it was granted permission to pursue." *Munchkin*, 960 F.3d at 1381.

To be sure, the denial of a motion to dismiss does not preclude a subsequent fee award in all instances. But the circumstances of the court's § 101 denial here precludes a fee award based on an exceptionally meritless § 101 position *in this case*. In opposing DISH's motion to dismiss, Realtime argued that claim construction would "further illuminate the eligibility" of the claims because it would "demonstrate that the claims are limited to digital data compression and cannot be performed with pen and paper." Appx293. To support this argument, Realtime relied on orders regarding similar patents owned by Realtime's parent, Realtime Data LLC. Appx282–283 (citing and attaching *Realtime Data LLC v. Actian Corp.*, No. 6:15-CV-463-RWS-JDL, 2016 WL 259581 (E.D. Tex. Jan. 21, 2016), *adopting report &*

rec., 2015 WL 11089485 (E.D. Tex. Nov. 30, 2015)). Those orders found that claim construction disputes were material and potentially dispositive on patent-eligibility.

In the *Actian* R&R, Judge Love recommended denying the motion to dismiss because "the issues central to a § 101 determination in this case" included whether "the data Plaintiff refers to throughout the claims should be construed to mean 'digital data.'" *Actian*, 2015 WL 11089485, at *5 (further noting plaintiff's arguments that "the data referred to the claims is specific to *digital* data"). Judge Schroeder adopted the R&R in full. *Actian*, 2016 WL 259581, at *1. He agreed with Judge Love's analysis of the claim construction issue and went further, holding that

> if Plaintiff's construction of the claims at issue prevails, the patents are more analogous to those in *DDR Holdings* because they provide technological solutions to problems arising specifically in the realm of computer technology. *Therefore, under Plaintiff's construction, Defendants' argument that the patents are directed to an abstract idea would fail.*

Id. (emphasis added).

In March 2018, the district court denied DISH's motion to dismiss the '610 patent. The court expressly referred to Judge Schroder's decision, noting that he "actually explains his decision" in adopting Judge Love's R&R. Appx386 at 9:15–25. The court agreed that claim construction disputes were potentially dispositive on patent-eligibility. Appx386 at 9:24–25 ("Depending on which way you construe

certain terms, it might be an abstract idea or might not be."). In response to the court's questioning, Realtime's counsel identified the key claim construction dispute as whether the term "compression" is limited to *digital* data compression. Appx388–389 at 11:10–12:8. The court approved this argument in denying dismissal. It noted that it was "satisfied with the merits of Judge Schroeder's view" and that "we need to get these terms defined and then see where we are." Appx391 at 14:9–15.

In January 2019, the district court issued its claim construction order. The district court adopted Realtime's constructions for "compression" and "data block" in the '610 patent and rejected DISH's broader constructions. Appx1200–1203, Appx1207–1208. For "throughput of a communication channel," the court adopted DISH's narrower construction. Appx1191–1193. The parties' competing proposals are shown below (with the court's constructions in bold):

'610 Term	Realtime's Proposal	DISH's Proposal
"compression"	**"representation of data with fewer bits"**	Plain and ordinary meaning Alternatively: "reduction of the amount of data required to process, transmit, or store a given quantity of information."
"data block"	**"a single unit of data, which may range in size from individual bits through complete files or collection of multiple files"**	Plain and ordinary meaning

’610 Term	Realtime’s Proposal	DISH’s Proposal
“throughput of a communication channel”	Plain and ordinary meaning	**“number of pending transmission requests over a communication channel”**

Appx1200–1203, Appx1207–1208, Appx1191–1193.

Thus, the *same* claim construction dispute discussed at the motion to dismiss stage (and recognized in the *Actian* orders) was resolved in Realtime’s favor. The constructions for “compression” and “data block” further supported the eligibility of the ’610 patent because, as Realtime argued before, they showed “that the claims are limited to digital data compression and cannot be performed with pen and paper.” Appx293. And the court rejected DISH’s broader “plain and ordinary” meaning constructions intended to support unpatentability. And although not proposed by Realtime, the narrower construction of “throughput” further limited the claims to a particular species of digital data compression.

Realtime relied on each of these constructions to argue that the ’610 claims are directed to specific improvements in computer technology and thus patent-eligible. Again, the question is not whether Realtime won. The question is whether Realtime’s reliance on the court’s motion to dismiss denial and subsequent claim constructions to argue for patent-eligibility was reasonable. At the motion to dismiss stage, the district court indicated the claims were patent eligible if it construed them

as limited to digital data compression. The court did construe them as limited to digital data compression but nonetheless changed its own prior ruling in granting summary judgment of ineligibility. While the error of the district court's later summary judgment ruling is the subject of a separate appeal, Realtime could not reasonably have anticipated that the district court would reject its own reasoning and suddenly find claim construction irrelevant. Realtime was consistent in arguing for eligibility under its preferred constructions from the motion to dismiss to summary judgment. And not only were those arguments supported by the two *Actian* orders, they were approved by the court's own reasoning for denying the motion to dismiss.

B. Realtime reasonably disputed DISH's *Alice* step one assertion—that the '610 patent claims are directed to "selecting compression based on data characteristics"—as incomplete and incorrect.

Realtime's § 101 position was also reasonable because it was fully justified in disputing DISH's characterization of the asserted claims. For *Alice* step one, DISH asserted that the '610 claims are "directed to" selecting a compression algorithm based on data characteristics. Appx1272. To support this assertion, DISH analogized digital data compression to "stuffing items into a suitcase":

> Compression is analogous to stuffing items into a small suitcase. A traveler has many options when faced with the challenge of fitting clothes into a suitcase of fixed size, just like a programmer selecting a compression algorithm. The traveler could sit on the suitcase to compress its contents, and then zipper the suitcase. Or, the traveler could more efficiently arrange the suitcase's contents . . . .

> Returning to the suitcase analogy, it is inevitable for the traveler to choose how to pack. It would be natural to base that decision on characteristics of the traveler's items and the suitcase itself. A traveler is more likely to use the sitting technique if the suitcase is packed with casual clothes and less likely if it contains fragile items. Similarly, the traveler is more likely to sit on a soft suitcase and less likely with a hard-shell suitcase.

Appx1273–1274.

Realtime disputed this analogy as inapplicable to the subject matter of the '610 patent: digital data compression. Realtime also disputed DISH's characterization of the '610 claims under *Alice* step 1 as an oversimplification that stripped out most of the claim language (including the limitations of using "asymmetric" compression and selecting compression based on "a throughput of a communications channel"). Indeed, DISH's directed to assertion—"selecting compression based on data characteristics" (Appx1272)—was so broad that it could describe nearly any patent in the field of data compression. It was even broader than the description at issue in *Realtime Data*: "choosing a compression method based on the data type." *Realtime Data LLC v. Reduxio Sys., Inc.*, 831 F. App'x 492, 497 (Fed. Cir. 2020) ("*Realtime Data*"). But this Court already rejected the *Realtime Data* description because it invoked "sweeping generalizations" and "created an incorrect starting point for the required analysis." *Id.* The same flaw applied to DISH's directed to assertion for the '610 patent, which simply took the description from

Realtime Data and further broadened it by replacing "data type" with "data characteristics."

Here, DISH has the burden to prove patent-ineligibility by clear and convincing evidence and was required to accurately characterize the '610 claims under *Alice* step one. As Judge Stark explained, the requirement to "articulate an abstract idea that is fair to the claims being challenged" is "one of the most basic tasks required of the party moving to end a patent infringement cause of action based on Section 101." *Consumeron, LLC v. Maplebear Inc.,* C.A. No. 21-1147-LPS, 2021 WL 7209516, at *6 (D. Del. Nov. 30, 2022) ("The importance of fairly stating an abstract idea to which the claims are allegedly directed is clear from many decisions of the Supreme Court and the Federal Circuit."). And where defendants fall short of that obligation, "the Court is free to deny the motion *on that basis alone*." *Id.* (emphasis added); *see also Digi Portal, LLC v. Quotient Tech. Inc.,* C.A. No. 18-1485-LPS-CJB, 2019 WL 2904670, at *2 (D. Del. July 5, 2019) (denying motion to dismiss and noting that "[w]hile it may be possible that claim 1 could be accurately characterized as directed to some abstract idea, all I need to decide today is that the claim is not directed to the abstract idea articulated by defendant").

In this case, Realtime disputed DISH's step one assertion—and its related "stuffing items into a suitcase" analogy—as an unfair characterization of the '610

claims. That was reasonable under the facts and the law. DISH therefore erred at the foundational stage and could not meet its burden to prove ineligibility by clear and convincing evidence. Realtime was not required to come up with a better step one argument on DISH's behalf. Nor was it required give up based on the perceived strength of a hypothetical argument / step 1 articulation that DISH never made. To the contrary, the '610 patent was presumptively patent-eligible. And Realtime had every right to argue that DISH was oversimplifying the claims and therefore failed to prove patent-ineligibility.

C. Realtime reasonably relied on § 101 orders from the Central District and this Court as supporting its § 101 position.

Realtime's § 101 position was also reasonable in view of the Central District of California's § 101 order denying a motion to dismiss on three patents related to the '610 patent. Like all claims of the '477 and '046 patents addressed by the Central District, the '610 claims recite "throughput" and require compression based on throughput and other parameters. Indeed, much of claim 9 of the '610 patent (the apparatus version of claim 1) and claim 1 of the '477 patent are similar in substance:

'610 Patent Claim 9	'477 Patent Claim 1
An apparatus, comprising:	A system, comprising . . .
a controller configured to:	**one or more processors configured to**:
determine a parameter or an attribute of at least a portion of a	**determine one or more data parameters**, at least one of the determined one or more data parameters

’610 Patent Claim 9	’477 Patent Claim 1
data block having video or audio data, and	relating to **a throughput of a communications channel** measured in bits per second; and
select one or more compression algorithms from among a plurality of compression algorithms to determine a plurality of compression algorithms to apply to the at least the portion of the data block **based upon the determined parameter** or attribute **and a throughput of a communication channel**, at least one of the plurality of **compression algorithms being asymmetric**	**select one or more asymmetric data compression encoders** from among the plurality of different asymmetric data compression encoders **based upon, at least in part, the determined one or more data parameters.**

Appx69, Appx2393 (similar limitations bolded).

The Central District found that there is evidence that the claims of the ’477 and ’046 patents “are tied to specific computer systems that ‘improve[] computer functionality in some way’ rather than being drawn to purely abstract concepts.” Appx2398. The court explained that the claims are “related to compression/ decompression systems, an area firmly rooted in computer technology,” and “relate to improvements to such compression/decompression technology.” Appx2398.

The Central District also rejected defendants’ primary argument that the claims are directed to “selecting the most optimal among conventional alternatives.” Appx2396–2397. On this point, the court analyzed this Court’s *Visual Memory* decision and found it to be “particularly instructive” for supporting eligibility.

Appx2397–2398. The court even copied the claim at issue in *Visual Memory* and analogized it to the claims of the ’477 and ’046 patents. Appx2397–2398. On *Alice* step 2, the court noted that even assuming the claims are drawn to an abstract idea, there would be a question of fact as to whether “the ordered combination of multiple encoders selected from a system as claimed” was conventional. Appx2399 at n.3.

Realtime relied on each of these findings in opposing summary judgment. Indeed, Realtime’s reliance on the Central District’s order and this Court’s *Visual Memory* decision (which the Central District found “particularly instructive” for assessing Realtime’s claims) was certainly reasonable. Under any objective measure, they supported Realtime’s § 101 arguments for the ’610 patent and showed those arguments had merit. There is no evidence or findings in the record that show that Realtime’s reliance on the Central District’s order and *Visual Memory* was frivolous. The court’s $3.9 million fee award should therefore be reversed.

Further still, by the time the stay was lifted (in January 2021), this Court had issued its *Realtime Data* decision a few months earlier (in October 2020). *Realtime Data LLC v. Reduxio Sys.*, Inc., 831 Fed. Appx. 492 (Fed. Cir. 2020). That decision offered additional support for Realtime’s position, including regarding the *Actian* and *Carbonite* decisions that the district court relied on in denying the motion to dismiss for the ’610 patent. In *Realtime Data*, this Court noted that Judge Love’s

"lengthy written opinions" were "fully adopted by two different district court judges—Judge Robert W. Schroeder III of the Eastern District of Texas and . . . Judge William G. Young of the District of Massachusetts—each with significant experience in patent cases." *Id.* at 494. This Court vacated the district court's judgment that the asserted digital data compression patents were ineligible for patenting under § 101 due in part to its failure to acknowledge, much less distinguish those decisions. As noted by this Court, "[t]wo district court judges and one magistrate judge, across two judicial districts, have separately considered whether the claims are patent eligible and concluded that they are." *Id.* at 497–98.

This Court also "questioned" the district court's statements that the claims were directed to "merely 'choosing a compression method based on the data type,'" as this characterization "omit[ed] key aspects of the claims." *Id.* at 497. Accordingly, the Court "caution[ed] the district court away from sweeping generalizations" and directed it to "carefully consider the 'directed to' question once more." *Id.*

Judge Taranto also wrote a concurring opinion further emphasizing the importance of avoiding overgeneralizations, noting that the district court "erred at the foundational stage" in failing to consider what the claim language and specifications make clear are important advances over the prior art. *Id.* at 499. Judge Taranto further noted that "the claims, on their face and understood in light of the

specifications, purport to solve engineering problems in the transfer of data." *Id.* at 500. Judge Taranto further directed the district court to consider "a number of post-July 2019 precedents that provide clarifying guidance concerning the inquiries pertinent to the analysis in cases like the ones before us," including *TecSec, Inc. v. Adobe Inc.*, 978 F.3d 1278 (Fed. Cir. 2020); *Packet Intel. LLC v. NetScout Sys., Inc.*, 965 F.3d 1299 (Fed. Cir. 2020), *Uniloc USA, Inc. v. LG Elecs. USA, Inc.*, 957 F.3d 1303 (Fed. Cir. 2020); *Koninklijke KPN N.V. v. Gemalto M2M GmbH*, 942 F.3d 1143 (Fed. Cir. 2019); and *SRI Int'l, Inc. v. Cisco Sys.*, Inc., 930 F.3d 1295 (Fed. Cir. 2019). *Id.* at 501.

The Court's analysis in *Realtime Data* and its decisions in *TecSec*, *Packet Intelligence*, *Uniloc*, *Koninklijke*, and *SRI* further supported Realtime's belief that its claims were patent-eligible under § 101, and further informed Realtime's decision to proceed forward with its claims against DISH.

IV. The So-Called "Red Flags" Identified by the District Court Fail to Show that Realtime's § 101 Position Was Exceptionally Meritless

Because Realtime's § 101 position was not exceptionally meritless, the fee award should be reversed. But as an independent basis for reversal, the district court's exceptionality finding rested on legal error and a clear error in judgment in weighing relevant factors. The district court found this was an exceptional case solely based on alleged "red flags" that affected the validity of the '610 claims. The

district court found that "by carrying on despite numerous danger signals or red flags as I have called them, Realtime accepted the risk of having to reimburse defendants' reasonable attorney's fees." Appx8.

This was error. There is no "red flags" exception to the American Rule. As Judge Dyk explained, "the mere fact that the losing party made a losing argument is not a relevant consideration" for an *Octane Fitness* fee award. *Stragent, LLC v. Intel Corp.*, No. 6:11-cv-421-TBD-JDL, 2014 WL 6756304, at *4 (E.D. Tex. Aug. 6, 2014). Rather, "the focus must be on arguments that were frivolous or made in bad faith." *Id.* "To impose fees on a party simply for making losing arguments would be the same in effect as fully adopting the English Rule, whereby the losing party always pays the winner's fees." *Id.*

Realtime was entitled to advocate for the '610 patent, which was presumptively patent-eligible and had not been invalidated by any court (for any reason). Realtime may have accepted the risk that it would not win the lawsuit—as all parties do in hard-fought litigation. But it *never* accepted the risk that it would be forced to pay $3.9 million in the other side's attorney's fees. *See Gaymar*, 790 F.3d at 1373 ("fee awards are not to be used 'as a penalty for failure to win a patent infringement suit'"); *Nantkwest, Inc. v. Iancu*, 898 F.3d 1177, 1181 (Fed. Cir. 2018) (*en banc*) ("[T]he American Rule preserves access to district courts for small

businesses and individual inventors seeking to avail themselves of [the Patent Act's] benefits.").

Indeed, the district court's entire approach of enumerating certain "red flags"—while ignoring Realtime's counterarguments and affirmative arguments and evidence—was the wrong analysis. It is the same approach that the district court followed in *Munchkin*, where it concluded that "Munchkin was objectively unreasonable in persisting in all out litigation' in the face of '*these red flag warnings*' as to the '993 patent's validity." *Munchkin*, 960 F.3d at 1377 (emphasis added). This Court reversed. In *Munchkin*, as here, the district court needed to make a "detailed, fact-based analysis of Munchkin's litigating positions to establish they were wholly lacking in merit." *Id.* at 1379. And in *Munchkin*, as here, the district court's conclusory approach and failure to make specific findings to support frivolousness was an abuse of discretion. *Id.* at 1380–81.

For the same reasons as in *Munchkin*, the district court's fee award should be reversed. This is confirmed by an evaluation of the alleged "red flags" identified by the district court. None of those "red flags"—either individually or together—rendered Realtime's § 101 position for the '610 patent exceptionally meritless.

A. The *Google* and *Netflix* Decisions Regarding Claim 15 of the '535 Patent

The first red flags identified by the district court are the two district court decisions in *Google* and *Netflix* finding claim 15 of the '535 patent ineligible under § 101. According to the district court, those rulings were "highly significant" to its "ultimate determination that the '610 patent suffered the same fate." Appx4. The court noted that the "two patents have nearly the same title," "the specifications for the two patents are virtually identical," and, "[m]ost importantly, Claim 1 of the '610 patent and Claim 15 of the '535 patent are so similar as to be essentially the same in substance." *Id.* Thus, in the court's view, "the two cases should have featured prominently in Realtime's thinking about the present case." Appx5.

