

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NETAPP, INC.,
Petitioner,

v.

KOM SOFTWARE, INC.,
Patent Owner.

IPR2019-00591
Patent 6,438,642 B1

Before KIMBERLY McGRAW, DANIEL J. GALLIGAN, and
BRENT M. DOUGAL, *Administrative Patent Judges*.

GALLIGAN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

In this *inter partes* review, NetApp, Inc. (“Petitioner”)¹ challenges the patentability of claims 1–7, 10, 16, 17, and 20 of U.S. Patent No. 6,438,642 B1 (“the ’642 patent,” Ex. 1001), which is assigned to KOM Software, Inc. (“Patent Owner”).

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision, issued pursuant to 35 U.S.C. § 318(a), addresses issues and arguments raised during the trial in this *inter partes* review. For the reasons discussed below, we determine that Petitioner has proven by a preponderance of the evidence that claims 1–7, 10, 16, 17, and 20 of the ’642 patent are unpatentable. *See* 35 U.S.C. § 316(e) (“In an *inter partes* review instituted under this chapter, the petitioner shall have the burden of proving a proposition of unpatentability by a preponderance of the evidence.”).

A. Procedural History

On January 24, 2019, Petitioner requested *inter partes* review of claims 1–7, 10, 16, 17, and 20 of the ’642 patent on the following grounds:

Claim(s) Challenged	35 U.S.C. § ²	Reference(s)/Basis
1–6, 16	103(a)	Carter ³
5	103(a)	Carter, Frey ⁴

¹ Hewlett Packard Enterprise Company (“HPE”) was a petitioner on the original Petition, but this *inter partes* review has since been terminated as to HPE. *See* Paper 26.

² The Leahy-Smith America Invents Act (“AIA”) included revisions to 35 U.S.C. §§ 102 and 103 that became effective after the filing of the application for the ’642 patent. Therefore, we apply the pre-AIA versions of these sections.

³ US 5,987,506, filed May 2, 1997, issued Nov. 16, 1999 (Ex. 1005).

⁴ US 6,029,168, filed Jan. 23, 1998, issued Feb. 22, 2000 (Ex. 1006).

Claim(s) Challenged	35 U.S.C. § ²	Reference(s)/Basis
3–5	103(a)	Carter, Mutalik ⁵
5	103(a)	Carter, Frey, Mutalik
7, 10, 17, 20	103(a)	Carter, Cannon ⁶

Paper 3 (“Pet.”), 11. Patent Owner filed a Preliminary Response. Paper 9. We instituted trial on all grounds of unpatentability. Paper 10 (“Dec. on Inst.”), 18.

During the trial, Patent Owner filed a Response (Paper 13, “PO Resp.”), Petitioner filed a Reply (Paper 15, “Pet. Reply”), and Patent Owner filed a Sur-reply (Paper 19, “PO Sur-reply”).

An oral hearing was held on May 6, 2020, a transcript of which appears in the record. Paper 32.

B. Related Matters

As required by 37 C.F.R. § 42.8(b)(2), the parties identify various related matters. Pet. 69–70; Paper 5, 2–3; Paper 8, 2–3; Paper 29, 1–2. Petitioner also challenges claims of the ’642 patent in IPR2019-00592, in which a final written decision is issuing concurrently with this Decision.

C. Real Parties in Interest

The parties identify themselves as the real parties in interest. Pet. 69; Paper 5, 2; Paper 8, 2; Paper 29, 1.

D. The ’642 Patent and Illustrative Claim

The ’642 patent relates to computer storage and characterizes the art as having certain drawbacks. Ex. 1001, 1:14–65. For example, the ’642 patent explains that computers have limited storage in their hard drives and

⁵ US 6,161,111, filed Mar. 31, 1998, issued Dec. 12, 2000 (Ex. 1007).

⁶ US 5,983,239, filed Oct. 29, 1997, issued Nov. 9, 1999 (Ex. 1008).

that increasing storage may require adding a hard drive, which can be costly and inconvenient. Ex. 1001, 1:14–45. To address this and other drawbacks of the art, the '642 patent discloses providing a virtual storage medium that is made up of physical storage media and that can be upgraded without affecting users. Ex. 1001, 1:66–2:1. Figures 2 and 3 of the '642 patent are reproduced below.

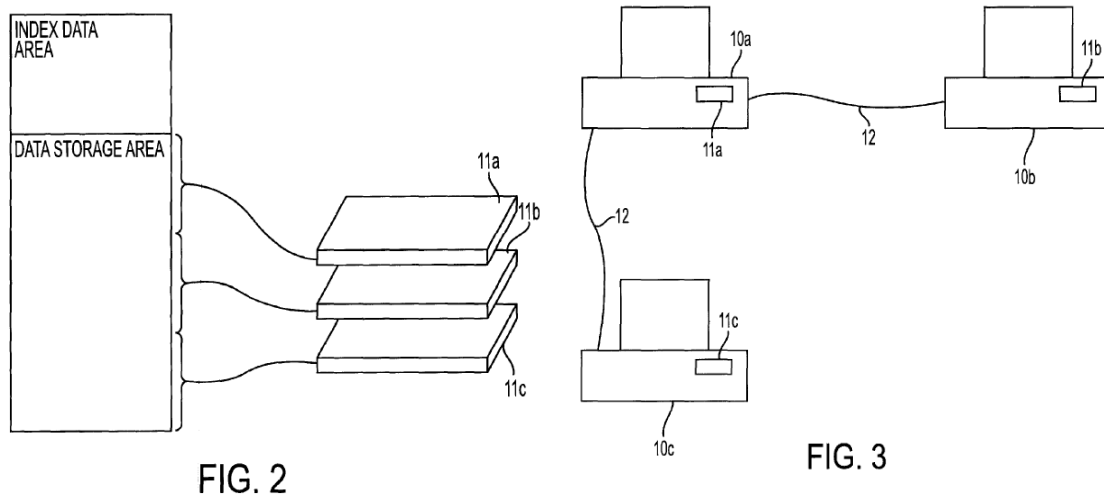


Figure 2, reproduced above on the left, depicts a virtual storage device having an index data area and having a data storage area made up of three hard disk drives, denoted 11a, 11b, and 11c. Ex. 1001, 3:26–40. The index data area stores information used to locate data stored in the virtual storage medium. Ex. 1001, 3:41–54. Figure 3, reproduced above on the right, shows “the virtual storage device of FIG. 2 in a network configuration.” Ex. 1001, 4:7–9. Figure 3 depicts a network of three computers, 10a, 10b, and 10c, having disk drives 11a, 11b, and 11c that are used to form a single virtual storage medium. Ex. 1001, 3:57–62. The '642 patent explains that each of the disk drives has an area for local file storage for the user of that

computer and another area that forms part of the virtual storage medium.