But as a matter of law, the mere fact that claim 15 of the '535 patent was found ineligible did not render Realtime's § 101 arguments as to '610 claims frivolous. This Court has made clear that "separate patents describe 'separate and distinct [inventions],' and it cannot be presumed that related patents rise and fall together." *Comair Rotron, Inc. v. Nippon Densan Corp.*, 49 F.3d 1535, 1539 (Fed. Cir. 1995); *Data Engine Techs. LLC v. Google LLC*, 906 F.3d 999, 1002 & n.1, 1011–12 (Fed. Cir. 2018) (finding claim from one patent eligible despite finding claim from another patent with a "substantially identical" specification ineligible). This is because all issued patents are presumptively patent eligible under § 101, *Cellspin Soft, Inc. v.*

Fitbit, Inc., 927 F.3d 1306, 1319 (Fed. Cir. 2019), and the § 101 analysis is "claim specific." *Realtime Data*, 831 F. App'x at 497; *see also CosmoKey Sols. GmbH & Co. KG v. Duo Sec. LLC*, 15 F.4th 1091, 1099 (Fed. Cir. 2021) ("While prior cases can be helpful in analyzing eligibility, whether particular claim limitations are abstract or, as an ordered combination, involve an inventive concept that transforms the claim into patent eligible subject matter, *must be decided on a case-by-case basis* in light of the ***particular claim limitations***, patent specification, and invention at issue." (emphasis added)).

Indeed, the Central District's order in *Google* expressly limited its ineligibility ruling to claim 15 of the '535 patent and its dependent claims. As discussed above, the Central District *denied* the motion to dismiss for the vast majority of the challenged claims, including all claims of the '477 and '046 patents and claims 1–14 of the '535 patent. Thus, under the terms of the order itself, claim 15 of the '535 patent was distinguishable and did not undermine the eligibility of two related patents (or even other claims of the same patent).

Realtime agreed that claim 15 of the '535 patent was distinguishable from other patents / claims and therefore did not seek to amend claim 15 (even though the Central District granted leave to do so). Unlike the claims of the '610 patent—and claims of the '477 and '046 patents—claim 15 of the '535 patent does not recite

"throughput" at all and describes compression based on data characteristics alone. In this critical respect, the claims of the '610 patent were more similar to the claims of the '477 and '046 patent. This is supported by the chart above comparing '610 claim 9 to '477 claim 1 that was addressed in the Central District's order.

In addition, the Central District's primary concern that claim 15 of the '535 patent could be "performed manually by a user" did not apply to the '610 claims, especially in light the court's narrower claim constructions discussed above. For example, it would be impossible for a human to manually compress audio or video data based on the "throughput of a communication channel," i.e., "a number of pending transmission requests across a communications channel." This is especially so under the court's construction for "asymmetric" compression, which invoked "execution time." This was yet another reason that claim 15 was distinguishable.

The Magistrate Judge's R&R in *Netflix* regarding claim 15 of the '535 patent was distinguishable for the same reasons. The R&R treated claim 15 as representative of all claims of the '535 patent. But claim 15 had different limitations and was not representative of the '610 claims, including because it does not recite the key "throughput" limitation. Appx1767–1768; *see also* CAFC No. 21-2268, Dkt. 24 at 45–46. Claim 15 was not even representative of claims 1–14 of the '535 patent

as the Central District found. The R&R's discussion of the § 101 issue was also contrary to the Central District's rulings in favor of eligibility.[5]

In sum, Realtime presented reasonable, fact-based arguments that the claims of the '610 patent are more analogous to the claims of the '046 and '477 patents, which (like the '535 patent) also share a similar title, specification, and claim language, and which the Central District found were not abstract. The district court's conclusory assertion that claim 15 of the '535 patent is "so similar" to the '610 patent is insufficient and cannot sustain a $3.9 million fee award. Nor can it justify disregarding Realtime's arguments under the facts and law. Indeed, to the extent the district court wanted to rely on the outcome of related patents to assess the reasonableness of Realtime's § 101 position on the '610 patent, it needed to address the Central District's rulings on the '477 and '046 patents that supported Realtime. Yet the district court ignored the vast majority of the Central District's order and gave no indication that the findings and reasoning regarding the '477 and '046 patents even existed. This was "a clear error of judgment in weighing relevant factors" and therefore an abuse of discretion. *Munchkin*, 960 F.3d at 1378.

[5] Notably, neither the district court nor DISH ever asserted that the R&R's rulings on the '477 and '046 patents undermined the eligibility of the '610 patent. For good reason. The Central District provided detailed analysis regarding the '477 and '046 patents, which supported Realtime's eligibility arguments on the '610 patent.

Further still, whether the claims of the '610 patent are "more like" claim 15 of the '535 patent or claim 1 of the '477 patent is at minimum subject to reasonable debate. It is the akin to any number of factual or legal arguments that parties dispute every day—and certainly not exceptional. Here, there is no indication that the district court considered claim 1 of the '477 patent or compared them to the '610 claims. This was necessary to provide a "fact-intensive" explanation for why Realtime's argument was allegedly frivolous. Because the district court did not—and because Realtime's argument was not frivolous—the fee award should be reversed.

B. This Court's Non-Precedential Decision in *Adaptive Streaming Inc. v. Netflix, Inc*.

Another "red flag" identified by the district court was this Court's unpublished decision in *Adaptive Streaming Inc. v. Netflix, Inc.*, 836 F. App'x 900 (Fed. Cir. 2020). That order involved an unrelated patent and party that has nothing to do with Realtime or Realtime Data LLC. While the district court correctly observed that an "unpublished opinion does not create a binding precedent," it nonetheless found that "it was another red flag for the present case." Appx6. This too was error.

This Court has expressly held that "a non-precedential decision . . . is not binding" and "should be read as ***limited to the particular claim and specification at issue in that case***." *Exmark Mfg. Co. Inc. v. Briggs & Stratton Power Prod. Grp., LLC*, 879 F.3d 1332, 1346 (Fed. Cir. 2018) (emphasis added); *see also Trading*

Techs. Int'l, Inc. v. IBG LLC, 921 F.3d 1084, 1095 (Fed. Cir. 2019) (rejecting argument that the Court should follow prior non-precedential decisions regarding eligibility of other patents owned by patentee—"We are not bound by non-precedential decisions at all, much less ones to different patents, different specifications, or different claims."); *Hamilton v. Brown*, 39 F.3d 1574, 1581 (Fed. Cir. 1994) (explaining that non-precedential decisions "do not represent the considered view of the Federal Circuit regarding aspects of a particular case beyond the decision itself," and that it is "error to assume that a nonprecedential order or opinion provides support for a particular position or reflects a new or changed view held by this court").

Thus, while DISH and the district court were entitled to cite *Adaptive Streaming*, the notion that Realtime should have immediately conceded that the '610 claims were invalid and dismissed its case pursuant to an unpublished, non-precedential decision regarding a different, unrelated patent with a different specification and different claims is nonsensical. In any event, Realtime addressed *Adaptive Streaming* head on and distinguished it. Appx1766–1767. Realtime argued that unlike the patent in *Adaptive Streaming*, the claims of the '610 patent are not directed to mere "format conversion," and that the '610 specification did not suggest this as the claimed advance. Appx1766. Realtime further argued that the *Adaptive*

Streaming case did not involve the same claim terms nor the district court's constructions (Appx1766) and cited other decisions from this Court which it believed supported the eligibility of the '610 claims, including *Visual Memory LLC v. NVidia*, 867 F.3d 1253, 1257 (Fed. Cir. 2017); *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327 (Fed. Cir. 2016); *DDR Holdings, LLC v. Hotels.com, L.P.*, 773 F.3d 1245 (Fed. Cir. 2014); and *TecSec, Inc. v. Adobe Inc.*, 978 F.3d 1278 (Fed. Cir. 2020). Appx1760–1761, Appx1764.

Most important was this Court's precedential decision in *Visual Memory*. Realtime had relied on *Visual Memory* in successfully opposing DISH's motion to dismiss, and the Central District of California found it to be "particularly instructive" for analyzing the claims of the related '477 and '046 patents. Appx281; Appx2397. *Adaptive Streaming* did not and could not overrule *Visual Memory* and the other precedential cases Realtime relied on. Nor did it undermine Realtime's other arguments in support of patent-eligibility which, unlike *Adaptive Streaming*, were tied to the '610 patent claims and specification, and the court's constructions.

Further still, DISH's arguments regarding *Adaptive Streaming* severely mischaracterized this Court's decision—itself highlighting the danger of relying on nonprecedential decisions. DISH relied heavily on certain language regarding "dynamic selection" in dependent claim 42 to argue that the '610 claims are also

abstract. Appx1392. But this Court did not address the dynamic selection limitation at all, as the patentee in *Adaptive Streaming* appears to have focused its eligibility arguments on the independent claims.

That the district court ultimately found *Adaptive Streaming* "persuasive" (Appx2006) is not a basis for exceptionality. On any legal issue, parties will analogize and distinguish cases, and a court may find some cases more persuasive than others. But nowhere did the district court indicate that Realtime's arguments distinguishing *Adaptive Streaming* were frivolous. Nor did the district court acknowledge Realtime's cited cases (which, unlike *Adaptive Streaming*, were precedential) or the Central District's order on the '477 and '046 patents. In fact, the district court did not address the merits of these arguments at all.[6]

For the district court to later identify *Adaptive Streaming* as a "red flag" that should have prompted Realtime to dismiss its case was legal error and an abuse of discretion, particularly since the district court itself failed to explain what about the *Adaptive Streaming* decision was somehow relevant. Realtime's arguments

[6] In vacating the judgment of § 101 invalidity in *Realtime Data*, this Court found that the Delaware court's failure to address and distinguish Realtime's cited cases, which also included *Visual Memory*, *Enfish*, and *DDR Holdings*, was error. *Realtime Data*, 831 F. App'x at 496, 498. The district court in this case likewise failed to even mention, much less distinguish, Realtime's cited cases in its order granting summary judgment.

distinguishing this case were objectively reasonable, especially in view of this Court's vacatur and analysis in *Realtime Data* (and Judge Taranto's concurring opinion directing the Delaware court to numerous recent § 101 decisions, including *TecSec*). The mere existence of a non-precedential decision going the other way does not and cannot demonstrate that Realtime's § 101 position was meritless. *See Mortg. Application Techs., LLC v. MeridianLink, Inc.*, 839 F. App'x 520, 528 (Fed. Cir. 2021) (rejecting argument that defendant's "handful of cases finding patent ineligibility under § 101" rendered the plaintiff's § 101 arguments substantively weak and affirming denial of attorney fees under § 285).

C. The PTAB's IPR Decisions on Claims 1–14 of the '535 patent

The next "red flags" identified by the district court were two final written decisions (FWDs) issued by the PTAB finding claims 1–14 of the '535 patent unpatentable under §§ 102 and 103. Appx6 (citing *Netflix, Inc. v. Realtime Adaptive Streaming LLC*, No. IPR2018-01169, 2020 WL 120083 (P.T.A.B. Jan. 10, 2020) and *Google LLC v. Realtime Adaptive Streaming LLC*, No. IPR2018-01342, 2020 WL 959190 (P.T.A.B. Feb. 27, 2020).[7] This fails for multiple reasons.

[7] Realtime withdrew its patent infringement claims regarding the '535 patent while the case was still stayed, and before the attorney fees that are the subject of this appeal began to accrue. Appx1219. The district court's exceptionality finding was based solely on Realtime's continued litigation of the '610 patent despite purported "indicators that the '610 patent was likely invalid." Appx3.

The FWDs regarding the validity of the challenged claims of the ***'535 patent*** under ***§§ 102 and 103*** are legally and factually irrelevant to the issue of whether the claims of the ***'610 patent*** are eligible for patenting under ***§ 101***. The PTAB's decisions concerned a completely different patent with different claim limitations (which do not recite the "throughput of a communication channel" term found in the '610 patent, among other terms). Not only were these decisions on a different patent and a different issue, the court gave zero indication about the substantive strength of Realtime's positions in those IPRs or how that applies to this case.

Indeed, DISH did not even mention these FWDs in its motion for summary judgment, much less argue that that they supported a finding of invalidity under § 101. DISH simply noted in the "Procedural Background" section of its motion that "the case was stayed for inter partes review (***which cannot consider § 101***)." Appx1387 (emphasis added). Nor did the district court mention the FWDs in its order granting DISH's motion for summary judgment. In fact, the *first and only* time the district court mentioned the FWDs was in the fee order identifying them as "events bearing somewhat on this case." Appx5–6. But even then, the district court failed to explain how the FWDs regarding the '535 patent bear any relevance to the § 101 inquiry for the '610 patent—because they do not. *Id.*

In sum, the notion that FWDs from the PTAB concerning the novelty and obviousness of a different patent with different claims, which neither DISH nor the district court relied on in their § 101 analyses, should have served as a "red flag" to Realtime that its claims were ineligible under § 101 is untenable. That the district court would have listed it as a basis for exceptionality only demonstrates that the fee award rests on a clear error in judgment in weighing relevant factors.

D. Two Non-Final Office Action Rejections in *Ex Parte* Reexamination

The next "red flags" identified by the district court are two non-final office actions finding certain claims of the '610 patent unpatentable on obviousness grounds during *ex parte* reexamination. Appx7. And while the district court's fee order expressly states that it "did not consider those non-final office actions in my decision on the motion for summary judgment," it nonetheless found that these non-final office actions "*could have* served as additional red flags regarding the viability of Realtime's case." *Id.* (emphasis added). This was also error.

As an initial matter, Supreme Court precedent holds that has a "rejection on [§ 102 or § 103] grounds does not affect the determination that respondents' claims recited subject matter which was eligible for patent protection under § 101." *Diamond v. Diehr*, 450 U.S. 175, 191 (1981). Thus, as a matter of law, the PTO's non-final office actions finding the '610 claims unpatentable in view of the prior art under §§ 102 and 103 could not have alerted Realtime that the claims were ineligible

under § 101. Indeed, the *ex parte* reexam for the '610 applied the "broadest reasonable interpretation" claim construction standard. And it did not apply the court's claim construction of "throughput" as "number of pending transmission requests across a communications channel." That construction was relevant to both prior art invalidity, as well as Realtime's § 101 arguments under both *Alice* steps.

Further still, the district court *twice* admitted that these non-final office actions had no effect on its decision to grant summary judgment under § 101. The fee order expressly states that it did not consider them (Appx7), and the summary judgment order likewise states that "while these office actions raise questions of validity based on the prior art, they are not final and are not the subject of the pending motion for summary judgment." Appx2004 n.1. For the district court to turn around and list this as another potential "red flag" when it already determined (correctly) that it was irrelevant to the § 101 analysis is nonsensical.

E. DISH's February 2021 Letter to Realtime Demanding Dismissal

The district court's order next states: "On February 11, 2021, in a letter to Realtime's counsel, defendants reiterated their position on invalidity, noted that substantial litigation expense would be incurred if the case continued, and asked plaintiff to dismiss its claims. ECF No. 308-5. Realtime chose not to do so." Appx7. To the extent that the district court considered DISH's letter (Appx2143–2147) as another "red flag" warning that the '610 claims were ineligible under § 101, this was

error. Realtime fully responded to DISH's letter (Appx2403–2409) on February 22, 2021, and DISH did not respond any further.

DISH's letter was five pages, and the section regarding ineligibility comprises two paragraphs and less than a single page. Appx2146. The first paragraph references the *Google* and *Netflix* decisions regarding the '535 patent, discussed *supra*, and baldly states that "[e]ven a casual comparison of the '610 patent asserted claims to the now invalid claims of the '535 patent reveals that the '610 asserted claims are likely to suffer the same ineligibilty [sic] finding." *Id.* In the next paragraph, DISH briefly discusses the (unpublished) *Adaptive Streaming* decision, stating that "[g]iven the similarities of the claims of the '610 patent to the claims of the *Adaptive Streaming* patent reviewed by the Federal Circuit, there can be no objective basis for continuing to litigate claims against Defendants that are clearly patent ineligible." Appx2146. DISH concluded its letter by demanding confirmation "that Realtime will drop its infringement allegations as to the '610 patent." *Id*.

Realtime, however, disagreed with DISH's § 101 position, including its reliance on the *Google*, *Netflix*, and *Adaptive Streaming* decisions, and responded to that effect. Realtime's decision to press forward with its claims was objectively reasonable, especially since it had had defeated DISH's § 101 motion to dismiss, obtained claim constructions that supported its eligibility arguments, and received

favorable § 101 rulings on three related patents from the California court. Indeed, what is unreasonable is the expectation that Realtime should have simply dropped its claims pursuant to a demand letter from opposing counsel containing little more than conclusory allegations and regarding orders on different patents, rather than advocate for its presumptively valid claims. *See In re Protegrity Corp.*, No. 3:15-MD-02600-JD, 2017 WL 747329, at *6 (N.D. Cal. Feb. 27, 2017) (denying motion for attorney fees under § 285 after the claims were invalidated under § 101—"[Plaintiff] owned presumptively valid patents, and *Alice* did not, as [defendant] urges, provide such clear-cut guidance that [plaintiff] should have voluntarily given that presumption up without a fight.").

Nothing in DISH's letter supports an exceptionality finding here. To the extent the district court found otherwise, this was error. Where DISH did not further follow up or even request a meet and confer for a Rule 11 motion, the mere fact that it sent a letter with attorney characterizations is entitled to no weight.

F. The Declaration of DISH's Expert Regarding Eligibility

The last "red flag" identified by the district court was the declaration of DISH's expert, Dr. Bovik, which was filed as an exhibit to DISH's summary judgment motion. Appx7. *Id.* While the district court acknowledged that "parties to litigation typically are not persuaded by the opinions of the opposing party's retained expert," it found that "Dr. Bovik's opinions merited serious consideration" as

"another red flag" since the court "gave them weight in [its] summary judgment order." *Id.* This was also error.

It cannot seriously be disputed that Realtime had no obligation to accept the opinions of DISH's expert as true, disregard the rebuttal opinions of its own expert (and the plethora of other evidence and authority supporting Realtime's § 101 arguments, discussed above), and give up its claims. Not surprisingly, the district court cites no authority to support such a rule, and Realtime is not aware of any. Indeed, accepting such an argument would lead to absurd results where a patentee would be forced to voluntarily dismiss its case any time an accused infringer could find an expert willing to testify that the asserted claims were invalid.

Nor did the district court specifically identify any portion of the Bovik declaration that was new or compelling to show that the '610 claims were invalid under § 101. To the contrary, as argued in Realtime's opposition to DISH's motion for summary judgment, Dr. Bovik's opinions were unreliable in light of his admissions that he failed to consider the district court's claim constructions in his § 101 analysis. Appx1768 (quoting Appx1846–1847 ("**Q:** my question is, in [the § 101 section of your report] you don't discuss the Court's claim constructions of the '610 patent, right? **A:** . . . just because a judge gave a construction doesn't mean I can't explain why it's not patentable . . . I didn't feel I needed to.")). And unlike Dr.