Ex. 1001, 3:62–64.

Of the challenged claims, claims 1 and 16 are independent. Claim 1 is illustrative and is reproduced below.

1. A method of providing automated file management comprising the steps of storing data in a virtual file-based non-volatile storage medium comprising:

providing said virtual file-based non-volatile storage medium having a file-based automated file management file system interfacing with a plurality of file system storage partitions of a plurality of corresponding physical non-volatile storage media associated therewith, locations within each physical non-volatile storage medium of said plurality of corresponding physical non-volatile storage media corresponding to locations within said virtual file-based non-volatile storage medium;

providing data for storage in said virtual file-based non-volatile storage medium using said file-based automated file management file system;

determining any free space at said locations within said virtual file-based non-volatile storage medium, said free space sufficient for storing the provided data, locations having said any free space corresponding to said locations within said plurality of corresponding physical non-volatile storage media having available non-volatile storage space therein;

storing the provided data at said locations having said any free space; and

storing index information for the stored data.

II. ANALYSIS

A. Level of Ordinary Skill in the Art

Petitioner contends a person of ordinary skill at the time of the invention of the '642 patent (a “POSITA”) would have held either “a bachelor’s degree in computer engineering or computer science with two

years of experience in the field of data storage management or a master's degree in either discipline with an emphasis on data storage management." Pet. 11 (citing Ex. 1002 ¶ 30). Patent Owner provides a similar definition, stating "a POSITA should have a bachelor's degree in electrical engineering, computer science, or equivalent with two years or more of experience in computing systems development; a master's degree in electrical engineering, computer science, or equivalent; or comparable computing systems work experience." PO Resp. 7 (citing Ex. 2001 ¶ 32).

Thus, the parties dispute whether a POSITA must have a degree in computer science/engineering or whether a POSITA could instead have a degree in electrical engineering as well as whether the POSITA's experience must be in data storage management or could encompass experience in the field of computing systems development. *See* Ex. 2001 ¶ 32 (Dr. Melendez testifying that a POSITA may also have a degree in electronics engineering or applied mathematics).

Although the parties articulate different levels of skill for a POSITA, neither party explains how its recited level of skill impacts the obviousness analysis such that application of one proposal versus the other would lead to different ultimate outcomes.

Based on the record before us, including the types of problems and solutions described in the '642 patent and the cited prior art, we determine that a person of ordinary skill in the art would have had a bachelor's degree in a technical field such as computer engineering, computer science, electrical engineering, electronics engineering, applied mathematics, or their equivalent, with two years of experience in the field of computing systems development, including fields of data storage management or file storage

and manipulation; a master’s degree in such a technical field; or comparable computing systems work experience. We further note that our analysis would be the same under either parties’ definition.

B. Claim Interpretation

The Petition was accorded a filing date of January 24, 2019. Paper 4, 1. In an *inter partes* review for a petition filed on or after November 13, 2018, a claim “shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b).” 37 C.F.R. § 42.100(b) (2018); *see* Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018) (amending 37 C.F.R. § 42.100(b) effective November 13, 2018) (now codified at 37 C.F.R. § 42.100(b) (2019)). In applying this claim construction standard, we are guided by the principle that the words of a claim “are generally given their ordinary and customary meaning,” as understood by a person of ordinary skill in the art in question at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc) (citation omitted). “In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence.” *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17). There is a “heavy presumption” that a claim term carries its ordinary and customary meaning. *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002) (citation omitted).

1. File-based

Challenged independent claims 1 and 16 recite a “virtual file-based non-volatile storage medium,” and claim 1 recites a “file-based automated file management file system.” Petitioner does not offer an express construction for these terms, but Petitioner argues that Carter’s disclosure of a file system maintaining files teaches a system that is “file-based.” Pet. 11–12, 23–24. Patent Owner argues that Petitioner’s contentions reflect an “unreasonably broad interpretation of the ‘file-based’ terms as used in the ’642 Patent’s independent claims, which would allow even prior art, Ofer, overcome during original patent prosecution to be applied against the ’642 Patent’s limitations.” PO Resp. 8 (citing Ex. 2005⁷; Ex. 2001 ¶ 26). Patent Owner argues that “[t]he index in the ’642 Patent is file-based (*i.e.*, it associates the location information at issue with a particular file)” and that “the ’642 Patent invention has information to associate a file with a location and that it associates a file with a location.” PO Resp. 10 (citing Ex. 2001 ¶ 27). Patent Owner contrasts this “file-based” approach with “global addressing schemes of the prior art,” in which “there is no global link between a file and the locations at issue.” PO Resp. 10 (citing Ex. 2001 ¶ 27). Patent Owner, therefore, “proposes that a ‘virtual file-based non-volatile storage medium’ be defined as ‘a virtual non-volatile storage medium comprising a globally accessible file data structure index to files stored within the medium’” and that “a ‘file-based automated file management file system’ be construed as an ‘automated file management

⁷ Ofer, US 6,148,369, issued Nov. 14, 2000 (Ex. 2005).

file system comprising a globally accessible file data structure index of files stored within the medium.” PO Resp. 9 (citing Ex. 2001 ¶ 27).

Petitioner argues that “[t]he ’642 patent’s claims contain no support for ‘global file index data,’ ‘global index,’ or any of the other qualifications Patent Owner now proposes for ‘file-based,’” and Petitioner points out that “the challenged independent claims recite ‘storing index information for the stored data’ with no further qualifiers.” Pet. Reply 4. We agree with Petitioner’s point that the ’642 patent does not support the inclusion of the qualifier “globally accessible” in construing these terms. The term “global” appears nowhere in the Specification of the ’642 patent, and we see no persuasive reason that the recited “file-based” claim language would be used to include this qualifier. Patent Owner argues that a “globally accessible” index distinguishes the claims from prior art disclosures of “[a] local index of a storage medium (non virtual),” which allegedly “the ’642 Patent overcomes.” PO Sur-reply 4–5. All of the challenged claims, however, are directed to providing a “virtual” storage medium, which expressly distinguishes the claims from prior art showing merely “non virtual” storage. Thus, prior art that discloses merely a “local index of a storage medium (non virtual)” (*see* PO Sur-reply 4–5) would not satisfy the claims by the claims’ express language and would not need to be further distinguished with the “globally accessible” index language Patent Owner seeks to incorporate into the “file-based” limitations.