Rhyne's detailed and well-supported opinions (Appx1820–1842), Dr. Bovik failed to cite any evidence to support his opinions that the claims lack inventive concept. Appx1295–1298.

Notably, DISH has *never* argued that Dr. Rhyne's opinions were unreliable. Nor did the district court make any findings regarding the credibility of Dr. Rhyne's opinions. In fact, the district court did not mention Dr. Rhyne or his opinions in the summary judgment or fee orders at all.[8] Thus, there is nothing to support that Realtime's reliance on its own expert opinions was unreasonable. And while the district court ultimately was not persuaded by Realtime's arguments and "gave [Dr. Bovik's opinions] weight" in its summary judgment order (Appx7), this does not mean that Realtime's arguments were exceptionally meritless.

* * *

In sum, none of the purported "red flags," individually or together, are sufficient to show that Realtime's § 101 arguments on the '610 patent were exceptionally meritless. Realtime "reasonably believed its patent to be valid in light of the statutory presumption of validity," *Q-Pharma, Inc. v. Andrew Jergens Co.*, 360 F.3d 1295, 1303 (Fed. Cir. 2004), as well as well as the statements in '610

[8] As Realtime argued in the co-pending appeal, the district court's failure to consider Dr. Rhyne's opinions and its resolution of disputed issues of fact regarding whether the '610 claims provide inventive concept under *Alice* step two was error.

patent's specification regarding the claimed advance; the expert opinions of Dr. Rhyne supporting that the claimed methods for digital data compression were not well-understood, routine, or conventional; the district court's claim constructions; the district court's denial of DISH's motion to dismiss; and the other evidence and authority discussed above.

Most of the "red flags" identified by the district court were not even relevant to the § 101 analysis of the '610 claims. To the extent they were, Realtime addressed them head on and provided reasonable, well-supported counterarguments for each one. That the court ultimately disagreed with Realtime's arguments (for the most part without explaining why) does not render them frivolous. Nor is it a basis for disregarding all the affirmative arguments and evidence in Realtime's favor.

CONCLUSION

For the foregoing reasons, the district court's orders and judgment awarding DISH attorney's fees pursuant to § 285 should be reversed.

Respectfully submitted,

/s/ Philip X. Wang
Reza Mirzaie
rmirzaie@raklaw.com
Brian D. Ledahl
bledahl@raklaw.com
RUSS AUGUST & KABAT
12424 Wilshire Boulevard, Ste. 1200

Philip X. Wang
pwang@raklaw.com
Paul A. Kroeger
pkroeger@raklaw.com
RUSS AUGUST & KABAT
12424 Wilshire Boulevard, 12th Floor
Los Angeles, California 90025

Los Angeles, California 90025
Telephone: (310) 826-7474
Facsimile: (310) 826-6991

Telephone: (310) 826-7474
Facsimile: (310) 826-6991

Counsel for Plaintiff-Appellant
Realtime Adaptive Streaming LLC

January 26, 2023

CERTIFICATE OF COMPLIANCE

This brief complies with the type-volume limitation of Federal Circuit Rule 32(a). This brief contains 12,749 words, excluding the parts of the brief exempted under Federal Rule of Appellate Procedure 32(f) and Federal Circuit Rule 32(b).

This brief complies with the typeface requirements of Federal Rule of Appellate Procedure 32(a)(5) and the type-style requirements of Federal Rule of Appellate Procedure 32(a)(6). This brief has been prepared in a proportionally spaced typeface using Microsoft Word in 14-point Times New Roman font.

Dated: January 26, 2023

/s/ Philip X. Wang

Philip X. Wang
pwang@raklaw.com
Russ August & Kabat
12424 Wilshire Boulevard, 12th Floor
Los Angeles, CA 90025
Tel: (310) 826-7474
Fax: (310) 826-6991

Attorney for Plaintiff-Appellant
Realtime Adaptive Streaming LLC

Addendum

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IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLORADO
Judge R. Brooke Jackson

Civil Action No 17-cv-02097-RBJ

REALTIME ADAPTIVE STREAMING LLC,

Plaintiff,

v.

SLING TV L.L.C.,
SLING MEDIA, L.L.C.,
ECHOSTAR TECHNOLOGIES L.L.C.,
DISH NETWORK L.L.C

Defendants.

ORDER re ATTORNEY'S FEES

The Court granted summary judgment dismissing plaintiff's remaining claims on July 31, 2021, concluding that the subject patent was invalid because it claimed an abstract idea ineligible for patenting. ECF Nos. 305 (order) and 306 (final judgment). Defendants then moved for an award of attorney's fees. Plaintiff objects. The Court finds that this was an "exceptional case" warranting an award of attorney's fees but will need additional information and likely a hearing to determine the reasonable amount of fees to be awarded.

BACKGROUND

Briefly, by the time summary judgment was granted, the remaining claim was Realtime Adaptive Streaming LLC's claim that defendants had infringed Claim 1 (and possibly other claims) of U.S. Patent No. 8,867,610 ("the '610 patent"). Entitled "System and Methods for Video and Audio Data Distribution," the '610 patent concerns data compression and decompression algorithms. It purports to optimize compression time for digital files to prevent

problems such as download delay, data buffering, and reduced system speeds. First it assigns a data profile based on the frequency that the data is accessed or written. Then it assigns a compression algorithm to each profile, depending upon whether the read to write ratio is balanced (symmetrical) or unbalanced (asymmetrical).

The Patent Act does not permit patenting of "laws of nature, natural phenomena, and abstract ideas." *Alice Corp. Pty. Ltd. v. CLSBank Int'l,* 573 U.S. 208, 216 (2014). In addressing defendants' argument that the '610 patent claimed an ineligible abstract idea, I followed a two-step process: first, was the claim directed to an abstract idea; and second, did the claim nevertheless contain an "inventive concept" sufficient to transform the abstract idea into a patent-eligible application. *See Mayo Collaborative Services v. Prometheus Laboratories, Inc.,* 566 U.S. 66, 77-79 (2012).

At the first step I found that the patent was indeed directed to an ineligible abstract concept, and that Realtime's reliance on this Court's definition of the claim term "throughput of a communication channel" to distinguish law on which defendants relied was unpersuasive because that term itself embodied an abstract idea. *Id.* at 10-11. At the second step I found that there was no "inventive concept" that rescued the claim, notably because it provided no details as to how the invention would work to solve the problems the patent claimed to solve, such as an unconventional encoding or decoding structure or other compression, transmission, or storage techniques. *Id.* at 14.

The merits of those findings and conclusions are currently on appeal to the Federal Circuit. However, the attorney's fee issue remains before me, and I regret that I have been unable to turn to it until now.

STANDARD OF REVIEW

"The court in exceptional cases may award reasonable attorney fees to the prevailing party." 35 U.S.C. § 285. "An exceptional case 'is simply one that stands out from others with respect to the substantive strength of a party's litigating position (considering both the governing law and the facts of the case) or the unreasonable manner in which the case was litigated.'" *University of Utah v. Max-Planck-Gesellschaft zur Foerderung der Wissenschaften e.V.,* 851 F.3d 1317, 1322 (Fed. Cir. 2017. There is no precise formula for making that determination. *Biax Corp. v. Nvidia Corp.,* 626 F. App'x 968, 970-71 (Fed. Cir. Feb. 24, 2015) (unpublished).

ANALYSIS AND CONCLUSIONS

A. Defendants' Entitlement to a Fee Award.

I find that this case was "exceptional" because Realtime disregarded repeated indicators that the '610 patent was likely invalid and pressed on at great expense to the defendants (and itself). A chronology of key events serves to explain this finding.

This case was filed on August 31, 2017. Initially Realtime claimed that defendants (collectively "Dish") had infringed three patents: U.S. Patent Nos. 8,275.897 ("the '897 patent"); 8,867,610 ("the '610 patent"); and 8,934,535 ("the '535 patent"). This was not Realtime's first venture into infringement litigation. In its motion for attorney's fees Dish characterizes Realtime as a "serial litigant," having filed some 145 cases, and Dish claims that Realtime was created by a patent attorney for the purpose of licensing and monetizing patents. ECF No. 308 at 10-11. That description does not bear on the merits of a particular case. If Dish infringed a valid patent it deserves a defeat in court, no matter what Dish speculates about Realtime's underlying business plan. However, Realtime's litigation experience does suggest that it should be particularly alert to the risks of pursuing a potentially invalid claim too long.

Shortly after the case was filed Dish (and then co-defendant Arris Group, Inc.) filed motions to dismiss and for judgment on the pleadings. ECF Nos. 47 and 48. The motions were based on defendants' contention that the patents were invalid because they were directed to an abstract idea. *See* ECF No. 47, *passim;* ECF No. 48 at 1. The Court denied those motions during the course of a Scheduling Conference on March 7, 2018, finding that it would proceed to claim construction first. ECF No. 80 (transcript) at 14. But the Court also expressed its concern about validity:

> [I]f all you're talking about is algorithms and applying some formula, my intuition, my gut instinct would be, well, maybe the defendants have a point. Maybe this is just an abstract concept. This doesn't sound like something you would patent. It doesn't sound like it's technology. It just sounds like an idea.

Id. at 9.

Later in 2018, two courts found that Claim 15 of Realtime's similar '535 patent was invalid as directed to an abstract idea without an "inventive concept" that revived its patentability. Those rulings were highly significant to this Court's ultimate determination that the '610 patent suffered the same fate. The two patents have nearly the same title.[1] More importantly, the specifications for the two patents are virtually identical. ECF No. 305 at 2, 6. Most importantly, Claim 1 of the '610 patent and Claim 15 of the '535 patent are so similar as to be essentially the same in substance. *See id.* at 6-7 (chart comparing the components of the two claims). Thus, the reasoning in the two cases, *Realtime Adaptive Streaming LLC v. Google LLC,* No. CV 18-3629-GW(JCx) (C.D. Cal. Oct. 25, 2018) (slip op. filed at ECF No. 234-6) and *Realtime Adaptive Streaming, LLC v. Netflix, Inc.,* No 17-1692-CFC-SRF, 2018 WL 6521978

[1] The '610 patent is titled "System and Methods for Video and Audio Data Distribution." The '535 patent is titled "System and Methods for Video and Audio Data Storage and Distribution."

(D. Del. Dec. 12, 2018), featured prominently in my order granting summary judgment in this case. ECF No. 305 at 7-9.

In my view, the two cases should have featured prominently in Realtime's thinking about the present case. However, Realtime attempted to distinguish *Google,* largely based on Claim 1's term "throughput of a communication channel," which is not found in the '535 patent, and on my interpretation of the term in the Claim Construction Order.[2] The only reference to the term in the '610 Specification states: "In one embodiment, a controller marks and monitors the throughput (data storage and retrieval) of a data compression system and generates control signals to enable/disable different compression algorithms when, e.g., a bottleneck occurs as to increase the throughput and eliminate the bottleneck." ECF No. 2-2 at 9:53-58. The problem is, absent any indication of how the system tracks the number of pending requests to determine the throughput of the communication channel, i.e., a mechanism for determining the number of requests, the term is itself an abstract idea. *See* ECF No. 305 at 11.

Realtime attempted to discredit the *Netflix* case as wrongly decided, in part because it found Claim 15 of the '535 claim to be a representative claim. But the California court also implicitly found Claim 15 to be representative of at least Claims 16-30. More importantly, representative or not, Claim 15 is so similar to Claim 1 of the '610 patent that the two courts' rulings should have served as a red flag that Claim 1 faced serious trouble.

This case was stayed on February 26, 2019, pending an *Inter Partes* Review ("IRP") of the '610 patent's validity by the Patent Trial and Appeal Board. *See* ECF Nos. 157 and 161. While the stay was in effect certain events bearing somewhat on this case took place.

[2] In the Claim Construction Order, issued on January 11, 2019, I defined "throughput of a communication channel" to mean the "number of pending transmission requests over a communication channel." *See* ECF No. 151 at 8-10.

First, two administrative patent judges found claims 1-14 of the '535 patent (the claims not addressed in the California court's invalidity order) unpatentable on obviousness grounds. *See Netflix, Inc. v. Realtime Adaptive Streaming, LLC,* 2020 WL 120083, at *14 (P.T.A.B. Jan. 10, 2020); *Google LLC v. Realtime Adaptive Streaming, LLC,* 2020 WL 959190, at *16 (P.T.A.B. Feb. 27, 2020).

Second, the Federal Circuit issued an unpublished decision in *Adaptive Streaming Inc. v. Netflix, Inc.,* 836 F. App'x 900 (Dec. 14, 2020). The case involved a patent that claimed systems for communicating audio and video signals between devices that use different formats. The court affirmed the dismissal of plaintiff's case, finding that the claims at issue failed the first *Alice* step because they "were directed to the abstract idea of 'collecting information and transcoding it into multiple formats.'" *Id.* at 903. At the second step, the court determined that the claims "do not incorporate anything that would transform their subject matter into an eligible application of the abstract idea. . . .In particular, there is no identification in the claims or written description of specific, unconventional encoding, decoding, compression, or broadcasting techniques." *Id.* at 904. An unpublished opinion does not create a binding precedent, but it was another red flag for the present case. The case was later highlighted in defendants' notice of intent to file a motion for summary judgment based on invalidity. *See* ECF No. 204 at 2.

The IRP was terminated on jurisdictional grounds (untimeliness) on January 31, 2020, and rehearing was denied on February 4, 2020. *See* ECF No. 172. Appeals were filed, and the Court elected to continue the stay in effect until the conclusion of the IPR proceedings. *See* ECF No 173. In a joint status report filed on January 14, 2021, the parties informed the Court that no IRPs were still pending. ECF No. 178 at 2. Accordingly, the Court lifted the stay on January 15,

2021. *See* ECF No. 179 (minute order). That marks the date when defendants began to incur the attorney's fees that they are seeking in this case. *See* ECF No. 308-2 at 1.

On February 11, 2021, in a letter to Realtime's counsel, defendants reiterated their position on invalidity, noted that substantial litigation expense would be incurred if the case continued, and asked plaintiff to dismiss its claims. ECF No. 308-5. Realtime chose not to do so.

On February 4, 2021 and June 9, 2021 a PTO examiner conducting an *ex parte* reexamination of the '610 patent issued first and second non-final office actions rejecting Claim 1 and several other claims as unpatentable on obviousness grounds. *See* ECF No. 305 at 4, n.1. I did not consider those non-final office actions in my decision on the motion for summary judgment. *Id.* However, they could have served as additional red flags regarding the viability of Realtime's case.

Finally, on May 28, 2021, as an exhibit to a motion for summary judgment, defendants filed a declaration of Dr. Alan C. Bovik. ECF No. 223-1. A modified version of the declaration was filed on June 2, 2021 as an exhibit to defendant's Motion for Summary Judgment of Invalidity Based on Lack of Subject Matter Eligibility – the motion that I ultimately granted. ECF No. 234-1. Realtime promptly filed a Rule 702 motion to exclude certain of his opinions. ECF No. 237. I understand that parties to litigation typically are not persuaded by the opinions of the opposing party's retained expert. In my view, however, Dr. Bovik's opinions merited serious consideration, at least as another red flag concerning the potential resolution of the invalidity issue. I gave them weight in my summary judgment order. ECF No. 305 at 13-14.

The parties completed briefing on summary judgment and, meanwhile, they were preparing for trial. To be clear, I am not critical of Realtime or counsel for believing it their case

and wanting the opportunity to present it to a jury. Rather, my point is that by carrying on despite numerous danger signals or red flags as I have called them, Realtime accepted the risk of having to reimburse defendants' reasonable attorney's fees. In sum, when I consider the totality of the circumstances leading up to this Court's grant of summary judgment on July 31, 2021, I find that Realtime's dogged pursuit of the case notwithstanding those danger signals renders this an exceptional case. I conclude that defendants are entitled to an award of reasonable attorney's fees.

B. Amount of Fees.

Defendants seek an award of $5,075,519, claiming that those are the attorney's fees it reasonably incurred in the six and one-half months after the stay was lifted. Included in that amount are fees attributed to extensive discovery by both sides; multiple letters of intent to file and then the filing and briefing of multiple summary judgment motions; the filing and briefing of Rule 702 motions; motions in limine; and trial preparation. Defendants ask the Court to evaluate these fees in the context of Realtime's seeking damages in the range of $42 million.

In support, defendants file the declaration of one of its lawyers, Adam Shartzer, describing the members of the Fish & Richardson PC team that worked on this case: 13 lawyers (six at the partner level); three litigation paralegals; four discovery analysts; four library and search analysts; an IP operations specialist; and a graphic artist. ECF No. 308-1. Their rates ranged upward to $900 per hour; overall, these individuals had an average billing rate of approximately $668 per hour. That includes a 15.5% discount that Dish uniquely receives. *Id.* at 11-12. In addition, the Denver law firm Wheeler Trigg O'Donnell LLP was retained in April 2021 to assist in trial preparation. According to the affidavit of Hugh Gottschalk, their fees totaled $103,986.50, representing the work of one partner, one associate and one paralegal, at

rates between $685 and $220 per hour, with an overall average billing rate of approximately $637 per hour.

The backgrounds of the several lawyers are impressive. But given the number of lawyers and others working on the case, it is inevitable that there are duplications and other inefficiencies in the numbers. There is no indication that the time entries have been reviewed and culled to eliminate inefficiency and assure that the time was necessarily and productively recorded.

In determining the reasonableness of attorney's fees, the Court starts with the "lodestar" (reasonable hours times reasonable rates), which is presumptively reasonable. *See Robinson v. City of Edmund,* 160 F.3d 1275, 1281 (10th Cir. 1998). However, the lodestar can and frequently is adjusted after applying factors such as those articulated in *Johnson v. Georgia Highway Express, Inc.*, 488 F. 2d 714 (5th Cir. 1974].[3] The Colorado Rules of Professional Conduct provide a similar list of relevant factors.[4] Defendants have not yet explained or defended their figures in that context.

In its response Realtime asserts that $5 million is unreasonable on its face. ECF No. 319 at 14. However, plaintiff declines to dig into the "84 pages of raw billing entries" to highlight those it believes to be unreasonable, and it suggests that the Court should not have to do that

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[3] *Johnson* lists 12 factors for courts to consider in determining reasonableness: (1) the time and labor required; (2) the novelty and difficulty of the questions; (3) the skill required; (4) preclusion of other employment; (5) the customary fee in the community; (6) whether the fee is fixed or contingent; (7) time limitations imposed by the client; (8) the amount involved and the results obtained; (9) the experience, reputation and ability of the attorney's; (10) the undesirability of the case; (11) the nature and relationship of the professional relationship with the client; and (12) awards in similar cases. *Id.* at 717-19.

[4] The Colorado Rules of Professional Conduct are found as an Appendix to Chapters 18 to 20, COLORADO COURT RULES – STATE (2018). These factors identified in Rule 1.5 are (1) time and labor required, (2) likelihood of preclusion of other employment, (3) fee customarily charged in the locality, (4) amount involved and results obtained, (5) time limitations imposed by the client or circumstances, (6) nature and length of the professional relationship, (7) experience, reputation, and ability of the lawyer(s), and (8) whether the fee is fixed or contingent.

either. *Id.* Realtime requests the opportunity for further briefing without indicating what briefing it desires or how that would advance the ball.

The parties are entitled to a hearing on the reasonableness of the amount. Prior to the hearing, however, I request that a responsible partner/principal carefully review the defense teams' time entries and cull all time that he or she finds to be duplicative, inefficient, or otherwise unreasonable in view of the *Johnson* factors. The remaining time entries should then be carefully reviewed by a responsible member of the plaintiff's legal team to identify time that plaintiff still regards as unreasonable or not satisfactorily explained. Counsel should then confer and attempt to reach agreement. If agreement is not reached, then set an evidentiary hearing. In that event, if plaintiff is willing to divulge information about the time spent by members of the plaintiff's team and their corresponding rates, the Court would consider that information in the reasonableness determination. However, the Court is not requiring that plaintiff provide that information.

ORDER

Defendants' motion for attorney's fees, ECF No. 308, is granted as to their entitlement to an award of reasonable attorney's fees. The Court makes no ruling on the amount of such fees and has provided directions to counsel concerning that issue.

DATED this 20th day of January, 2022.

BY THE COURT:

R. Brooke Jackson
United States District Judge

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLORADO
Judge R. Brooke Jackson

Civil Action No 17-cv-02097-RBJ

REALTIME ADAPTIVE STREAMING LLC,

Plaintiff,

v.

SLING TV L.L.C.,
SLING MEDIA, L.L.C.,
ECHOSTAR TECHNOLOGIES L.L.C.,
DISH NETWORK L.L.C

Defendants.

ORDER AWARDING ATTORNEY'S FEES

The Court previously granted summary judgment in favor of the defendants and found that this is an "exceptional case" for purposes of an attorney's fee award. The amount of the attorney's fee claimed by defendants was disputed. Having considered the parties' briefs and the evidence and arguments presented during the hearing, the Court awards attorney's fees to defendants Sling TV L.L.C., Sling Media, L.L.C., Echostar Technologies, L.L.C., and Dish Network, L.L.C. (collectively the "Dish defendants") and against plaintiff Realtime Adaptive Streaming, L.L.C. in the amount of $3,911,002.79.

BACKGROUND

This patent infringement case was filed on August 31, 2017. ECF No. 2. On February 26, 2019, the Court granted the then-parties' joint motion for a stay until resolution of certain related matters pending before the Patent Trial and Appeal Board. ECF No. 162. The case was

administratively closed at that time. ECF No. 163. The stay was lifted, and the case was reopened, on January 15, 2021. ECF No. 179.

On May 26, 2021, the Dish defendants filed a motion for summary judgment based on their contention that the subject patent was invalid. ECF No. 216. Two days later the Dish defendants filed four additional motions for summary judgment based on other theories. *See* ECF Nos. 218, 221, 223 and 227. The Court rejected what appeared to be an effort to circumvent its page limitations by filing five separate motions for summary judgment; denied all the motions for that reason; and recommended that the Dish defendants pick whatever it considered to be its best issue and move on that basis. ECF No. 232.

On June 2, 2021, the Dish Defendants filed a motion for summary judgment of invalidity based on lack of subject matter jurisdiction. ECF No. 234. Briefing on this motion was completed upon the filing of the Dish defendants' reply brief on July 2, 2021. ECF No. 280. The Court granted the motion and dismissed the case with prejudice in an order issued on July 21, 2021. ECF No. 305. On August 13, 2021, the Dish defendants moved to dismiss their counterclaims in view of the Court's granting of their motion for summary judgment. ECF No. 307. That motion was granted, and an amended final judgment was entered on January 20, 2022. ECF Nos. 325 and 326. The merits of those findings and conclusions are currently on appeal to the Federal Circuit.

In the meantime, however, the Dish defendants moved for an award of attorney's fees under 35 U.S.C. § 285 in the amount of $5,075,519. ECF No. 308. Following briefing, the Court on January 20, 2022 found that this is an exceptional case and that the Dish defendants as the prevailing parties are entitled to an award of attorney's fees. ECF No. 326. The Court did not determine a reasonable amount at that time. Rather, I asked that a responsible partner or

principal lawyer carefully review the defense teams' time entries and cull all time that he or she finds to be duplicative, inefficient, or otherwise unreasonable in view of the factors set forth in *Johnson v. Georgia Highway Express, Inc.*, 488 F. 2d 714 (5th Cir. 1974). I indicted that a responsible member of the plaintiff's legal team should then review the remaining time entries to identify time that plaintiff still considered to be unreasonable or not satisfactorily explained. Then counsel should confer and attempt to reach agreement. If agreement were not reached, then the parties should set an evidentiary hearing. I invited plaintiff to divulge information about the time spent by members of the plaintiff's team and their corresponding rates if it was willing to do so.

Adam Shartzer, a principal of the law firm Fish & Richardson that served as lead counsel for the Dish defendants, did the screening and culling requested by the Court. However, plaintiff's counsel did not object to any of the remaining time entries. There was discussion of a possible resolution, but nothing came of it. The Court then conducted an evidentiary hearing on May 19, 2022; and because the hearing was not completed, the Court held a second session of the hearing on August 4, 2022. The Court then took the matter under advisement pending its review of the evidence and preparation of this order.

STANDARD OF REVIEW

In determining the reasonableness of attorney's fees, the Court starts with the "lodestar" which is the product of hours "reasonably expended" times a "reasonable hourly rate." *See Robinson v. City of Edmund*, 160 F.3d 1275, 1281 (10th Cir. 1998). The lodestar is presumed to be a reasonable fee. *Id.* However, the lodestar can be adjusted after considering factors affecting reasonableness such as the 12 factors articulated in *Johnson v. Georgia Highway Express, Inc.*, 488 F. 2d 714 (5th Cir. 1974): (1) the time and labor required; (2) the novelty and difficulty of

the questions; (3) the skill required; (4) preclusion of other employment; (5) the customary fee in the community; (6) whether the fee is fixed or contingent; (7) time limitations imposed by the client; (8) the amount involved and the results obtained; (9) the experience, reputation and ability of the attorney's; (10) the undesirability of the case; (11) the nature and relationship of the professional relationship with the client; and (12) awards in similar cases. *Id.* at 717-19. The Colorado Rules of Professional Conduct provide a similar list of relevant factors.[1]

ANALYSIS AND CONCLUSIONS

A. The Dish Defendants' Initial Application.

As indicated above, in their motion for an award of attorney's fees the Dish defendants sought an award of $5,075,519, claiming that those were the attorney's fees they reasonably incurred in the six and one-half months after the stay was lifted. ECF No. 308 at 14. This sum included fees billed by Fish & Richardson, L.L.C. ($4,971,532.50) and by Denver counsel Wheeler, Trigg, O'Donnell LLP ($103,986.50). ECF Nos. 308-1 at 1; 308-3 at 1.

In support, the Dish defendants filed the declaration of Mr. Shartzer, describing the members of the Fish & Richardson PC team and the work they performed. The Fish & Richardson contingent included thirteen lawyers; three paralegals; four discovery analysts; four library and search analysts; an IP operations specialist; and a graphic artist. ECF No. 308-1. Their rates ranged upward to $900 per hour. Overall, these individuals had an average billing rate of approximately $668 per hour. That included a 15.5% discount that Dish receives. *Id.* at

[1] The Colorado Rules of Professional Conduct are found as an Appendix to Chapters 18 to 20, COLORADO COURT RULES – STATE (2018). These factors identified in Rule 1.5 are (1) time and labor required, (2) likelihood of preclusion of other employment, (3) fee customarily charged in the locality, (4) amount involved and results obtained, (5) time limitations imposed by the client or circumstances, (6) nature and length of the professional relationship, (7) experience, reputation, and ability of the lawyer(s), and (8) whether the fee is fixed or contingent.

11-12. Defendants also filed the affidavit of Hugh Gottschalk, a partner in Wheeler Trigg O'Donnell LLP, who indicated that his firm's fees totaled $103,986.50. This represented the work of one partner, one associate and one paralegal, at rates between $685 and $220 per hour, with an overall average billing rate of approximately $637 per hour. ECF No. 308-3.

In its response Realtime asserted that $5 million is unreasonable on its face. ECF No. 319 at 14. However, it declined to dig into the "84 pages of raw billing entries" to highlight those it believed to be unreasonable, and it suggested that the Court should not have to do that either. *Id.*

B. The Dish Defendants' Revised Application: the Lodestar.

After receiving the Court's direction that counsel cull out all duplicative and otherwise inefficient time, Mr. Shartzer reviewed the Fish & Richardson billing records and reduced the total amount from $4,971,532.50 to $4,293,406.93, a reduction of $678,125.57. *Compare* ECF No. 308-2 with ECF No. 333-1.[2] The reduction was accomplished by eliminating 1,073 hours, including the hours of fourteen timekeepers. *See* Ex. 7 at 3-4. The Dish defendants also withdrew their previous request for an award of prejudgment interest.

The Dish defendants' total request after the culling but with the addition of Fish & Richardson's "fees-on-fees," is $4,564,236.63, comprised as follows:

Fish & Richardson pre-attorney's fee application fees:		$4,293,406.93
Wheeler Trigg O'Donnell fees		103,986.50
"Fees-on-Fees"		166,843.20
Hours billed drafting fees motion	97,065.50	
Hours billed calculating fees	69,777.70	
TOTAL		$4,564,236.63

[2] Defendants have also indicated that they culled $164,942 before submitting their original fee request. *See* ECF No. 335 at 64.

I deem that figure, $4,564,236.63, to be the "lodestar" for purposes of this analysis. It is the product of what defendants submitted as reasonable hours after going through the culling exercises and the rates billed to the Dish defendants by the two law firms.

C. Wheeler Trigg O'Donnell Fees.

While plaintiff objected to the awarding of any attorney's fees, it does not object to the amount of the Wheeler Trigg O'Donnell fees. Therefore, I will include that amount in the fee award without further discussion.

D. Fish & Richardson Fees.

As indicated above, the "lodestar" is presumptively reasonable. *Robinson,* 160 F.3d at 1281. It may be modified after consideration of the *Johnson* factors. However, several *Johnson* factors are presumably reflected in the lodestar amount, so the Court must be careful not to double count factors already considered. *See, e.g., Imperium IP Holdings (Cayman), Ltd,* No. 4:14-CV-00371, 2018 WL 16022460, at *7 (E.D. Tex. April 3, 2018). With that in mind, I look at the *Johnson* factors to determine whether an adjustment from the lodestar is warranted in this case.

1. The time and labor required.

Plaintiff's primary argument is that the Fish & Richardson firm's hours, even after culling, were excessive. However, plaintiff's counsel did not identify any line item in the Fish & Richardson billing records to which plaintiff objects. Indeed, during the second phase of the hearing counsel expressly disavowed any desire to scrutinize or complain about the fee request on a line-item basis. Rather, plaintiff identified large categories of time that it asked the Court to eliminate. I address those categories in turn.

a. Hours Exceeding Plaintiff's Counsel's Hours.

Philip X. Wang was plaintiff's lead counsel in this case. In his declaration Mr. Wang provided a chart showing that plaintiff's legal team recorded 2,094 hours in this case. ECF No. 331 at 2. Actually, plaintiff's team recorded 2,430.5 hours, including 1009.5 hours by Mr. Wang alone. However, he stated that this figure "included substantial work on other Realtime cases (including multiple Federal Circuit appeals, the '610 patent reexam, and other district court cases)." *Id.* at 2, n.4. Thus, he excluded 336.6 of his own hours from his summary of the hours relevant to the present case, resulting in the 2,094-hour number. Counsel suggested that if defendants would accept fees determined by multiplying plaintiff's remaining 2,094 hours times Fish & Richardson's average hourly rate of $668 (which was lower than plaintiff's average hours rate), plaintiff would find that to be reasonable. This would produce attorney's fees for the Fish & Richardson component of defendants' fee request of $1,398,792.

I disagree with this approach. I invited plaintiff to provide its counsel's hours and rates if it wished to do so, and I appreciate receiving the information. It puts defendants' fees in a useful context. However, the fact that plaintiff's team recorded fewer hours does not establish that the Fish & Richardson hours were unreasonable. Defendants were facing a $42 million claim based on alleged infringement of multiple patent claims. Although plaintiff perhaps would have narrowed its claims and theories by the time of trial, defendants reasonably had to prepare to defend all the claims and theories.

Realtime has initiated multiple infringement lawsuits through the same law firm. In my order granting defendants' motion for summary judgment, I noted that two courts had already invalidated similar claims in Realtime's '535 patent as expressing ineligible abstract ideas.

When the plaintiff and its lawyers research and brief similar arguments in multiple cases, one can expect economies of scale. Indeed, the fact that Mr. Wang recorded 336.6 hours to this file that he believes more appropriately should have been recorded to different Realtime cases supports my point. When a law firm is filing multiple infringement cases raising similar claims against a variety of defendants, the hours recorded to individual files and lawsuits do not necessarily reflect the amount of work the case would have required if it were Realtime's only case.

Neither side chose to present independent expert testimony regarding the reasonableness of their respective hours billed. That is fine, but the undisputed fact that the Dish defendants paid all the fees billed, including the amounts culled by Mr. Shartzer, is in a sense independent evidence. After all, defendants are sophisticated technology companies and presumably sophisticated consumers of legal services.

In sum, the comparison to plaintiff's hours is not dispositive in evaluating the reasonableness of defense counsel's hours. It is a factor that I have considered, but I find other factors to be more significant, as I discuss next.

b. Hours Spent on Excessive Summary Judgment Motions.

Here, I agree with plaintiff. The Court has practice standards setting the page limits of motions for summary judgment, responses, and replies. Defendants filed multiple motions for summary judgment, each addressing a different theory of relief. The individual motions each met the Court's page limits, but collectively they far exceeded them. As indicated earlier in this order, the Court struck those motions and advised defendants to pick whichever they regarded as their best issue and file a succinct and compliant motion based on that issue. *See* ECF No. 232. They did so. ECF No. 234. That motion was ultimately granted.

Plaintiff contends that the time spent preparing the summary judgment motions that the Court did not consider should be eliminated. Plaintiff indicates that this time accounts for 762 hours. Defendants have not shown that that figure is incorrect. However, they argue that the time should not be excluded because it was time that also contributed to defendants' preparation for trial. I accept that some of the time spent on summary judgment motions was beneficial during trial preparation. However, I have no way to quantify it. The briefing of summary judgment motions and the preparation for trial are two different phases of a case, often done by different members of the team. In any event, I am not inclined to find time spent in derogation of the Court's practice standards to be reasonable. Therefore, while the hours included in the lodestar were presumptively reasonable, I find that the presumption has been rebutted with respect to the hours spent on the stricken motions. Accordingly, I will eliminate 762 hours at Fish & Richardson's average hourly rate of $674.12 for a total of $513,679.44.[3]

c. Fees on Fees.

Defendants' hours preparing and defending its motion for attorney's fees should be included. *See Central Soya Co., Inc. v. Geo. A. Hormel & Co.*, 723 F.2d 1573, 1578 (Fed. Cir. 1983) (citing *Codex Corp. v. Milgo Electronics Corp.*, 541 F. Supp. 1198, 1201 (D. Mass. 1982) which held that attorney's fees spent on the fee application itself may be awarded under § 285). Defendants had no choice but to incur attorney's fees justifying their application for a fee award in light of plaintiff's opposition. Thus, I will not exclude the $97,065.50 for "hours billed drafting fees motion." However, I will exclude the $69,777.70 allocated to "hours billed calculating fees." This was Mr. Shartzer's and perhaps others' work culling the original fee

[3] The average rate of the Fish & Richardson attorneys was initially $668, but it increased slightly to $674.12 as a result of the culling process.

application at the Court's request to eliminate duplication, inefficiency, etc. Essentially, it is work that was done to make the final amount charged to the plaintiff reasonable. Plaintiff should not be required to pay fees for the time expended by defense counsel assuring that the amount billed was reasonable.

d. Summary Judgment Delay.

Plaintiff argues that defendants should have filed their motion for summary judgment based on invalidity shortly after the stay was lifted on January 15, 2021, rather than waiting until June 2, 2021 to file the ultimately successful motion. Plaintiffs suggest that, had defendants done so, much of the time spent in the intervening four and a half months would have been avoided.[4] I do not agree that this time should be discounted.

It is ironic that plaintiff, who from the outset contested defendants' position that the subject claims were invalid, now is claiming that defendants should have filed and won their motion for summary judgment sooner. One might counter than if plaintiff had conceded invalidity, none of the fees that are the subject of this order would have been incurred. Courts grant summary judgment only if there are no material facts that are genuinely disputed. I cannot fault defendants for obtaining discovery and getting their "ducks in a row" before filing their motion.

2. The novelty and difficulty of the questions. Patent infringement litigation is complex. Attacking the validity of a patent on grounds that it claims an abstract idea is inherently difficult; the line between what is patent-eligible and what is not is not an easy one to draw. On the other hand, as I pointed

[4] In support of the delay theory, plaintiff suggest that only the attorney's fees incurred during the first two months after the stay was lifted should be awarded. ECF No. 335 at 17-18. Alternatively, plaintiff argued that all time before May 28, 2021 should be eliminated. *Id.* at 16-17. May 28, 2021 was the date that on which defendants filed the declaration of their expert, Dr. Alan C. Bovik. The Court cited Dr. Bovik's declaration as one factor supporting its order that this was an exceptional case. *See* ECF No. at 326 at 7. Plaintiff posits that the case only became exceptional on that date. However, the Court found that the case was exceptional based upon several factors, only one of which was Dr. Bovik's opinion.

out in my order finding this to be an exceptional case, two courts had already found similar claims in different Realtime patents to be invalid. *See* ECF No. 326 at 4-5. That somewhat eased the burden on defendants to show that the subject claims were invalid. On balance, I find that this factor does not suggest that the Fish & Richardson hours remaining after the exclusions I discussed above should either be increased or further reduced.