Patent Owner also argues that this “globally accessible” index distinguishes the claims from prior art disclosures of global addressing, such as allegedly disclosed in Ofer, which the applicant for the ’642 patent successfully distinguished during prosecution. PO Sur-reply 5–6;

PO Resp. 9–10. We do not agree that including the qualifier “globally accessible” is justified for this reason either. Patent Owner is correct that during prosecution the applicant for the ’642 patent distinguished the claims from Ofer’s disclosure. *See* PO Resp. 9–10; PO Sur-reply 5–8. During prosecution, the applicant argued the following:

A file system can determine the real allocation of which blocks belong to which file and the sequence of the blocks. Ofer’s device is limited to providing a **block-based** meta device and would still require the addition of a separate file system, not taught or suggested in Ofer, to store and organize the data in the form of files. Ofer’s device simply provides a data container that can be made up of several devices without any interpretation of the actual contents of the blocks. Applicant maintains that Ofer’s teaching of a **block-based** storage media does **not** anticipate, teach or suggest the **file-based** storage media of the claimed invention

Ex. 1004, 170; *see* PO Resp. 15 (quoting this argument at Ex. 2003, 2–4).

The applicant further argued that “[t]he present invention provides file-based virtualization at the **file system level**” and that “[t]he claimed invention operates as a file system, which is a layer **above** block virtualization schemes such as disclosed in Ofer.” Ex. 1004, 171; *see* PO Resp. 15 (quoting this argument at Ex. 2003, 2–4). These arguments simply distinguish a “block-based” scheme that does not use a file system and that does not organize data in files from the claimed “file-based” subject matter. As with the distinction between virtual and non-virtual storage, the claims expressly recite “file-based.” Thus, Patent Owner’s arguments do not explain how the “globally accessible” language is relevant to, much less required to be read into, the “file-based” limitations.

Although Patent Owner proposes constructions for the terms “virtual file-based non-volatile storage medium” and “file-based automated file

management file system,” Patent Owner’s argument is really directed to how the ’642 patent allegedly indexes files. Indexing is recited in claims 1 and 16 in the step “storing index information for the stored data,” and in that regard Patent Owner argues that “[t]he index in the ’642 Patent is file-based (*i.e.*, it associates the location information at issue with a particular file)” and that “the ’642 Patent invention has information to associate a file with a location and that it associates a file with a location.” PO Resp. 10 (citing Ex. 2001 ¶ 27). This understanding is consistent with the ’642 patent, which explains that an index area of the virtual storage medium stores information that “allows locating and retrieving of portions of a stored data file and/or an entire stored data file.” Ex. 1001, 3:41–56. As explained below, this is how the asserted prior art operates as well.

Based on the foregoing, we agree with Patent Owner that the claims require index data that associates location information with a particular file. We, however, do not agree with Patent Owner that the terms “virtual file-based non-volatile storage medium” and “file-based automated file management file system” should be construed to include the “globally accessible” qualifier Patent Owner proposes. No further construction of the “file-based” terms is necessary.

C. Principles of Law

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying

factual determinations including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) any secondary considerations, if in evidence.⁸ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

*D. Obviousness over Carter
(Claims 1–6 and 16)*

Petitioner asserts claims 1–6 and 16 of the '642 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over the teachings of Carter. Pet. 9, 12–44.

1. Carter

Carter discloses a globally addressable storage environment that allows data to be shared among various computers on multiple networks. Ex. 1005, code (57). Carter discloses creating a “virtual storage space” that spans each storage device connected to a network such that “all data stored on the network can be stored within the virtual space and the actual physical location of the data can be in any of the storage devices connected to the network.” Ex. 1005, 3:10–17. Figure 2 of Carter is reproduced below.

⁸ Patent Owner does not present any objective evidence of nonobviousness (i.e., secondary considerations) as to any of the challenged claims.

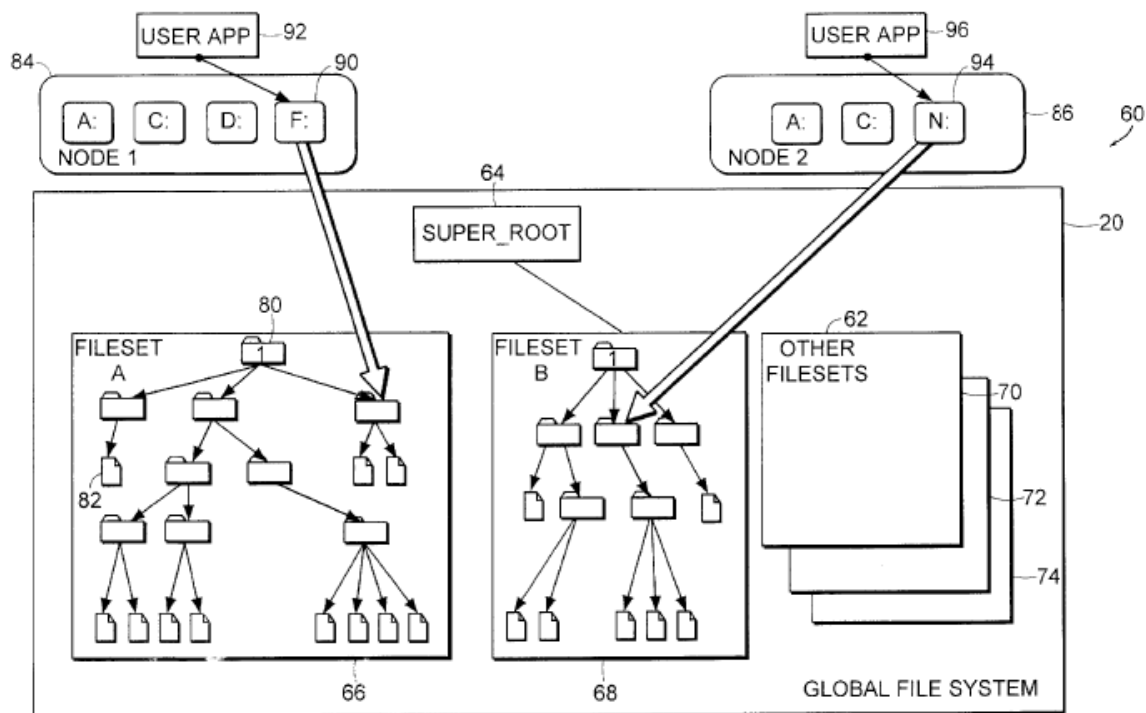


FIG. 2

Figure 2 of Carter, reproduced above, depicts “a distributed addressable shared memory file system providing storage for computer files such as source code files, wordprocessing documents files, etc.” Ex. 1005, 5:13–17. Referring to Figure 2, Carter discloses that “structured file system 60 employs the properties of the addressable shared memory space 20 to implement what looks to all network nodes like a coherent, single file system when in fact it spans all network nodes coupled to the addressable shared memory space 20.” Ex. 1005, 8:25–30.