3. The skill required. The lawyers on both sides were highly experienced and skilled in patent infringement and validity litigation. Fish & Richardson "specializes in intellectual property litigation with broad experience across ever IP forum – from district courts to the PTAB to the ITC – and on appeal to the Federal Circuit and the United States Supreme Court." Shartzer Affidavit, ECF No. 308-1, at 2. The Affidavit goes on to describe the backgrounds and experience of the principal lawyers who worked on this case. *Id.* at 4-10. Plaintiff has not challenged or questioned the skill or the experience of the Fish & Richardson team. The case was litigated at a high level by lawyers who specialize in high-stakes patent litigation. This tends to support a finding that the hours remaining after the culling process and the Court's elimination of two significant categories of time are reasonable.

4. Preclusion of other employment. The hours supporting the fee application were recorded for the most part between January 15 and July 31, 2021. *See* ECF No. 308-2. The number of hours recorded during that six and one-half period suggests that at least several of the lawyers on the team were working essentially fulltime on the case. However, while their work on this case likely limited the time they could devote to other clients during that period of time, I have no evidence that these lawyers lost clients, or that they were precluded from working for their other clients for more than a few months. Moreover, Fish & Richardson is a large firm with many other lawyers available to handle its cases. This is not a factor of importance in this case.

5. The customary fee in the community. Plaintiff does not dispute Fish & Richardson's rates. Indeed, their rates, on average, were somewhat lower than the rates of the plaintiff's lawyers. As for the overall fee, defendants provided excerpts from an economic survey by the American Intellectual Property Law Association concerning billing rates and "typical costs" of patent infringement litigation. Ex. 2-C.

If I am reading the charts correctly, the median litigation costs in 2020 where more than $25 million was at stake was $2,375,000. *Id.* at 2-C-008. That does not, of course, focus on the Denver community. Then again, the principal lawyers on both sides were not Colorado-based. The only information presented concerning the "customary fee" in the Denver or Colorado communities is Mr. Gottschalk's affidavit on behalf of Denver-based co-counsel Wheeler Trigg O'Donnell LLP. The Wheeler Trigg O'Donnell lawyers came into the case in April 2021, largely to assist in trial preparation and trial, and their hours are far less than those of their Fish & Richardson co-counsel. The average hourly rate for the Wheeler Trigg O'Donnell lawyers was $637, see ECF Nos. 30383 and 308-4. That is roughly comparable to the rates of the Fish & Richardson lawyers.

6. Whether the fee is fixed or contingent. The fee was neither fixed nor contingent. The fees recorded, including the time that Mr. Shartzer culled for present purposes, was all billed on a time basis and were paid by the Dish defendants.

7. Time limitations imposed by the client. I am not aware of any such limits.

8. The amount involved and the results obtained. Plaintiffs were seeking damages in the range of $42 million. While I would not classify this as "bet the company" litigation, the monetary stakes were high and justified a vigorous defense.

9. The experience, reputation and ability of the attorneys. I have discussed that above. The lawyers on both sides were top drawer in the field of patent infringement and validity litigation.

10. The undesirability of the case. From counsel's perspective, this was not an undesirable engagement. On the contrary, it was big-ticket, lucrative litigation of the type that firms like Fish & Richardson are built to handle. This is not a factor suggesting modification of the fee.

11. The nature and relationship of the professional relationship with the client. Fish & Richardson has a relationship with defendants that includes a 15% discount from their regularly hourly rates. That discount was applied to the rates in this case. Defendants appear to be ongoing, repeat clients of the law firm.

12. Awards in similar cases. Defendants cited four cases in which fee awards were higher than what they seek here. Ex. 7 at 18. In *Imperium IP Holdings (Cayman), Ltd,* in which a jury found that defendant infringed a total of seven claims in two patents and awarded nearly $7 million in damages, the court awarded $7,080,695.77 in attorney's fees. 2018 WL 1602460 at *8. The awards in the other three cases were also substantial. *See Finjan, Inc. v. Juniper Networks, Inc.*, No. C 17-05659 WHA, 2021 WL 3140716 (N.D. Cal. July 26, 2021) (approximately $5.9 million, including costs); *Kilopass Tech, Inc. v. Sidense Corp,* 82 F. Supp. 3d 1154, 1175 (N.D. Cal. 2015) (approximately $5.3 million); and *Aventis CropScience, N.V. v. Pioneer Hi-Bred Int'l, Inc.,* No. 1:00CV463, 2010 WL 2306677, at * (M.D. N.C. June 8, 2010) (approximately $4.9 million including costs I also mentioned the economic survey by the American Intellectual Property Law Association above. The "typical" costs shown in that survey were lower than what is requested here. However, I cannot tell from that survey what fees were awarded in cases similar to this case. Suffice it to say that in high stakes patent infringement and invalidity litigation, such as the present case, the attorney's fees are likely to be high. I believe the experienced lawyers and parties in this case understood that from the outset.

E. Conclusion re the Fish & Richardson Fees.

The Fish & Richardson fees in their revised application ($4,293,406.93 plus the hours billed with respect to the fees motion ($97,065.50), minus the fees allocated to the improperly filed motions for summary judgment ($513,679.44 and minus the fees incurred for re-calculating the fees ($69,777.70) nets to a total of $3,807,015.29

ORDER

The Court finds and concludes that defendants' fees in the total amount of $3,911,002.79, comprised of $3,807,015.29 billed by the Fish & Richardson law firm and $103,987.50 billed by the Wheeler Trigg O'Donnell law firm are reasonable. The Court orders plaintiff to pay those fees to the defendants. A Second Amended Final Judgment will issue including those fees.

DATED this 19th day of September, 2022.

BY THE COURT:

R. Brooke Jackson
United States District Judge

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLORADO

Civil Action No 17-cv-02097-RBJ

REALTIME ADAPTIVE STREAMING LLC,

Plaintiff,

v.

SLING TV L.L.C.,
SLING MEDIA, L.L.C.,
ECHOSTAR TECHNOLOGIES L.L.C.,
DISH NETWORK L.L.C., and
ARRIS GROUP, INC.,

Defendants.

SECOND AMENDED FINAL JUDGMENT

In accordance with the orders filed during the pendency of this case, and pursuant to Fed. R. Civ. P. 58(a) the following Final Judgment is hereby entered.

Pursuant to the ORDERS of Judge R. Brooke Jackson entered on July 31, 2021 [ECF No. 305], January 20, 2022 [ECF No. 324] and September 19, 2022 [ECF No. 342] it is

ORDERED that the defendants' motion for summary judgment [ECF No. 234] is GRANTED, and the plaintiff's claims against Sling TV L.L.C., Sling Media L.L.C., Dish Technologies L.L.C., and Dish Network L.L.C. are dismissed with prejudice. It is

FURTHER ORDERED that, as the prevailing party, the defendants are awarded reasonable costs in the stipulated amount of $65,058.57 [ECF No. 322]. It is

FURTHER ORDERED that the defendants are awarded attorney's fees in the amount of $3,911,002.79. It is

FURTHER ORDERED that the defendants' counterclaims are dismissed without prejudice.

Dated at Denver, Colorado this 20th day of September, 2022.

FOR THE COURT:
JEFFREY P. COLWELL, CLERK

By: s/ J. Dynes
J. Dynes
Deputy Clerk

US008867610B2

(12) **United States Patent**
Fallon et al.

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(54) **SYSTEM AND METHODS FOR VIDEO AND AUDIO DATA DISTRIBUTION**

(71) Applicant: **Realtime Data LLC**, Armonk, NY (US)

(72) Inventors: **James J. Fallon**, Armonk, NY (US); **Stephen J. McErlain**, Astoria, NY (US)

(73) Assignee: **Realtime Data LLC**, Armonk, NY (US)

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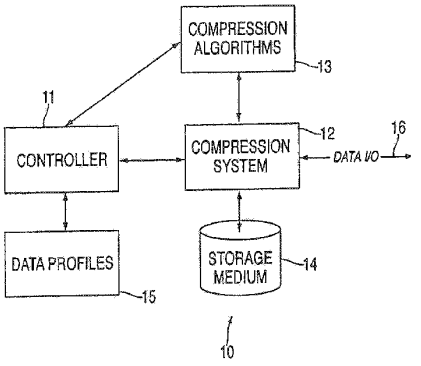
Primary Examiner — Tesfaldet Bocure
(74) *Attorney, Agent, or Firm* — Sterne, Kessler, Goldstein & Fox P.L.L.C.

(57) **ABSTRACT**

Data compression and decompression methods for compressing and decompressing data based on an actual or expected throughput (bandwidth) of a system. In one embodiment, a controller tracks and monitors the throughput (data storage and retrieval) of a data compression system and generates control signals to enable/disable different compression algorithms when, e.g., a bottleneck occurs so as to increase the throughput and eliminate the bottleneck.

30 Claims, 4 Drawing Sheets



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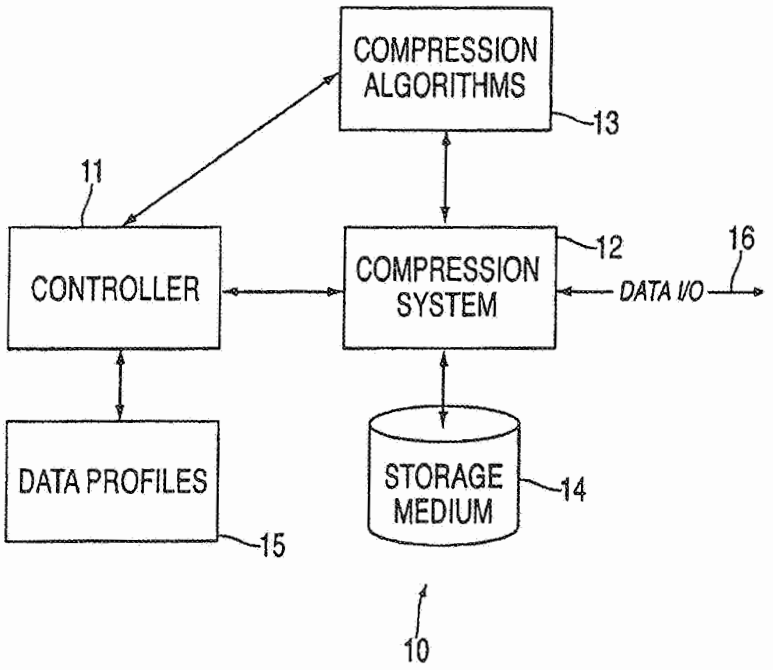
COMPRESSION ALGORITHMS
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11
CONTROLLER
COMPRESSION SYSTEM
12
16
DATA I/O
DATA PROFILES
15
STORAGE MEDIUM
14
10

FIG. 1

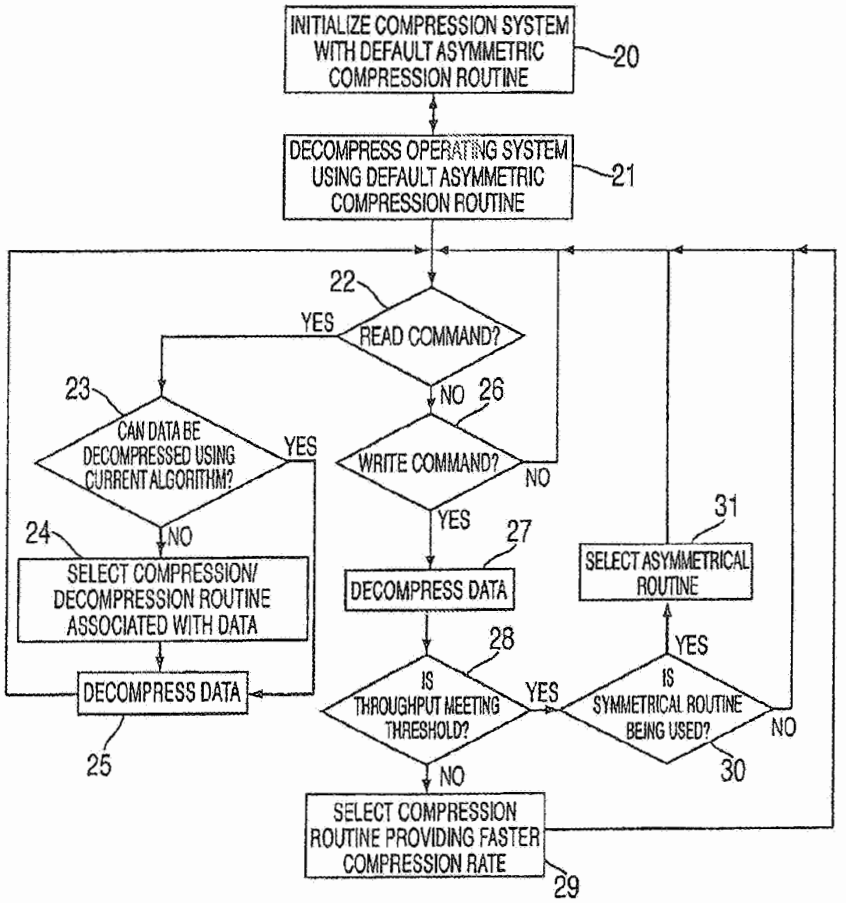
INITIALIZE COMPRESSION SYSTEM WITH DEFAULT ASYMMETRIC COMPRESSION ROUTINE
20
DECOMPRESS OPERATING SYSTEM USING DEFAULT ASYMMETRIC COMPRESSION ROUTINE
21
22
READ COMMAND?
YES
NO
23
CAN DATA BE DECOMPRESSED USING CURRENT ALGORITHM?
YES
NO
24
SELECT COMPRESSION/ DECOMPRESSION ROUTINE ASSOCIATED WITH DATA
DECOMPRESS DATA
25
26
WRITE COMMAND?
YES
NO
27
DECOMPRESS DATA
28
IS THROUGHPUT MEETING THRESHOLD?
YES
NO
SELECT COMPRESSION ROUTINE PROVIDING FASTER COMPRESSION RATE
29
IS SYMMETRICAL ROUTINE BEING USED?
YES
NO
30
31
SELECT ASYMMETRICAL ROUTINE

FIG. 2

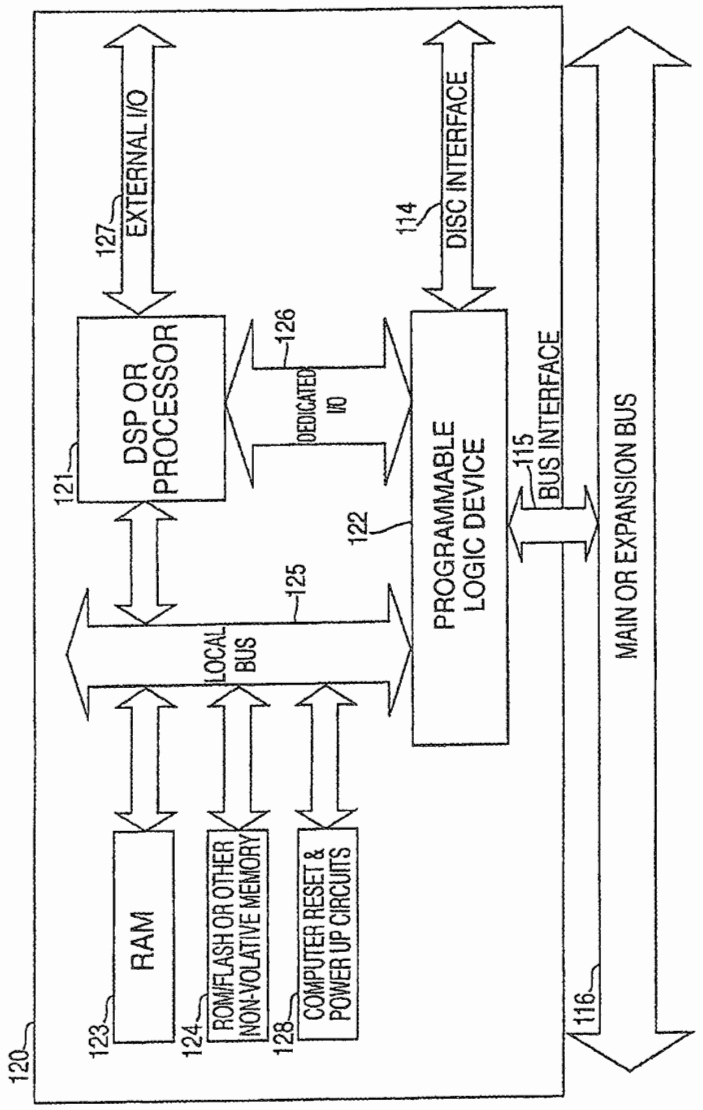

FIG. 3

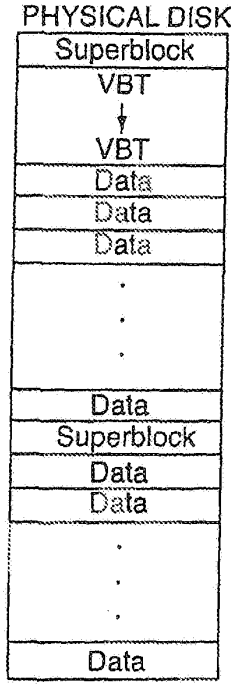

FIG. 4A

SECTOR MAP DEFINITION

SECTOR MAP	
Type	2 bits
C Type	3 bits
C Info	19 bits
Sector Count	8 bits
LBA	32 bits

FIG. 4B

SYSTEM AND METHODS FOR VIDEO AND AUDIO DATA DISTRIBUTION

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 14/033,245, filed on Sep. 20, 2013, which is a continuation of U.S. patent application Ser. No. 13/154,239, filed on Jun. 6, 2011, now U.S. Pat. No. 8,553,759, which is a continuation of U.S. patent application Ser. No. 12/123,081, filed on May 19, 2008, now U.S. Pat. No. 8,073,047, which is a continuation of U.S. patent application Ser. No. 10/076,013, filed on Feb. 13, 2002, now U.S. Pat. No. 7,386,046, which claims the benefit of U.S. Provisional Application No. 60/268,394, filed on Feb. 13, 2001, each of which is fully incorporated herein by reference.

BACKGROUND

1. Technical Field

The present invention relates generally to data compression and decompression and, in particular, to a system and method for compressing and decompressing data based on an actual or expected throughput (bandwidth) of a system that employs data compression. Additionally the present invention relates to the subsequent storage, retrieval, and management of information in data storage devices utilizing either compression and/or accelerated data storage and retrieval bandwidth.

2. Description of the Related Art

There are a variety of data compression algorithms that are currently available, both well-defined and novel. Many compression algorithms define one or more parameters that can be varied, either dynamically or a-priori, to change the performance characteristics of the algorithm. For example, with a typical dictionary based compression algorithm such as Lempel-Ziv, the size of the dictionary can affect the performance of the algorithm. Indeed, a large dictionary may be employed to yield very good compression ratios but the algorithm may take a long time to execute. If speed were more important than compression ratio, then the algorithm can be limited by selecting a smaller dictionary, thereby obtaining a much faster compression time, but at the possible cost of a lower compression ratio. The desired performance of a compression algorithm and the system in which the data compression is employed, will vary depending on the application.

Thus, one challenge in employing data compression for a given application or system is selecting one or more optimal compression algorithms from the variety of available algorithms. Indeed, the desired balance between speed and efficiency is typically a significant factor that is considered in determining which algorithm to employ for a given set of data. Algorithms that compress particularly well usually take longer to execute whereas algorithms that execute quickly usually do not compress particularly well.

Accordingly, a system and method that would provide dynamic modification of compression system parameters so as to provide an optimal balance between execution speed of the algorithm (compression rate) and the resulting compression ratio, is highly desirable.

Yet another problem within the current art is data storage and retrieval bandwidth limitations. Modern computers utilize a hierarchy of memory devices. In order to achieve maximum performance levels, modern processors utilize onboard memory and on board cache to obtain high bandwidth access to both program and data. Limitations in process technologies currently prohibit placing a sufficient quantity of onboard memory for most applications. Thus, in order to offer sufficient memory for the operating system(s), application programs, and user data, computers often use various forms of popular off-processor high speed memory including static random access memory (SRAM), synchronous dynamic random access memory (SDRAM), synchronous burst static ram (SBSRAM). Due to the prohibitive cost of the high-speed random access memory, coupled with their power volatility, a third lower level of the hierarchy exists for non-volatile mass storage devices. While mass storage devices offer increased capacity and fairly economical data storage, their data storage and retrieval bandwidth is often much less in relation to the other elements of a computing system.

Computers systems represent information in a variety of manners. Discrete information such as text and numbers are easily represented in digital data. This type of data representation is known as symbolic digital data Symbolic digital data is thus an absolute representation of data such as a letter, figure, character, mark, machine code, or drawing.

Continuous information such as speech, music, audio, images and video, frequently exists in the natural world as analog information. As is well known to those skilled in the art, recent advances in very large scale integration (VLSI) digital computer technology have enabled both discrete and analog information to be represented with digital data. Continuous information represented as digital data is often referred to as diffuse data. Diffuse digital data is thus a representation of data that is of low information density and is typically not easily recognizable to humans in its native form.

Modern computers utilize digital data representation because of its inherent advantages. For example, digital data is more readily processed, stored, and transmitted due to its inherently high noise immunity. In addition, the inclusion of redundancy in digital data representation enables error detection and/or correction. Error detection and/or correction capabilities are dependent upon the amount and type of data redundancy, available error detection and correction processing, and extent of data corruption.

One outcome of digital data representation is the continuing need for increased capacity in data processing, storage, and transmittal. This is especially true for diffuse data where increases in fidelity and resolution create exponentially greater quantities of data. Data compression is widely used to reduce the amount of data required to process, transmit, or store a given quantity of information. In general, there are two types of data compression techniques that may be utilized either separately or jointly to encode/decode data: lossless and lossy data compression.

Over the last decade, computer processor performance has improved by at least a factor of 50. During this same period, magnetic disk storage has only improved by a factor of 5. Thus one additional problem with the existing art is that memory storage devices severely limit the performance of consumer, entertainment, office, workstation, servers, and mainframe computers for all disk and memory intensive operations.

For example, magnetic disk mass storage devices currently employed in a variety of home, business, and scientific computing applications suffer from significant seek-time access delays along with profound read/write data rate limitations. Currently the fastest available (15,000) rpm disk drives support only a 40.0 Megabyte per second data rate (MB/sec). This is in stark contrast to the modern Personal Computer's Peripheral Component Interconnect (PCI) Bus's input/output capability of 512 MB/sec and internal local bus capability of 1600 MB/sec.

Another problem within the current art is that emergent high performance disk interface standards such as the Small Computer Systems Interface (SCSI-3), iSCSI, Fibre Channel, AT Attachment UltraDMA/100+, Serial Storage Architecture, and Universal Serial Bus offer only higher data transfer rates through intermediate data buffering in random access memory. These interconnect strategies do not address the fundamental problem that all modern magnetic disk storage devices for the personal computer marketplace are still limited by the same typical physical media restriction. In practice, faster disk access data rates are only achieved by the high cost solution of simultaneously accessing multiple disk drives with a technique known within the art as data striping and redundant array of independent disks (RAID).

RAID systems often afford the user the benefit of increased data bandwidth for data storage and retrieval. By simultaneously accessing two or more disk drives, data bandwidth may be increased at a maximum rate that is linear and directly proportional to the number of disks employed. Thus another problem with modern data storage systems utilizing RAID systems is that a linear increase in data bandwidth requires a proportional number of added disk storage devices.

Another problem with most modern mass storage devices is their inherent unreliability. Many modern mass storage devices utilize rotating assemblies and other types of electromechanical components that possess failure rates one or more orders of magnitude higher than equivalent solid state devices. RAID systems employ data redundancy distributed across multiple disks to enhance data storage and retrieval reliability. In the simplest case, data may be explicitly repeated on multiple places on a single disk drive, on multiple places on two or more independent disk drives. More complex techniques are also employed that support various tradeoffs between data bandwidth and data reliability.

Standard types of RAID systems currently available include RAID Levels 0, 1, and 5. The configuration selected depends on the goals to be achieved. Specifically data reliability, data validation, data storage/retrieval bandwidth, and cost all play a role in defining the appropriate RAID data storage solution. RAID level 0 entails pure data striping across multiple disk drives. This increases data bandwidth at best linearly with the number of disk drives utilized. Data reliability and validation capability are decreased. A failure of a single drive results in a complete loss of all data. Thus another problem with RAID systems is that low cost improved bandwidth requires a significant decrease in reliability.

RAID Level 1 utilizes disk mirroring where data is duplicated on an independent disk subsystem. Validation of data amongst the two independent drives is possible if the data is simultaneously accessed on both disks and subsequently compared. This tends to decrease data bandwidth from even that of a single comparable disk drive. In systems that offer hot swap capability, the failed drive is removed and a replacement drive is inserted. The data on the failed drive is then copied in the background while the entire system continues to operate in a performance degraded but fully operational mode. Once the data rebuild is complete, normal operation resumes. Hence, another problem with RAID systems is the high cost of increased reliability and associated decrease in performance.

RAID Level 5 employs disk data striping and parity error detection to increase both data bandwidth and reliability simultaneously. A minimum of three disk drives is required for this technique. In the event of a single disk drive failure, that drive may be rebuilt from parity and other data encoded on disk remaining disk drives. In systems that offer hot swap capability, the failed drive is removed and a replacement drive is inserted. The data on the failed drive is then rebuilt in the background while the entire system continues to operate in a performance degraded but fully operational mode. Once the data rebuild is complete, normal operation resumes.

Thus another problem with redundant modern mass storage devices is the degradation of data bandwidth when a storage device fails. Additional problems with bandwidth limitations and reliability similarly occur within the art by all other forms of sequential, pseudo-random, and random access mass storage devices. Typically mass storage devices include magnetic and optical tape, magnetic and optical disks, and various solid-state mass storage devices. It should be noted that the present invention applies to all farms and manners of memory devices including storage devices utilizing magnetic, optical, neural and chemical techniques or any combination thereof.

Yet another problem within the current art is the application and use of various data compression techniques. It is well known within the current art that data compression provides several unique benefits. First, data compression can reduce the time to transmit data by more efficiently utilizing low bandwidth data links. Second, data compression economizes on data storage and allows more information to be stored for a fixed memory size by representing information more efficiently.

For purposes of discussion, data compression is canonically divided into lossy and lossless techniques. Lossy data compression techniques provide for an inexact representation of the original uncompressed data such that the decoded (or reconstructed) data differs from the original unencoded/uncompressed data. Lossy data compression is also known as irreversible or noisy compression. Negentropy is defined as the quantity of information in a given set of data. Thus, one obvious advantage of lossy data compression is that the compression ratios can be larger than that dictated by the negentropy limit, all at the expense of information content. Many lossy data compression techniques seek to exploit various traits within the human senses to eliminate otherwise imperceptible data. For example, lossy data compression of visual imagery might seek to delete information content in excess of the display resolution or contrast ratio of the target display device.

On the other hand, lossless data compression techniques provide an exact representation of the original uncompressed data. Simply stated, the decoded (or reconstructed) data is identical to the original unencoded/uncompressed data. Lossless data compression is also known as reversible or noiseless compression. Thus, lossless data compression has, as its current limit, a minimum representation defined by the entropy of a given data set.

A rich and highly diverse set of lossless data compression and decompression algorithms exist within the current art. These range from the simplest "adhoc" approaches to highly sophisticated formalized techniques that span the sciences of information theory, statistics, and artificial intelligence. One fundamental problem with almost all modern approaches is the compression ratio to encoding and decoding speed achieved. As previously stated, the current theoretical limit for data compression is the entropy limit of the data set to be encoded. However, in practice, many factors actually limit the compression ratio achieved. Most modern compression algorithms are highly content dependent. Content dependency exceeds the actual statistics of individual elements and often includes a variety of other factors including their spatial location within the data set.

Of popular compression techniques, arithmetic coding possesses the highest degree of algorithmic effectiveness, and as expected, is the slowest to execute. This is followed in turn by dictionary compression, Huffman coding, and run-length coding with respectively decreasing execute times. What is not apparent from these algorithms, that is also one major deficiency within the current art, is knowledge of their algorithmic efficiency. More specifically, given a compression ratio that is within the effectiveness of multiple algorithms, the question arises as their corresponding efficiency.

Within the current art there also presently exists a strong inverse relationship between achieving the maximum (current) theoretical compression ratio, which we define as algorithmic effectiveness, and requisite processing time. For a given single algorithm the effectiveness over a broad class of data sets including text, graphics, databases, and executable object code is highly dependent upon the processing effort applied. Given a baseline data set, processor operating speed and target architecture, along with its associated supporting memory and peripheral set, we define algorithmic efficiency as the time required to achieve a given compression ratio. Algorithmic efficiency assumes that a given algorithm is implemented in an optimum object code representation executing from the optimum places in memory. This is almost never achieved in practice due to limitations within modern optimizing software compilers. It should be further noted that an optimum algorithmic implementation for a given input data set may not be optimum for a different data set. Much work remains in developing a comprehensive set of metrics for measuring data compression algorithmic performance, however for present purposes the previously defined terms of algorithmic effectiveness and efficiency should suffice.

Various solutions to this problem of optimizing algorithmic implementation are found in U.S. Pat. Nos. 6,195,024 and 6,309,424, issued on Feb. 27, 2001 and Oct. 30, 2001, respectively, to James Fallon, both of which are entitled "Content Independent Data Compression Method and System," and are incorporated herein by reference. These patents describe data compression methods that provide content-independent data compression, wherein an optimal compression ratio for an encoded stream can be achieved regardless of the data content of the input data stream. As more fully described in the above incorporated patents, a data compression protocol comprises applying an input data stream to each of a plurality of different encoders to, in effect, generate a plurality of encoded data streams. The plurality of encoders are preferably selected based on their ability to effectively encode different types of input data. The final compressed data stream is generated by selectively combining blocks of the compressed streams output from the plurality of encoders based on one or more factors such as the optimal compression ratios obtained by the plurality of decoders. The resulting compressed output stream can achieve the greatest possible compression, preferably in real-time, regardless of the data content.

Yet another problem within the current art relates to data management and the use of existing file management systems. Present computer operating systems utilize file management systems to store and retrieve information in a uniform, easily identifiable, format. Files are collections of executable programs and/or various data objects. Files occur in a wide variety of lengths and must be stored within a data storage device. Most storage devices, and in particular, mass storage devices, work most efficiently with specific quantities of data. For example, modern magnetic disks are often divided into cylinders, heads and sectors. This breakout arises from legacy electro-mechanical considerations with the format of an individual sector often some binary multiple of bytes (512, 1024, . . .). A fixed or variable quantity of sectors housed on an individual track. The number of sectors permitted on a single track is limited by the number of reliable flux reversals that can be encoded on the storage media per linear inch, often referred to as linear bit density. In disk drives with multiple heads and disk media, a single cylinder is comprised of multiple tracks.

A file allocation table is often used to organize both used and unused space on a mass storage device. Since a file often comprises more than one sector of data, and individual sectors or contiguous strings of sectors may be widely dispersed over multiple tracks and cylinders, a file allocation table provides a methodology of retrieving a file or portion thereof. File allocation tables are usually comprised of strings of pointers or indices that identify where various portions of a file are stored.

In-order to provide greater flexibility in the management of disk storage at the media side of the interface, logical block addresses have been substituted for legacy cylinder, head, sector addressing. This permits the individual disk to optimize its mapping from the logical address space to the physical sectors on the disk drive. Advantages with this technique include faster disk accesses by allowing the disk manufacturer greater flexibility in managing data interleaves and other high-speed access techniques. In addition, the replacement of bad media sectors can take place at the physical level and need not be the concern of the file allocation table or host computer. Furthermore, these bad sector replacement maps are definable on a disk by disk basis.

Practical limitations in the size of the data required to both represent and process an individual data block address, along with the size of individual data blocks, governs the type of file allocation tables currently in use. For example, a 4096 byte logical block size (8 sectors) employed with 32 bit logical block addresses. This yields an addressable data space of 17.59 Terabytes. Smaller logical blocks permit more efficient use of disk space. Larger logical blocks support a larger addressable data space. Thus one limitation within the current art is that disk file allocation tables and associated file management systems are a compromise between efficient data storage, access speed, and addressable data space.

Data in a computer has various levels of information content. Even within a single file, many data types and formats are utilized. Each data representation has specific meaning and each may hold differing quantities of information. Within the current art, computers process data in a native, uncompressed, format. Thus compressed data must often be decompressed prior to performing various data processing functions or operations. Modern file systems have been designed to work with data in its native format. Thus another significant problem within the current art is that file systems are not able to randomly access compressed data in an efficient manner.

Further aggravating this problem is the fact that when data is decompressed, processed and recompressed it may not fit back into its original disk space, causing disk fragmentation or complex disk space reallocation requirements. Several solutions exist within the current art including file by file and block structured compressed data management.

In file by file compression, each file is compressed when stored on disk and decompressed when retrieved. For very small files this technique is often adequate, however for larger files the compression and decompression times are too slow, resulting in inadequate system level performance. In addition, the ability to access randomly access data within a specific file is lost. The one advantage to file by file compression techniques is that they are easy to develop and are compatible with

existing file systems. Thus file by file compressed data management is not an adequate solution.

Block structured disk compression operates by compressing and decompressing fixed block sizes of data. Block sizes are often fixed, but may be variable in size. A single file usually is comprised of multiple blocks, however a file may be so small as to fit within a single block. Blocks are grouped together and stored in one or more disk sectors as a group of Blocks (GOBs). A group of blocks is compressed and decompressed as a unit, thus there exists practical limitations on the size of GOBs. Most compression algorithms achieve a higher level of algorithmic effectiveness when operating on larger quantities of data. Restated, the larger the quantity of data processed with a uniform information density, the higher the compressions ratio achieved. If GOBs are small compression ratios are low and processing time short. Conversely, when GOBS are large compression ratios are higher and processing time is longer. Large GOBs tend to perform in a manner analogous to file by file compression. The two obvious benefits to block structured disk compression are pseudo-random data access and reduced data compression/decompression processing time.

Several problems exist within the current art for the management of compressed blocks. One method for storage of compressed files on disk is by contiguously storing all GOBs corresponding to a single file. However as files are processed within the computers, files may grow or shrink in size. Inefficient disk storage results when a substantial file size reduction occurs. Conversely when a file grows substantially, the additional space required to store the data may not be available contiguously. The result of this process is substantial disk fragmentation and slower access times.

An alternate method is to map compressed GOBs into the next logical free space on the disk. One problem with this method is that average file access times are substantially increased by this technique due to the random data storage. Peak access delays may be reduced since the statistics behave with a more uniform white spectral density, however this is not guaranteed.

A further layer of complexity is encountered when compressed information is to be managed on more than one data storage device. Competing requirements of data access bandwidth, data reliability/redundancy, and efficiency of storage space are encountered.

These and other limitations within the current art are solved with the present invention.

SUMMARY OF THE INVENTION

The present invention is directed to a system and method for compressing and decompressing based on the actual or expected throughput (bandwidth) of a system employing data compression and a technique of optimizing based upon planned, expected, predicted, or actual usage.

In one aspect of the present invention, a system for providing bandwidth sensitive data compression comprises:

a data compression system for compressing and decompressing data input to the system;

a plurality of compression routines selectively utilized by the data compression system; and

a controller for tracking the throughput of the system and generating a control signal to select a compression routine based on the system throughput. In a preferred embodiment, when the controller determines that the system throughput falls below a predetermined throughput threshold, the controller commands the data compression engine to use a compression routine providing a faster rate of compression so as to increase the throughput.

In another aspect, a system for providing bandwidth sensitive data compression comprises a plurality of access profiles, operatively accessible by the controller that enables the controller to determine a compression routine that is associated with a data type of the data to be compressed. The access profiles comprise information that enables the controller to select a suitable compression algorithm that provides a desired balance between execution speed (rate of compression) and efficiency (compression ratio).

In yet another aspect, a system comprises a data storage controller for controlling the compression and storage of compressed data to a storage device and the retrieval and decompression of compressed data from the storage device. The system throughput tracked by the controller preferably comprises a number of pending access requests to a storage device.

In another aspect, the system comprises a data transmission controller for controlling the compression and transmission of compressed data, as well as the decompression of compressed data received over a communication channel. The system throughput tracked by the controller comprises a number of pending transmission requests over the communication channel.