2. Independent Claim 1

a) Providing a virtual non-volatile storage medium

Independent claim 1 recites “[a] method of providing automated file management comprising the steps of storing data in a virtual file-based non-volatile storage medium comprising” five steps recited in the claim. The first step of claim 1 recites the following:

providing said virtual file-based non-volatile storage medium having a file-based automated file management file system interfacing with a plurality of file system storage partitions of a plurality of corresponding physical non-volatile storage media associated therewith, locations within each physical non-volatile storage medium of said plurality of corresponding physical non-volatile storage media corresponding to locations within said virtual file-based non-volatile storage medium.

Petitioner asserts Carter teaches this subject matter. Pet. 21–28.

Patent Owner argues that Carter does not teach the following three limitations recited in claim 1: (i) a “file-based” system (PO Resp. 14–24); (ii) a “non-volatile storage medium” (PO Resp. 24–28); or (iii) a “file-based automated file management file system” (PO Resp. 28–29). Below, we discuss Petitioner’s contentions in more detail and address Patent Owner’s arguments.

i. File-based

Petitioner contends Carter’s virtual storage space teaches the claimed “virtual file-based non-volatile storage medium.” Pet. 22–24. Carter discloses that “[t]he environment in which the invention operates includes systems that create and manage a *virtual storage space* shared by each computer on a network.” Ex. 1005, 3:10–12 (emphasis added). Petitioner contends Carter’s virtual storage space is “file-based,” as recited in claim 1, because Carter discloses that its system can be a file system that is used to store files. Pet. 23–24 (citing Ex. 1005, 5:13–23, 6:3–5, 6:22–30, 8:25–60; Ex. 1002 ¶¶ 49–51).

Patent Owner argues that Carter does not teach the “virtual file-based non-volatile storage medium” recited in claim 1 because Carter’s system uses “global addresses to find specific address (blocks or pages)” and, therefore, is not “file-based” as required by the claims. See PO Resp. 13–24.

Patent Owner contends Carter's system is a "virtual *address-based* non-volatile storage medium," which, according to Patent Owner, is the type of address-based system that the applicant distinguished during prosecution of the application for the '642 patent. PO Resp. 9–10, 13–24. In particular, Patent Owner quotes the applicant's arguments during prosecution characterizing Ofer, a prior art patent applied by the Examiner, as teaching "a *block-based* storage media [that] does **not** anticipate, teach or suggest the *file-based* storage media of the claimed invention." PO Resp. 15 (quoting Ex. 2003, 2–4). Patent Owner also quotes the applicant's representation during prosecution that "Ofer's device is limited to providing a **block-based** meta device and would still require the addition of a separate file system, not taught or suggested in Ofer, to store and organize the data in the form of files." PO Resp. 15 (quoting Ex. 2003, 2–4). Patent Owner argues that "[t]he mere existence of a file system, such as in both Carter (MS Windows NT) and Ofer (MS Windows NT), is not sufficient to disclose 'a virtual *file-based* non-volatile storage medium.'" PO Resp. 15–16. Patent Owner further argues that "both Carter and Ofer provide for the use of memory locations across multiple storage devices in exactly the same way—using global addresses to find device specific addresses (blocks or pages) and as such neither disclose nor render obvious 'a virtual *file-based* non-volatile storage medium.'" PO Resp. 16 (citing Ex. 1005, 9:60–62; Ex. 2005, 1:32–34; Ex. 2001 ¶ 37); *see* PO Resp. 16–20 (arguing additional similarities between Carter and Ofer). For the reasons that follow, we are persuaded that Carter teaches a system that is "file-based."

As an initial matter, Patent Owner's argument during this trial that Ofer actually teaches a file system (PO Resp. 15–16) contradicts the

applicant's representation to the Office during prosecution that Ofer would "require the addition of a separate file system, not taught or suggested in Ofer, to store and organize the data in the form of files." Ex. 2003, 4; Ex. 1004, 170. Furthermore, even if Patent Owner is correct that Carter discloses "using global addresses to find device specific addresses (blocks or pages)" (PO Resp. 16), we disagree that such a disclosure means Carter does not teach a "virtual file-based non-volatile storage medium" as recited in the claims. Carter contains the disclosure that the '642 patent applicant argued was lacking in the prior art cited by the Examiner, as illustrated in the following argument made by the applicant during prosecution:

A file system can determine the real allocation of which blocks belong to which file and the sequence of the blocks. Ofer's device is limited to providing a **block-based** meta device and would still require the addition of a separate file system, not taught or suggested in Ofer, to store and organize the data in the form of files. Ofer's device simply provides a data container that can be made up of several devices without any interpretation of the actual contents of the blocks.

Ex. 1004, 170; *see* PO Resp. 15 (quoting this argument at Ex. 2003, 2–4). Carter expressly discloses a file system to manage files. Figure 2 of Carter, reproduced above in § II.D.1, depicts "a distributed addressable shared memory file system providing storage for computer files such as source code files, wordprocessing documents files, etc." Ex. 1005, 5:13–17, *cited in* Pet. 24. Referring to Figure 2, Carter discloses that "structured file system 60 employs the properties of the addressable shared memory space 20 to implement what looks to all network nodes like a coherent, single file system when in fact it spans all network nodes coupled to the addressable shared memory space 20." Ex. 1005, 8:25–30, *cited in* Pet. 23.

Patent Owner acknowledges that “Carter provides automated file management in general,” but Patent Owner asserts that “the automated file management is performed through a global addressing scheme (address-based) rather than a file-based methodology.” PO Sur-reply 20 (citing Ex. 2001 ¶¶ 41–51). Patent Owner’s argument implies that a global addressing scheme and a file-based scheme are mutually exclusive. We disagree because Carter discloses a file system that uses an addressable shared memory space to organize, store, and retrieve files. For example, Carter discloses the following:

Referring to FIG. 3, in the disclosed embodiment of the file system 60, a directory 126 (such as the directory 80 of FIG. 2) is accessed by starting at a directory Inode or descriptor 128 containing an address that points to a directory entries stream descriptor 130. This descriptor 130 is a pointer to a block of data containing directory entries for files File 1 through File 3. The directory entry for File 1 has a number of entries; one of the entries is a string containing the name of the file and another entry is the address of the Inodes and stream descriptors 132. The stream descriptors for File 1 are used to locate and retrieve the various 4 kilobyte pages in the addressable shared memory space 20 that constitute File 1. Other files are retrieved and constructed from the addressable shared memory space 20 in the same fashion.

Ex. 1005, 9:34–48; *see* Pet. 36–40 (citing, *inter alia*, Ex. 1005, 9:34–48) (explaining how Carter teaches “storing index information for the stored data”). Thus, Carter discloses a file tracking scheme that associates the location information at issue with a particular file to retrieve the file, which meets Patent Owner’s interpretation of “file-based.” *See* PO Resp. 10 (“The index in the ’642 Patent is file-based (*i.e.*, it associates the location information at issue with a particular file).”). Carter’s disclosure of a file system that stores and organizes files is precisely the disclosure that the

applicant for the '642 patent argued was lacking in the asserted prior art (Ofer) during examination. *See* Ex. 1004, 170 (“Ofer’s device is limited to providing a **block-based** meta device and would still require the addition of a separate file system, not taught or suggested in Ofer, to store and organize the data in the form of files.”).

Patent Owner’s declarant, Dr. Melendez, testifies as follows:

The global file index of the '642 patent establishes its differentiation over the global addressing of the prior art (e.g. Carter and Ofer) consistent with allowance. In a virtual file-based non-volatile storage medium it is the global index of a file data structure that is used in order to ultimately identify a pointer and/or address location of a file within a physical storage device. When instead a global address is used by a control program to identify a data object that is mapped to particular page location(s) within a physical storage device, the result may be better referred to as an “address-based non-volatile storage medium.”

Ex. 2001 ¶ 27; *see also* Ex. 2001 ¶ 27 n.1 (analogizing an indexing system to a library card catalog). Patent Owner similarly argues that “[i]n a virtual file-based non-volatile storage medium, it is the global index of a file data structure that is used in order to ultimately identify a pointer and/or address location of a file within a physical storage device,” whereas “in the prior art (Ofer/Carter), a global address is used by a control program to identify a data object that is mapped to particular page location(s) within a physical storage device.” PO Resp. 9 (citing Ex. 2001 ¶ 27). Dr. Melendez’s testimony and Patent Owner’s argument, however, ignore Carter’s detailed disclosure of a file system that uses various data to track the location of files. *See* Ex. 1005, 9:34–48 (quoted above); *see also* Pet. 36–40 (citing, *inter alia*, Ex. 1005, 9:34–48) (explaining how Carter teaches “storing index information for the stored data”).

For all of the reasons discussed above, we are persuaded, and we find, that Carter’s virtual storage space is “file-based,” as required by claim 1.

ii. Non-volatile

Petitioner also contends that Carter teaches that its virtual storage space is “non-volatile,” as recited in claim 1, “because it comprises hard disks that store data in a persistent form, which is how a person of ordinary skill in the art would have understood the term ‘non-volatile’ at the time the ’642 patent was filed.” Pet. 22–23 (citing Ex. 1002 ¶ 49; Ex. 1005, 3:50–54, 3:65–4:5, 4:17–37, 4:62–67, 7:20–38). Carter discloses, for example, that

shared memory subsystems provide the network nodes with access to an addressable shared memory space, wherein at least a portion of that space is assigned to at least a portion of one or more of the *persistent storage memory devices (e.g., hard disks)* to allow the nodes addressably to store and retrieve data to and from the one or more persistent storage memory devices.

Ex. 1005, 7:28–34 (emphasis added). There is no dispute that a persistent storage device such as a hard disk is a non-volatile storage medium, but Patent Owner argues Carter discloses using both volatile and non-volatile memory and, therefore, does not teach the recited “virtual file-based non-volatile storage medium.” PO Resp. 24–28. Patent Owner’s argument is premised on its assertion that “[t]he ’642 Patent innovatively restricted its *virtual* file-based storage to physical non-volatile storage media.”

PO Resp. 27.

We disagree with Patent Owner. The claims recite providing a “virtual file-based non-volatile storage medium.” The claims do not prohibit the use or inclusion of volatile memory. Carter unquestionably discloses a non-volatile storage medium. Patent Owner acknowledges this fact in arguing the following:

Carter discloses use of two directory mechanisms within the globally addressable data storage system including, “a first directory for tracking data stored on the persistent data storage devices (*e.g.*, hard disks) and a second directory for tracking data stored on volatile storage devices (*e.g.*, RAM) on the first and second computer networks.”

PO Resp. 25–26 (quoting Ex. 1005, 4:62–67). We find that Carter’s disclosure of the “first directory for tracking data stored on the persistent data storage devices (*e.g.*, hard disks)” teaches that Carter tracks data, including files (discussed above), that are stored on the persistent storage devices (*i.e.*, non-volatile storage media). Therefore, we find that Carter teaches a “virtual file-based non-volatile storage medium,” as recited in claims 1 and 16. Carter’s additional disclosure of a second directory for tracking data stored on volatile devices may go above and beyond what is required in the claims, but it does not negate Carter’s clear disclosure of the claimed subject matter.

iii. Automated

Petitioner also contends Carter’s disclosure that its file system has certain automatic features teaches “a file-based automated file management file system,” as recited in claim 1. Pet. 21 (citing Ex. 1005, 8:43–46, 10:8–9; Ex. 1002 ¶ 47), 25. For example, Carter discloses that file system 60 of Figure 2 “automatically replicates data for redundancy and fault tolerance” and “automatically and dynamically migrates data to account for varying network usage and traffic patterns.” Ex. 1005, 8:43–46; *see also* Ex. 1005, 10:8–9 (“A default filesset is created automatically at the initialization of the addressable shared memory space 20.”).

Patent Owner argues that “Carter provides automated file management in general, but the automated file management is performed

through a global addressing scheme (address-based) rather than a file-based methodology.” PO Sur-reply 20; *see also* PO Resp. 28–29 (arguing that Petitioners explain why Carter provides automated file management but do not explain how Carter discloses or renders obvious a “*file-based* automated file management file system”). Thus, Patent Owner acknowledges that Carter teaches automated file management but disputes the “file-based” aspect of this limitation. For the reasons explained above in § II.D.2.a.i, we disagree with Patent Owner’s argument that Carter does not teach a “file-based” system. We are persuaded, and we find, that Carter’s disclosure of a file-based file system having certain automated functions teaches “a file-based automated file management file system,” as recited in claim 1. Ex. 1005, 8:42–50, 10:8–9.