In yet another aspect of the present invention, a method for providing bandwidth sensitive data compression in a data processing system, comprises the steps of:

compressing data using an first compression routine providing a first compression rate;

tracking the throughput of the data processing system to determine if the first compression rate provides a throughput that meets a predetermined throughput threshold; and

compressing data using a second compression routine providing a second compression rate that is greater than the first compression rate, if the tracked throughput does not meet the predetermined throughput threshold.

Preferably, the first compression routine comprises a default asymmetric routine and wherein the second compression routine comprises a symmetric routine.

In another aspect, the method comprises processing a user command to load a user-selected compression routine for compressing data.

In another aspect, the method further comprises processing a user command to compress user-provided data and automatically selecting a compression routine associated with a data type of the user-provided data.

These and other aspects, features and advantages of the present invention will become apparent from the following detailed description of preferred embodiments, which is to be read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a high-level block diagram of a system for providing bandwidth sensitive data compression/decompression according to an embodiment of the present invention.

FIG. **2** is a flow diagram of a method for providing bandwidth sensitive data compression/decompression according to one aspect of the present invention.

FIG. **3** is a block diagram of a preferred system for implementing a bandwidth sensitive data compression/decompression method according to an embodiment of the present invention.

FIG. **4**A is a diagram of a file system format of a virtual and/or physical disk according to an embodiment of the present invention.

FIG. **4**B is a diagram of a data structure of a sector map entry of a virtual block table according to an embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The present invention is directed to a system and method for compressing and decompressing based on the actual or expected throughput (bandwidth) of a system employing data compression. Although one of ordinary skill in the art could readily envision various implementations for the present invention, a preferred system in which this invention is employed comprises a data storage controller that preferably utilizes a real-time data compression system to provide "accelerated" data storage and retrieval bandwidths. The concept of "accelerated" data storage and retrieval was introduced in U.S. patent application Ser. No. 09/266,394, filed Mar. 11, 1999, entitled "System and Methods For Accelerated Data Storage and Retrieval," now U.S. Pat. No. 6,601,104, and U.S. patent application Ser. No. 09/481,243, filed Jan. 11, 2000, entitled "System and Methods For Accelerated Data Storage and Retrieval," now U.S. Pat. No. 6,604,158, both of which are commonly assigned and incorporated herein by reference.

In general, as described in the above-incorporated applications, "accelerated" data storage comprises receiving a digital data stream at a data transmission rate which is greater than the data storage rate of a target storage device, compressing the input stream at a compression rate that increases the effective data storage rate of the target storage device and storing the compressed data in the target storage device. For instance, assume that a mass storage device (such as a hard disk) has a data storage rate of 20 megabytes per second. If a storage controller for the mass storage device is capable of compressing (in real time) an input data stream with an average compression rate of 3:1, then data can be stored in the mass storage device at a rate of 60 megabytes per second, thereby effectively increasing the storage bandwidth ("storewidth") of the mass storage device by a factor of three. Similarly, accelerated data retrieval comprises retrieving a compressed digital data stream from a target storage device at the rate equal to, e.g., the data access rate of the target storage device and then decompressing the compressed data at a rate that increases the effective data access rate of the target storage device. Advantageously, providing accelerated data storage and retrieval at (or close to) real-time can reduce or eliminate traditional bottlenecks associated with, e.g., local and network disk accesses.

In a preferred embodiment, the present invention is implemented for providing accelerated data storage and retrieval. In one embodiment, a controller tracks and monitors the throughput (data storage and retrieval) of a data compression system and generates control signals to enable/disable different compression algorithms when, e.g., a bottleneck occurs so as to increase the throughput and eliminate the bottleneck.

In the following description of preferred embodiments, two categories of compression algorithms are defined—an "asymmetrical" data compression algorithm and a "symmetrical data compression algorithms. An asymmetrical data compression algorithm is referred to herein as one in which the execution time for the compression and decompression routines differ significantly. In particular, with an asymmetrical algorithm, either the compression routine is slow and the decompression routine is fast or the compression routine is fast and the decompression routine is slow. Examples of asymmetrical compression algorithms include dictionary-based compression schemes such as Lempel-Ziv.

On the other hand, a "symmetrical" data compression algorithm is referred to herein as one in which the execution time for the compression and the decompression routines are substantially similar. Examples of symmetrical algorithms include table-based compression schemes such as Huffman. For asymmetrical algorithms, the total execution time to perform one compress and one decompress of a data set is typically greater than the total execution time of symmetrical algorithms. But an asymmetrical algorithm typically achieves higher compression ratios than a symmetrical algorithm.

It is to be appreciated that in accordance with the present invention, symmetry may be defined in terms of overall effective bandwidth, compression ratio, or time or any combination thereof. In particular, in instances of frequent data read/writes, bandwidth is the optimal parameter for symmetry. In asymmetric applications such as operating systems and programs, the governing factor is net decompression bandwidth, which is a function of both compression speed, which governs data retrieval time, and decompression speed, wherein the total governs the net effective data read bandwidth. These factors work in an analogous manner for data storage where the governing factors are both compression ratio (storage time) and compression speed. The present invention applies to any combination or subset thereof, which is utilized to optimize overall bandwidth, storage space, or any operating point in between.

Referring now to FIG. **1**, a high-level block diagram illustrates a system for providing bandwidth sensitive data compression/decompression according to an embodiment of the present invention. In particular, FIG. **1** depicts a host system **10** comprising a controller **11** (e.g., a file management system), a compression/decompression (or data compression) system **12**, a plurality of compression algorithms **13**, a storage medium **14**, and a plurality of data profiles **15**. The controller tracks and monitors the throughput (e.g., data storage and retrieval) of the data compression system **12** and generates control signals to enable/disable different compression algorithms **13** when the throughput falls below a predetermined threshold. In one embodiment, the system throughput that is tracked by the controller **11** preferably comprises a number of pending access requests to the memory system.

The data compression system **12** is operatively connected to the storage medium **14** using suitable protocols to write and read compressed data to and from the storage medium **14**. It is to be understood that the storage medium **14** may comprise any form of memory device including all forms of sequential, pseudo-random, and random access storage devices. The storage medium **14** may be volatile or non-volatile in nature, or any combination thereof. Storage medium as known within the current art include all forms of random access memory, magnetic and optical tape, magnetic and optical disks, along with various other forms of solid-state mass storage media. Thus it should be noted that the current invention applies to all forms and manners of storage media including, but not limited to, storage mediums utilizing magnetic, optical, and chemical techniques, or any combination thereof. The data compression system **12** preferably operates in real-time (or substantially real-time) to compress data to be stored on the storage medium **14** and to decompress data that is retrieved from the storage medium **14**. In addition, the data compression system **12** may receive data (compressed or not compressed) via an I/O (input/output) port **16** that is transmitted over a transmission line or communication channel from a

remote location, and then process such data (e.g., decompress or compress the data). The data compression system **12** may further transmit data (compressed or decompressed) via the I/O port **16** to another network device for remote processing or storage.

The controller **11** utilizes information comprising a plurality of data profiles **15** to determine which compression algorithms **13** should be used by the data compression system **12**. In a preferred embodiment, the compression algorithms **13** comprise one or more asymmetric algorithms. As noted above, with asymmetric algorithms, the compression ratio is typically greater than the compression ratios obtained using symmetrical algorithms. Preferably, a plurality of asymmetric algorithms are selected to provide one or more asymmetric algorithms comprising a slow compress and fast decompress routine, as well as one or more asymmetric algorithms comprising a fast compress and slow decompress routine.

The compression algorithms **13** further comprise one or more symmetric algorithms, each having a compression rate and corresponding decompression rate that is substantially equal. Preferably, a plurality of symmetric algorithms are selected to provide a desired range of compression and decompression rates for data to be processed by a symmetric algorithm.

In a preferred embodiment, the overall throughput (bandwidth) of the host system **10** is one factor considered by the controller **11** in deciding whether to use an asymmetrical or symmetrical compression algorithm for processing data stored to, and retrieved from, the storage medium **14**. Another factor that is used to determine the compression algorithm is the type of data to be processed. In a preferred embodiment, the data profiles **15** comprise information regarding predetermined access profiles of different data sets, which enables the controller **11** to select a suitable compression algorithm based on the data type. For instance, the data profiles may comprise a map that associates different data types (based on, e.g., a file extension) with preferred one(s) of the compression algorithms **13**. For example, preferred access profiles considered by the controller **11** are set forth in the following table.

Access Profile 1:	Access Profile 2	Access Profile 3
Data is written to a storage medium once (or very few times) but is read from the storage medium many times	Data is written to the storage medium often but read few Times	The amount of times data is read from and written to the storage medium is substantially the same.

With Access Profile 1, the decompression routine would be executed significantly more times than the corresponding compression routine. This is typical with operating systems, applications and websites, for example. Indeed, an asymmetrical application can be used to (offline) compress an (OS) operating system, application or Website using a slow compression routine to achieve a high compression ratio. After the compressed OS, application or website is stored, the asymmetric algorithm is then used during runtime to decompress, at a significant rate, the OS, application or website launched or accessed by a user.

Therefore, with data sets falling within Access Profile 1, it is preferable to utilize an asymmetrical algorithm that provides a slow compression routine and a fast decompression routine so as to provide an increase in the overall system performance as compared the performance that would be obtained using a symmetrical algorithm. Further, the compression ratio obtained using the asymmetrical algorithm would likely be higher than that obtained using a symmetrical algorithm (thus effectively increasing the storage capacity of the storage device).

With Access Profile 2, the compression routine would be executed significantly more times than the decompression routine. This is typical with a system for automatically updating an inventory database, for example, wherein an asymmetric algorithm that provides a fast compression routine and a slow decompression routine would provide an overall faster (higher throughput) and efficient (higher compression ratio) system performance than would be obtained using a symmetrical algorithm.

With Access Profile 3, where data is accessed with a similar number of reads and writes, the compression routine would be executed approximately the same number of times as the decompression routine. This is typical of most user-generated data such as documents and spreadsheets. Therefore, it is preferable to utilize a symmetrical algorithm that provides a relatively fast compression and decompression routine. This would result in an overall system performance that would be faster as compared to using an asymmetrical algorithm (although the compression ratio achieved may be lower).

The following table summarizes the three data access profiles and the type of compression algorithm that would produce optimum throughput.

Access Profile	Example Data Types	Compression Algorithm	Compressed Data Characteristics	Decompression Algorithm
1. Write few, Read many	Operating systems, Programs, Web sites	Asymmetrical (Slow compress)	Very high compression ratio	Asymmetrical (Fast decompress)
2. Write many, Read few	Auto-matically updated inventory database	Asymmetrical (Fast compress)	Very high compression ratio	Asymmetrical (Slow decompress)
3. Similar number of Reads and Writes	User generated documents	Symmetrical	Standard compression ratio	Symmetrical

In accordance with the present invention, the access profile of a given data set is known a priori or determined prior to compression so that the optimum category of compression algorithm can be selected. As explained below, the selection process may be performed either manually or automatically by the controller **11** of the data compression system **12**. Further, the decision regarding which routines will be used at compression time (write) and at decompression time (read) is preferably made before or at the time of compression. This is because once data is compressed using a certain algorithm, only the matching decompression routine can be used to decompress the data, regardless of how much processing time is available at the time of decompression.

Referring now to FIG. **2**, a flow diagram illustrates a method for providing bandwidth sensitive data compression according to one aspect of the present invention. For purposes of illustration, it is assumed that the method depicted in FIG. **2** is implemented with a disk controller for providing accelerated data storage and retrieval from a hard disk on a PC (personal computer). The data compression system is initialized during a boot-up process after the PC is powered-on and a default compression/decompression routine is instantiated (step **20**).

In a preferred embodiment, the default algorithm comprises an asymmetrical algorithm since an operating system

and application programs will be read from hard disk memory and decompressed during the initial use of the host system **10**. Indeed, as discussed above, an asymmetric algorithm that provides slow compression and fast decompression is preferable for compressing operating systems and applications so as to obtain a high compression ratio (to effectively increase the storage capacity of the hard disk) and fast data access (to effectively increase the retrieval rate from the hard disk). The initial asymmetric routine that is applied (by, e.g., a vendor) to compress the operating system and applications is preferably set as the default. The operating system will be retrieved and then decompressed using the default asymmetric routine (step **21**).

During initial runtime, the controller will maintain use the default algorithm until certain conditions are met. For instance, if a read command is received (affirmative result in step **22**), the controller will determine whether the data to be read from disk can be compressed using the current routine (step **23**). For this determination, the controller could, e.g., read a flag value that indicates the algorithm that was used to compress the file. If the data can be decompressed using the current algorithm (affirmative determination in step **23**), then the file will be retrieved and decompressed (step **25**). On the other hand, if the data cannot be decompressed using the current algorithm (negative determination in step **23**), the controller will issue the appropriate control signal to the compression system to load the algorithm associated with the file (step **24**) and, subsequently, decompress the file (step **25**).

If a write command is received (affirmative result in step **26**), the data to be stored will be compressed using the current algorithm (step **27**). During the process of compression and storing the compressed data, the controller will track the throughput to determine whether the throughput is meeting a predetermined threshold (step **28**). For example, the controller may track the number of pending disk accesses (access requests) to determine whether a bottleneck is occurring. If the throughput of the system is not meeting the desired threshold (e.g., the compression system cannot maintain the required or requested data rates) (negative determination in step **28**), then the controller will command the data compression system to utilize a compression routine providing faster compression (e.g., a fast symmetric compression algorithm) (step **29**) so as to mitigate or eliminate the bottleneck.

If, on the other hand, the system throughput is meeting or exceeding the threshold (affirmative determination in step **28**) and the current algorithm being used is a symmetrical routine (affirmative determination in step **30**), in an effort to achieve optimal compression ratios, the controller will command the data compression system to use an asymmetric compression algorithm (step **31**) that may provide a slower rate of compression, but provide efficient compression.

This process is repeated such that whenever the controller determines that the compression system can maintain the required/requested data throughput using a slow (highly efficient) asymmetrical compression algorithm, the controller will allow the compression system to operate in the asymmetrical mode. This will allow the system to obtain maximum storage capacity on the disk. Further, the controller will command the compression system to use a symmetric routine comprising a fast compression routine when the desired throughput is not met. This will allow the system to, e.g., service the backlogged disk accesses. Then, when the controller determines that the required/requested data rates are subsequently lower and the compression system can maintain the data rate, the controller can command the compression system to use a slower (but more efficient) asymmetric compression algorithm.

With the above-described method depicted in FIG. **2**, the selection of the compression routine is performed automatically by the controller so as to optimize system throughput. In another embodiment, a user that desires to install a program or text files, for example, can command the system (via a software utility) to utilize a desired compression routine for compressing and storing the compressed program or files to disk. For example, for a power user, a GUI menu can be displayed that allows the user to directly select a given algorithm. Alternatively, the system can detect the type of data being installed or stored to disk (via file extension, etc.) and automatically select an appropriate algorithm using the Access Profile information as described above. For instance, the user could indicate to the controller that the data being installed comprises an application program which the controller would determine falls under Access Profile 1. The controller would then command the compression engine to utilize an asymmetric compression algorithm employing a slow compression routine and a fast decompression routine. The result would be a one-time penalty during program installation (slow compression), but with fast access to the data on all subsequent executions (reads) of the program, as well as a high compression ratio.

It is to be appreciated that the present invention may be implemented in any data processing system, device, or apparatus using data compression. For instance, the present invention may be employed in a data transmission controller in a network environment to provide accelerated data transmission over a communication channel (i.e., effectively increase the transmission bandwidth by compressing the data at the source and decompressing data at the receiver, in real-time).

Further, the present invention can be implemented with a data storage controller utilizing data compression and decompression to provided accelerated data storage and retrieval from a mass storage device. Exemplary embodiments of preferred data storage controllers in which the present invention may be implemented are described, for example, in U.S. patent application Ser. No. 09/775,905, filed on Feb. 2, 2001, entitled "Data Storewidth Accelerator", now U.S. Pat. No. 6,748,457, which is commonly assigned and fully incorporated herein by reference.

FIG. **3** illustrates a preferred embodiment of a data storage controller **120** as described in the above-incorporated U.S. Ser. No. 09/775,905 for implementing a bandwidth sensitive data compression protocol as described herein. The data storage controller **120** comprises a DSP (digital signal processor) **121** (or any other micro-processor device) that implements a data compression/decompression routine. The DSP **121** preferably employs a plurality of symmetric and asymmetric compression/decompression as described herein. The data storage controller **120** further comprises at least one programmable logic device **122** (or volatile logic device). The programmable logic device **122** preferably implements the logic (program code) for instantiating and driving both a disk interface **114** and a bus interface **115** and for providing full DMA (direct memory access) capability for the disk and bus interfaces **114**, **115**. Further, upon host computer power-up and/or assertion of a system-level "reset" (e.g., PCI Bus reset), the DSP **121** initializes and programs the programmable logic device **122** before of the completion of initialization of the host computer. This advantageously allows the data storage controller **120** to be ready to accept and process commands from the host computer (via the bus **116**) and retrieve boot data from the disk (assuming the data storage controller **120** is implemented as the boot device and the hard disk stores the boot data (e.g., operating system, etc.))

The data storage controller **120** further comprises a plurality of memory devices including a RAM (random access memory) device **123** and a ROM (read only memory) device **124** (or FLASH memory or other types of non-volatile memory). The RAM device **123** is utilized as on-board cache and is preferably implemented as SDRAM. The ROM device **124** is utilized for non-volatile storage of logic code associated with the DSP **121** and configuration data used by the DSP **121** to program the programmable logic device **122**.

The DSP **121** is operatively connected to the memory devices **123**, **124** and the programmable logic device **122** via a local bus **125**. The DSP **121** is also operatively connected to the programmable logic device **122** via an independent control bus **126**. The programmable logic device **122** provides data flow control between the DSP **121** and the host computer system attached to the bus **116**, as well as data flow control between the DSP **121** and the storage device. A plurality of external I/O ports **127** are included for data transmission and/or loading of one or more programmable logic devices. Preferably, the disk interface **114** driven by the programmable logic device **122** supports a plurality of hard drives.