*iv. Remaining undisputed subject matter
for preamble and first step*

Petitioner also contends Carter teaches that its virtual storage system “interfac[es] with a plurality of file system storage partitions of a plurality of corresponding physical non-volatile storage media associated therewith, locations within each physical non-volatile storage medium of said plurality of corresponding physical non-volatile storage media corresponding to locations within said virtual file-based non-volatile storage medium,” as recited in claim 1. Pet. 25–28. In particular, Petitioner relies on Carter’s disclosure that the virtual storage space is made up of storage from multiple computers. Pet. 25–27 (citing Ex. 1005, 3:1–4:17, 6:4–14, 7:27–34, 9:1–4; Ex. 1002 ¶¶ 55–59). Petitioner also relies on Carter’s disclosure of mapping the virtual storage space to persistent storage devices on the network. Pet. 27–28 (citing Ex. 1005, 8:34–39, 16:12–16, 16:21–2; Ex. 1002 ¶ 60).

Referring to Figure 1, Carter discloses that a portion of the shared memory space “is assigned to at least a portion of one or more of the persistent storage memory devices (e.g., hard disks) to allow the nodes addressably to store and retrieve data to and from the one or more persistent storage memory devices.” Ex. 1005, 7:27–34. Carter further discloses that

file system 60 manages the mapping of a directory and file structure onto a distributed addressable shared memory system 20 which has at least a portion of its addressable space mapped or assigned to at least a portion of one or more persistent storage devices (e.g., hard disks) on the network.

Ex. 1005, 8:32–39. Patent Owner does not dispute Petitioner’s contentions as to this subject matter. Based on the evidence discussed above, we are persuaded, and we find, that Carter teaches the limitation of claim 1 reciting “interfacing with a plurality of file system storage partitions of a plurality of corresponding physical non-volatile storage media associated therewith, locations within each physical non-volatile storage medium of said plurality of corresponding physical non-volatile storage media corresponding to locations within said virtual file-based non-volatile storage medium.”

v. Summary finding for preamble and first step

Based on the foregoing discussions, we are persuaded by Petitioner’s contentions and evidence, and we find that Carter teaches

[a] method of providing automated file management comprising the steps of storing data in a virtual file-based non-volatile storage medium comprising: providing said virtual file-based non-volatile storage medium having a file-based automated file management file system interfacing with a plurality of file system storage partitions of a plurality of corresponding physical non-volatile storage media associated therewith, locations within each physical non-volatile storage medium of said plurality of corresponding physical non-volatile storage media

corresponding to locations within said virtual file-based non-volatile storage medium,

as recited in claim 1.⁹ See Pet. 21–28.

b) Providing data for storage

Claim 1 recites “providing data for storage in said virtual file-based non-volatile storage medium using said file-based automated file management file system.” Petitioner contends Carter’s disclosure of a user storing data in the shared memory system teaches this subject matter. Pet. 28–29 (citing Ex. 1005, 6:56–68, 7:43–60, 7:65–8:4, 8:17–21, 8:25–30, Fig. 1; Ex. 1002 ¶¶ 63–65). For example, referring to Figure 1, Carter discloses that “a system user at node 12a can direct object 50a to be inserted at a set location within the data store 28.” Ex. 1005, 8:17–19; *see also* Ex. 1005, 7:64–67 (“The graphical user interface 42 allows a user at a node, for example at node 12a, to insert data objects graphically within the structured store of data 28.”). Carter discloses that “object 50a” is a “data object[.]” Ex. 1005, 8:14–17. Patent Owner does not dispute Petitioner’s contentions as to this limitation. Based on Petitioner’s persuasive argument and evidence, we find Carter teaches “providing data for storage in said virtual file-based non-volatile storage medium using said file-based automated file management file system,” as recited in claim 1.

c) Determining free space

Claim 1 recites “determining any free space at said locations within said virtual file-based non-volatile storage medium, said free space sufficient for storing the provided data, locations having said any free space

⁹ We need not decide whether the preambles of the challenged claims are limiting because we find that Petitioner has shown that these preamble recitations are taught by the cited art.

corresponding to said locations within said plurality of corresponding physical non-volatile storage media having available non-volatile storage space therein.” Petitioner contends Carter’s disclosure that its file system determines whether there is enough free space to accommodate a requested allocation of disk space teaches this subject matter. Pet. 30–32 (citing Ex. 1005, 3:36–40, 12:40–43, 12:59–13:3; Ex. 1002 ¶¶ 66–72).

Carter discloses the following:

Similar to the [WindowsNT File System (NTFS)], which controls the allocation of each disk partition and therefore can quickly determine the free volume space available for allocation, the file system 60 requests the total available space information and uses this information to quickly determine whether to proceed with the allocation processing. If the total available space is less than the required allocation size, the request is denied immediately. Otherwise, the file system 60 will proceed to allocate the pages to satisfy the request.

Ex. 1005, 12:59–67. As discussed above in § II.D.1.a.ii, Carter discloses that file system 60 uses persistent storage devices of computers on the network to store data. Ex. 1005, 7:27–34, 8:32–39. Patent Owner does not dispute Petitioner’s contentions as to this limitation. Based on Petitioner’s persuasive argument and evidence, we find Carter teaches “determining any free space at said locations within said virtual file-based non-volatile storage medium, said free space sufficient for storing the provided data, locations having said any free space corresponding to said locations within said plurality of corresponding physical non-volatile storage media having available non-volatile storage space therein,” as recited in claim 1.¹⁰

¹⁰ Petitioner also argues that Carter teaches the subject matter recited in this limitation “if one were to interpret ‘free space’ as requiring storage locations that have either never held data or have had any residual data expunged.”

d) Storing the provided data

Claim 1 recites “storing the provided data at said locations having said any free space.” Petitioner contends Carter teaches storing data at locations with free space. Pet. 34–35 (citing Ex. 1005, 7:67–8:4, 9:51–56, 12:66–67, Fig. 4; Ex. 1002 ¶¶ 74–76). As discussed above in § II.D.2.b, Carter discloses that a user can instruct the system to store a data object. Ex. 1005, 8:17–19. Carter further discloses that “data control program 32a can generate a set of commands that will present a stream of data to the shared memory subsystem 34a and the shared memory subsystem 34a will employ the data stream to store an object within the structured store of data 28.” Ex. 1005, 7:67–8:4. Patent Owner does not dispute Petitioner’s contentions as to this limitation. Based on Petitioner’s persuasive argument and evidence, we find Carter’s disclosure of storing an object teaches “storing the provided data at said locations having said any free space.”

e) Storing index information

Claim 1 recites “storing index information for the stored data.” Petitioner contends Carter’s storage of information that is used to access the stored data teaches this subject matter. Pet. 36–40 (citing Ex. 1005, 3:37–40, 7:23–28, 9:34–65, 11:34–50, Figs. 3, 4; Ex. 1002 ¶¶ 77–84). The following passage of Carter discloses using various pieces of data to access files:

Referring to FIG. 3, in the disclosed embodiment of the file system 60, a directory 126 (such as the directory 80 of FIG. 2) is accessed by starting at a directory Inode or descriptor 128

Pet. 33. Neither party argues for this interpretation of “free space,” and we do not view the claims as being so limited. Therefore, we need not rely on this alternative argument.

containing an address that points to a directory entries stream descriptor 130. This descriptor 130 is a pointer to a block of data containing directory entries for files File 1 through File 3. The directory entry for File 1 has a number of entries; one of the entries is a string containing the name of the file and another entry is the address of the Inodes and stream descriptors 132. The stream descriptors for File 1 are used to locate and retrieve the various 4 kilobyte pages in the addressable shared memory space 20 that constitute File 1. Other files are retrieved and constructed from the addressable shared memory space 20 in the same fashion.

Ex. 1005, 9:34–48.

As part of its “file-based” arguments, Patent Owner argues that Carter does not teach using “*file* index data in order to process the storage and data access requests of the host.” PO Resp. 18–19. For the reasons explained above in § II.D.2.a.i, we disagree with Patent Owner’s “file-based” arguments, including Patent Owner’s argument that Carter does not teach a file index.

As explained above in § II.D.2.a.i, we find that Carter discloses a file tracking scheme that associates the location information at issue with a particular file to retrieve the file. *See* Ex. 1005, 9:34–48; *see also* Ex. 1002 ¶ 78 (“A person of ordinary skill would recognize that Inode is a shorthand way of referring to an ‘index node.’ Inodes were well-known mechanisms prior to 1999, to track information relating to a data file, and specifically the actual data blocks making up the file.”). Based on Petitioner’s persuasive argument and evidence, we find Carter teaches “storing index information for the stored data,” as recited in claim 1.

f) Determination of unpatentability of claim 1

For the reasons discussed above, we find Carter teaches all of the limitations and the overall method of claim 1. Having considered the full

record developed during trial, we are persuaded by Petitioner's contentions and evidence, and we determine that Petitioner has proven by a preponderance of the evidence that claim 1 of the '642 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over the teachings of Carter.

3. *Dependent Claim 2*

Claim 2 recites, "The method as defined in claim 1 wherein the index information comprises data indicative of a file identifier, and locations within said virtual file-based nonvolatile storage medium for the stored data." Referring to its contentions for the limitation of claim 1 reciting "storing index information for the stored data," Petitioner argues that Carter's index information "include[s] 'a string containing the name of the file,'" thereby teaching the claimed "data indicative of a file identifier," and that Carter's index information includes "'the address of the Inodes and stream descriptors' associated with the file," thereby teaching the claimed "locations within said virtual file-based nonvolatile storage medium for the stored data." Pet. 40–41 (quoting Ex. 1005, 9:40–43) (citing Ex. 1002 ¶¶ 85–86).

Patent Owner does not separately address the additional limitations recited in claim 2. *See generally* PO Resp.

We are persuaded that Carter teaches the subject matter of claim 2 because, as discussed above in §§ II.D.2.a.i and II.D.2.e, Carter discloses storing index information for the file data so that the file can be retrieved from the locations where the data are stored. Ex. 1005, 9:34–48. Having considered the full record developed during trial, we are persuaded by Petitioner's contentions and evidence, summarized above, and we determine that Petitioner has proven by a preponderance of the evidence that claim 2 of

the '642 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over the teachings of Carter.

4. Dependent Claim 3

Claim 3 recites, “The method as defined in claim 1 wherein the index information comprises data indicative of a file identifier, an indication of said physical non-volatile storage medium on which the stored data is stored, and the corresponding locations within said physical non-volatile storage medium for the stored data.” Patent Owner separately argues the patentability of claim 3. PO Resp. 33–35.

Like claim 2, claim 3 recites that “the index information comprises data indicative of a file identifier.” Petitioner argues Carter teaches this subject matter for the same reasons given for claim 2 (*see* Pet. 40–41), and we are persuaded by Petitioner’s contentions (*see* § II.D.3 above).

Claim 3 differs from claim 2 in reciting that the index information comprises “an indication of said physical non-volatile storage medium on which the stored data is stored, and the corresponding locations within said physical non-volatile storage medium for the stored data.” Citing Carter’s disclosure that “stream descriptors for File 1 are used to locate and retrieve the various 4 kilobyte pages in the addressable shared memory space 20 that constitute File 1” (Ex. 1005, 9:43–46), Petitioner argues that a person of ordinary skill in the art would view these pages as either virtual pages or physical pages. Pet. 42 (citing Ex. 1002 ¶ 90). Petitioner argues that “[i]f they are physical, then they identify the specific physical locations where the data is stored (i.e., the claimed ‘corresponding locations within said physical nonvolatile storage medium for the stored data’).” Pet. 42 (citing Ex. 1005, 9:60–63; Ex. 1002 ¶ 90). Petitioner argues that if the pages are viewed as

virtual, “then *Carter*’s virtual-to-physical mappings, which identify the specific physical locations for the stored data, provide the claimed ‘corresponding locations within said physical non-volatile storage medium for the stored data.’” Pet. 42 (citing Ex. 1002 ¶ 90); *see* Ex. 1005, 3:37–40 (“The system provides physical storage for each portion of the virtual space in use by mapping (i.e., assigning) each such portion to a physical device such as RAM or a hard disk.”), *quoted in* Pet. 38–39. Petitioner argues that *Carter*’s storage space spans multiple physical devices and, therefore, that “one skilled in the art would have understood that *Carter*’s identification of physical locations in the form of pages would also specify the physical devices where those pages reside.” Pet. 42–43 (citing Ex. 1005, 3:10–16; Ex. 1002 ¶ 91).

According to Patent Owner, “[t]he ’642 Patent is explicit that under the limitations of dependent claim 3, ‘a need for a lookup table to translate virtual addresses is eliminated.’” PO Resp. 33 (quoting Ex. 1001, 3:51–54). Patent Owner argues that the limitations of claim 3 are

discussed in detail in the ’642 Patent as follows: “[a]lternatively, ***when index information is stored as a storage medium and a location within that storage medium, a need for a lookup table to translate virtual addresses is eliminated.*** Unfortunately, this alternative also makes moving of data or replacing of an entire physical storage medium more difficult.”