The storage controller **120** further comprises computer reset and power up circuitry **128** (or "boot configuration circuit") for controlling initialization (either cold or warm boots) of the host computer system and storage controller **120**. A preferred boot configuration circuit and preferred computer initialization systems and protocols are described in U.S. patent application Ser. No. 09/775,897, filed on Feb. 2, 2001, entitled "System and Methods For Computer Initialization," now abandoned, which is commonly assigned and incorporated herein by reference. Preferably, the boot configuration circuit **128** is employed for controlling the initializing and programming the programmable logic device **122** during configuration of the host computer system (i.e., while the CPU of the host is held in reset). The boot configuration circuit **128** ensures that the programmable logic device **122** (and possibly other volatile or partially volatile logic devices) is initialized and programmed before the bus **116** (such as a PCI bus) is fully reset. In particular, when power is first applied to the boot configuration circuit **128**, the boot configuration circuit **28** generates a control signal to reset the local system (e.g., storage controller **120**) devices such as a DSP, memory, and I/O interfaces. Once the local system is powered-up and reset, the controlling device (such as the DSP **121**) will then proceed to automatically determine the system environment and configure the local system to work within that environment. By way of example, the DSP **121** of the disk storage controller **120** would sense that the data storage controller **120** is on a PCI computer bus (expansion bus) and has attached to it a hard disk on an IDE interface. The DSP **121** would then load the appropriate PCI and IDE interfaces into the programmable logic device **122** prior to completion of the host system reset. Once the programmable logic device **122** is configured for its environment, the boot device controller is reset and ready to accept commands over the computer/expansion bus **116**.

It is to be understood that the data storage controller **120** may be utilized as a controller for transmitting data (compressed or uncompressed) to and from remote locations over the DSP I/O ports **127** or bus **116**, for example. Indeed, the I/O ports **127** of the DSP **121** may be used for transmitting data (compressed or uncompressed) that is either retrieved from the disk or received from the host system via the bus **116**, to remote locations for processing and/or storage. Indeed, the I/O ports **127** may be operatively connected to other data storage controllers or to a network communication channels. Likewise, the data storage controller **120** may receive data (compressed or uncompressed) over the I/O ports **127** of the DSP **121** from remote systems that are connected to the I/O ports **127** of the DSP, for local processing by the data storage controller **120**. For instance, a remote system may remotely access the data storage controller **120** (via the I/O ports of the DSP or the bus **116**) to utilize the data compression, in which case the data storage controller **120** would transmit the compressed data back to the system that requested compression.

In accordance with the present invention, the system (e.g., data storage controller **120**) preferably boots-up in a mode using asymmetrical data compression. It is to be understood that the boot process would not be affected whether the system boots up defaulting to an asymmetrical mode or to a symmetrical mode. This is because during the boot process of the computer, it is reading the operating system from the disk, not writing. However, once data is written to the disk using a compression algorithm, it must retrieve and read the data using the corresponding decompression algorithm.

As the user creates, deletes and edits files, the data storage controller **120** will preferably utilize an asymmetrical compression routine that provides slow compression and fast decompression. Since using the asymmetrical compression algorithm will provide slower compression than a symmetrical algorithm, the file system of the computer will track whether the data storage controller **120** has disk accesses pending. If the data storage controller **120** does have disk accesses pending and the system is starting to slow down, the file management system will command the data storage controller **120** to use a faster symmetrical compression algorithm. If there are no disk access requests pending, the file management system will leave the disk controller in the mode of using the asymmetrical compression algorithm.

If the data storage controller **120** was switched to using a symmetrical algorithm, the file management system will preferably signal the controller to switch back to a default asymmetrical algorithm when, e.g., the rate of the disk access requests slow to the point where there are no pending disk accesses.

At some point a user may decide to install software or load files onto the hard disk. Before installing the software, for example, as described above, the user could indicate to the data storage controller **120** (via a software utility) to enter and remain in an asymmetric mode using an asymmetric compression algorithm with a slow compression routine and a very fast decompression routine. The disk controller would continue to use the asymmetrical algorithm until commanded otherwise, regardless of the number of pending disk accesses. Then, after completing the software installation, the user would then release the disk controller from this "asymmetrical only" mode of operation (via the software utility).

Again, when the user is not commanding the data storage controller **120** to remain in a certain mode, the file management system will determine whether the disk controller should use the asymmetrical compression algorithms or the symmetrical compression algorithms based on the amount of backlogged disk activity. If the backlogged disk activity exceeds a threshold, then the file management system will preferably command the disk controller to use a faster compression algorithm, even though compression performance may suffer. Otherwise, the file management system will command the disk controller to use the asymmetrical algorithm that will yield greater compression performance.

It is to be appreciated that the data compression methods described herein by be integrated or otherwise implemented with the content independent data compression methods described in the above-incorporated U.S. Pat. Nos. 6,195,024 and 6,309,424.

FIG. 4A is a diagram of a file system format of a virtual and/or physical disk according to an embodiment of the present invention.

In yet another embodiment of the present invention, a virtual file management system is utilized to store, retrieve, or transmit compressed and/or accelerated data. In one embodiment of the present invention, a physical or virtual disk is utilized employing a representative file system format as illustrated in FIG. 4A. As shown in FIG. 4A, a virtual file system format comprises one or more data items. For instance, a "Superblock" denotes a grouping of configuration information necessary for the operation of the disk management system. The Superblock typically resides in the first sector of the disk. Additional copies of the Superblock are preferably maintained on the disk for backup purposes. The number of copies will depend on the size of the disk. One sector is preferably allocated for each copy of the Superblock on the disk, which allows storage to add additional parameters for various applications. The Superblock preferably comprises information such as (i) compress size; (ii) virtual block table address; (iii) virtual block table size; (iv) allocation size; (v) number of free sectors (approximate); (vi) ID ("Magic") number; and (vii) checksum.

The "compress size" refers to the maximum uncompressed size of data that is grouped together for compression (referred to as a "data chunk"). For example, if the compress size is set to 16 k and a 40 k data block is sent to the disk controller for storage, it would be divided into two 16 k chunks and one 8 k chunk. Each chunk would be compressed separately and possess its own header. As noted above, for many compression algorithms, increasing the compression size will increase the compression ratio obtained. However, even when a single byte is needed from a compressed data chunk, the entire chunk must be decompressed, which is a tradeoff with respect to using a very large compression size.

The "virtual block table address" denotes the physical address of the virtual block table. The "virtual block table size" denotes the size of the virtual block table.

The "allocation size" refers to the minimum number of contiguous sectors on the disk to reserve for each new data entry. For example, assuming that 4 sectors are allowed for each allocation and that a compressed data entry requires only 1 sector, then the remaining 3 sectors would be left unused. Then, if that piece of data were to be appended, there would be room to increase the data while remaining contiguous on the disk. Indeed, by maintaining the data contiguously, the speed at which the disk can read and write the data will increase. Although the controller preferably attempts to keep these unused sectors available for expansion of the data, if the disk were to fill up, the controller could use such sectors to store new data entries. In this way, a system can be configured to achieve greater speed, while not sacrificing disk space. Setting the allocation size to 1 sector would effectively disable this feature.

The "number Of free sectors" denotes the number of physical free sectors remaining on the disk. The ID ("Magic) number" identifies this data as a Superblock. The "checksum" comprises a number that changes based on the data in the Superblock and is used for error checking. Preferably, this number is chosen so that all of the words in the Superblock (including the checksum) added up are equal to zero.

FIG. 4B is a diagram of a data structure of a sector map entry of a virtual block table according to an embodiment of the present invention.

The "virtual block table" (VET) comprises a number of "sector map" entries, one for each grouping of compressed data (or chunks). The VET may reside anywhere on the disk. The size of the VBT will depend on how much data is on the disk. Each sector map entry comprises 8 bytes. Although there is preferably only one VBT on the disk, each chunk of compressed data will have a copy of its sector map entry in its header. If the VBT were to become corrupted, scanning the disk for all sector maps could create a new one.

The term "type" refers to the sector map type. For example, a value of "00" corresponds to this sector map definition. Other values are preferably reserved for future redefinitions of the sector map.

A "C Type" denotes a compression type. A value of "000" will correspond to no compression. Other values are defined as required depending on the application. This function supports the use of multiple compression algorithms along with the use of various forms of asymmetric data compression.

The "C Info" comprises the compression information needed for the given compression type. These values are defined depending on the application, In addition, the data may be tagged based on its use—for example operating system "00", Program "01", or data "10". Frequency of use or access codes may also be included. The size of this field may be greatly expanded to encode statistics supporting these items including, for example, cumulative number of times accessed, number of times accessed within a given time period or CPU clock cycles, and other related data.

The "sector count" comprises the number of physical sectors on the disk that are used for this chunk of compressed data. The "LBA" refers to the logical block address, or physical disk address, for this chunk of compressed data.

Referring back to FIG. 4A, each "Data" block represent each data chunk comprising a header and compressed data. The data chunk may up anywhere from 1 to 256 sectors on the disk. Each compressed chunk of data is preferably preceded on the disk by a data block header that preferably comprises the following information: (i) sector map; (ii) VBI; (iii) ID ("Magic") Number; and (iv) checksum.

The "sector map" comprises a copy of the sector map entry in the VBT for this data chunk. The "VBI" is the Virtual Block Index, which is the index into the VBT that corresponds to this data chunk. The "ID ("Magic) Number" identifies this data as a data block header. The "checksum" number will change based on the data in the header and is used for error checking. This number is preferably chosen such that the addition of all the words in the header (including the checksum) will equal zero.

It should be noted that the present invention is not limited to checksums but may employ any manner of error detection and correction techniques, utilizing greatly expanded fields error detection and/or correction.

It should be further noted that additional fields may be employed to support encryption, specifically an identifier for encrypted or unencrypted data along with any parameters necessary for routing or processing the data to an appropriate decryption module or user.

The virtual size of the disk will depend on the physical size of the disk, the compress size selected, and the expected compression ratio. For example, assume there is a 75 GB disk with a selected compress size expecting a 3:1 compression ratio, the virtual disk size would be 225 GB. This will be the maximum amount of uncompressed data that the file system will be able to store on the disk.

If the number chosen is too small, then the entire disk will not be utilized. Consider the above example where a system comprises a 75 GB disk and a 225 GB virtual size. Assume

that in actuality during operation the average compression ratio obtained is 5:1. Whereas this could theoretically allow 375 GB to be stored on the 75 GB disk, in practice, only 225 GB would be able to be stored on the disk before a "disk full" message is received. Indeed, with a 5:1 compression ratio, the 225 GB of data would only take up 45 GB on the disk leaving 30 GB unused. Since the operating system would think the disk is full, it would not attempt to write any more information to the disk.

On the other hand, if the number chosen is too large, then the disk will fill up when the operating system would still indicate that there was space available on the disk. Again consider the above example where a system comprises a 75 GB disk and a 225 GB virtual size. Assume further that during operation, the average compression ratio actually obtained is only 2:1. In this case, the physical disk would be full after writing 150 GB to it, but the operating system would still think there is 75 GB remaining. If the operating system tried to write more information to the disk, an error would occur.

Thus, in another embodiment of the present invention, the virtual size of the disk is dynamically altered based upon the achieved compression ratio. In one embodiment, a running average may be utilized to reallocate the virtual disk size. Alternatively, certain portions of the ratios may already be known—such as a preinstalled operating system and programs. Thus, this ratio is utilized for that portion of the disk, and predictive techniques are utilized for the balance of the disk or disks.

Yet in another embodiment, users are prompted for setup information and the computer selects the appropriate virtual disk(s) size or selects the best method of estimation based on, e.g., a high level menu of what is the purpose of this computer: home, home office, business, server. Another submenu may ask for the expected data mix, word, excel, video, music, etc. Then, based upon expected usage and associated compression ratios (or the use of already compressed data in the event of certain forms of music and video) the results are utilized to set the virtual disk size.

It should be noted that the present invention is independent of the number or types of physical or virtual disks, and indeed may be utilized with any type of storage.

It is to be understood that the systems and methods described herein may be implemented in various forms of hardware, software, firmware, special purpose processors, or a combination thereof. In particular, the present invention may be implemented as an application comprising program instructions that are tangibly embodied on a program storage device (e.g., magnetic floppy disk, RAM, ROM, CD ROM, etc.) and executable by any device or machine comprising suitable architecture. It is to be further understood that, because some of the constituent system components and process steps depicted in the accompanying Figures are preferably implemented in software, the actual connections between such components and steps may differ depending upon the manner in which the present invention is programmed. Given the teachings herein, one of ordinary skill in the related art will be able to contemplate these and similar implementations or configurations of the present invention.

Although illustrative embodiments have been described herein with reference to the accompanying drawings, it is to be understood that the present system and method is not limited to those precise embodiments, and that various other changes and modifications may be affected therein by one skilled in the art without departing from the scope or spirit of the invention. All such changes and modifications are intended to be included within the scope of the invention as defined by the appended claims.

What is claimed is:

1. A method, comprising:

determining, a parameter or an attribute of at least a portion of a data block having video or audio data;

selecting one or more compression algorithms from among a plurality of compression algorithms to apply to the at least the portion of the data block based upon the determined parameter or attribute and a throughput of a communication channel, at least one of the plurality of compression algorithms being asymmetric; and

compressing the at least the portion of the data block with the selected compression algorithm after selecting the one or more, compression algorithms.

2. The method of claim **1**, further comprising:

storing at least a portion of the compressed data block.

3. The method of claim **2**, further comprising:

retrieving at least a portion of the at least stored portion of the compressed data block based upon a user command or the throughput of the communication channel.

4. The method of claim **1**, wherein selecting comprises:

selecting the one or more compression algorithms to apply to the at least the portion of the data block based upon the determined parameter or attribute, the throughput of the communication channel, and a frequency of access of at least a portion of a second compressed or uncompressed data block.

5. The method of claim **1**, wherein compressing comprises:

compressing the at least the portion of the data block with the selected one or more compression algorithms based upon a user command.

6. The method of claim **1**, wherein each compression algorithm from among the plurality of compression algorithms is asymmetric.

7. The method of claim **1**, further comprising:

determining the throughput of the communication channel by utilization of a portion of a memory device.

8. The method of claim **2**, further comprising:

retrieving at least a portion of the at least stored portion of the compressed data block based upon a utilization of one or more central processing units (CPUs).

9. An apparatus, comprising:

a controller configured to:

determine a parameter or an attribute of at least a portion of a data block having video or audio data, and

select one or more compression algorithms from among a plurality of compression algorithms to determine a plurality of compression algorithms to apply to the at least the portion of the data block based upon the determined parameter or attribute and a throughput of a communication channel, at least one of the plurality of compression algorithms being asymmetric; and

a data compression system configured to compress the at least the portion of the data block with the selected one or more compression algorithms.

10. The apparatus of claim **9**, further comprising:

a storage medium configured to store a portion of the at least compressed portion of the data block.

11. The apparatus of claim **10**, wherein the data compression system is further configured to retrieve at least a portion of the at least stored portion of the at least compressed portion of the data block based upon the throughput of the communication channel or a user command.

12. The apparatus of claim **10**, wherein the data compression system is further configured to:

retrieve at least a portion of the at least stored portion of the at least compressed portion of the data block based upon the throughput of the communication channel; and

retrieve at least a portion of a second compressed data block, compressed with one or more second compression algorithms from among the plurality of compression algorithms, based upon a second throughput of the communication channel,

wherein at least one of the one or more second compression algorithms are different from at least one of the selected one or more compression algorithms, and

wherein the second throughput of the communication channel is different from the throughput of the communication channel.

13. The apparatus of claim **12**, wherein the controller is further configured to retrieve at least a portion of a third compressed data block that was compressed with one or more third compression algorithms from among the plurality compression algorithms based upon a third throughput of the communication channel, the third throughput of the communication channel differing from the first or the second throughputs of the communication channel.

14. The apparatus of claim **9**, wherein the controller is configured to select the one or more compression algorithms to apply to the at least the portion of the data block based upon the determined parameter or attribute, the throughput of the communication channel, and a frequency of access of at least the portion of a second compressed or uncompressed data block.

15. The apparatus of claim **9**, wherein the data compression system is configured to compress the at least the portion of the data block with the selected one or more compression algorithms based upon a user command.

16. The apparatus of claim **9**, wherein each compression algorithm from among the plurality of compression algorithms is asymmetric.

17. The apparatus of claim **9**, wherein the controller is further configured to determine the throughput of the communication channel by utilization of a portion of a memory device.

18. The apparatus of claim **10**, wherein the data compression system is further configured to retrieve at least a portion of the at least stored portion of the compressed data block based upon a utilization of one or more central processing units (CPUs).

19. A method, comprising:

determining a plurality of compression algorithms;

selecting one or more compression algorithms from among the determined plurality of compression algorithms based upon a frequency of access of at least a portion of a compressed or uncompressed data block, at least one of the plurality of compression algorithms being asymmetric; and

compressing, at least a portion of a second data block with the selected one or more compression algorithms.

20. The method of claim **19**, further comprising:

storing at least a portion of the at least compressed portion of the at least the portion of the second data block.

21. The method of claim **20**, further comprising:

retrieving at least a portion of the at least compressed portion of the at least the portion of the second data block based upon a throughput of a communication channel or a user command.

22. The method of claim **19**, further comprising:

selecting one or more second compression algorithms from among the determined plurality compression algorithms to apply to at least a portion of the second data block based upon a throughput of a communication channel.

23. The method of claim **19**, wherein compressing comprises:

compressing the at least the portion of the second data block with the selected one or more compression algorithms based upon a user command.

24. The method of claim **19**, wherein each compression algorithm from among the plurality of compression algorithms is asymmetric.

25. An apparatus, comprising:

a controller configured to:

determine a plurality of compression algorithms, at least one of the plurality of compression algorithms being asymmetric, and

select one or more compression algorithms from among the determined plurality of compression algorithms based upon a frequency of access of at least a portion of a compressed or uncompressed data block; and

a data compression system configured to compress at least a portion of a second data block with the selected one or more compression algorithms.

26. The apparatus of claim **25**, further comprising:

a storage medium configured to store at least portion of the compressed portion of the at least the portion of the second data block.

27. The apparatus of claim **26**, wherein the data compression system is further configured to retrieve a portion of the stored portion of the at least compressed portion of the at least the portion of the second data block based upon a throughput of a communication channel or a user command.

28. The apparatus of claim **25**, wherein the controller is further configured to select one or more second compression algorithms from among the determined plurality compression of algorithms to apply to the at least the portion of the second data block based upon a throughput of a communication channel.

29. The apparatus of claim **25**, wherein the data compression system is configured to compress the at least the portion of the second data block with the selected one or more compression algorithms based upon a user command.

30. The apparatus of claim **25**, wherein each compression algorithm from among the plurality of compression algorithms is asymmetric.

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