PO Resp. 33 (quoting Ex. 1001, 3:51–56). Patent Owner argues that “*Carter*’s entire methodology depends upon translation of global addresses and lookup tables” and that “[t]he direct mapping of virtual locations to physical locations creates the very lookup table to translate virtual addresses that the ’642 Patent aims to eliminate within the embodiment of dependent claim 3.” PO Resp. 33, 35.

We do not agree with Patent Owner's suggestion that claim 3 prohibits the use of a lookup table. First, the claim recites no such negative limitation. Second, the passage from the '642 patent relied upon by Patent Owner does not prohibit the use of a lookup table; rather, it says that a lookup table is not necessary in certain circumstances. Thus, we agree with Petitioner that "nothing in the claims recites the exclusion of lookup tables." *See* Pet. Reply 25.

In its Sur-reply, Patent Owner contends that "Ppetitioner misunderstands Patent Owner's argument" and that the language of claim 3 "replaces the lookup table and provides the very information a lookup table would be used to determine." PO Sur-reply 23. Therefore, according to Patent Owner, "it would make no sense for a lookup table to be present to provide information already acquired." PO Sur-reply 23. Whether or not a lookup table makes sense is irrelevant to whether Carter teaches the subject matter of claim 3, which does not prohibit the use of a lookup table.

We are persuaded by Petitioner's explanation as to how Carter teaches the limitations of claim 3. Carter explains that its "virtual space spans each storage device (e.g., RAM and hard disk) connected to the network" and that "all data stored on the network can be stored within the virtual space and the actual physical location of the data can be in any of the storage devices connected to the network." Ex. 1005, 3:11–16, *cited in* Pet. 42. As explained above in §§ II.D.2.a.i and II.D.2.e, Carter discloses storing index information that tracks where the file is stored so that the file can be retrieved. Ex. 1005, 9:34–38. Dr. Long testifies that "*Carter's* identification of physical locations in the form of pages would also specify the physical devices where those pages reside" because "[w]ithout this

device information, a person of ordinary skill would recognize that *Carter*'s system would not be able to reliably locate the stored data because it would be unclear on which drives to find the specified pages.” Ex. 1002 ¶ 91. We credit this testimony because it is consistent with *Carter*'s file tracking scheme that is used to retrieve files, which can be stored in various physical places in the virtual storage. Ex. 1005, 9:34–48. This is why *Carter* discloses stream descriptors for a file that “are used to locate and retrieve the various 4 kilobyte pages in the addressable shared memory space 20 that constitute” the file. Ex. 1005, 9:44–46. *Carter* discloses that “[o]ther files are retrieved and constructed from the addressable shared memory space 20 in the same fashion.” Ex. 1005, 9:46–48. Thus, we find *Carter*'s detailed description of tracking the locations where the constituent parts of a file are stored teaches “an indication of said physical non-volatile storage medium on which the stored data is stored, and the corresponding locations within said physical non-volatile storage medium for the stored data,” as recited in claim 3.

Having considered the full record developed during trial, we are persuaded by Petitioner's contentions and evidence, and we determine that Petitioner has proven by a preponderance of the evidence that claim 3 of the '642 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over the teachings of *Carter*.

5. Dependent Claim 4

Claim 4 recites, “The method as defined in claim 3 wherein some of the stored data stored within one of said physical non-volatile storage media is duplicated data of data stored in another of said physical non-volatile storage media.” Petitioner argues *Carter*'s disclosures of copying data to different storage devices and replicating data for fault tolerance teach this

subject matter. Pet. 44 (citing Ex. 1005, 8:43–44, 13:4–12, 23:11–21; Ex. 1002 ¶¶ 93–96). For example, Carter discloses that a “coherent replication controller can automatically generate a copy of the data stored in each page and can store the copy in a memory device that is separate from the memory device of the original copy.” Ex. 1005, 23:16–20.

Patent Owner does not separately address the additional limitations recited in claim 4. *See generally* PO Resp.

We are persuaded that Carter’s disclosure of replicating data to different memory devices teaches the data duplication recited in claim 4. Having considered the full record developed during trial, we are persuaded by Petitioner’s contentions and evidence, summarized above, and we determine that Petitioner has proven by a preponderance of the evidence that claim 4 of the ’642 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over the teachings of Carter.

6. Dependent Claim 5

Claim 5 recites, “The method as defined in claim 3 wherein a portion of the stored data less than the whole is stored on a first physical non-volatile storage medium and another portion of the stored data less than the whole is stored on a second physical non-volatile storage medium.” Petitioner argues Carter’s disclosures that multiple nodes contribute storage space and that data is stored on multiple nodes teach this subject matter. Pet. 45 (citing Ex. 1005, 7:28–34, 9:51–56; Ex. 1002 ¶¶ 97–98). For example, Carter discloses, referring to Figure 1, that

shared memory subsystems provide the network nodes with access to an addressable shared memory space, wherein at least a portion of that space is assigned to at least a portion of one or more of the persistent storage memory devices (e.g., hard disks)

to allow the nodes addressably to store and retrieve data to and from the one or more persistent storage memory devices.

Ex. 1005, 7:28–34. As discussed above in § II.D.4 for claim 3, Carter explains that its “virtual space spans each storage device (e.g., RAM and hard disk) connected to the network” and that “all data stored on the network can be stored within the virtual space and the actual physical location of the data can be in any of the storage devices connected to the network.”

Ex. 1005, 3:11–16; *see* Pet. 45 (referring to contentions for claim 3).

Patent Owner does not separately address the additional limitations recited in claim 5. *See generally* PO Resp.

We are persuaded that Carter’s disclosure of storing data on multiple nodes teaches that less than all of the stored data is on one physical medium. Having considered the full record developed during trial, we are persuaded by Petitioner’s contentions and evidence, summarized above, and we determine that Petitioner has proven by a preponderance of the evidence that claim 5 of the ’642 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over the teachings of Carter.

7. *Dependent Claim 6*

Claim 6 recites, “A method as defined in claim 3 wherein said first physical non-volatile storage medium and said second physical non-volatile storage medium form part of different computer systems in communication one with the other via a communication network.” Petitioner contends Carter discloses that “the physical storage that forms *Carter’s* globally addressable storage is comprised of physical media from different ‘network nodes,’ which are separate computers that communicate via a network.” Pet. 46 (citing Ex. 1005, 3:1–5, 3:9–16, Fig. 6; Ex. 1002 ¶ 100). Petitioner also notes that, although claim 6 recites that it depends from claim 3, the

terms “said first physical non-volatile storage medium” and “said second physical non-volatile storage medium” are introduced in claim 5 and have no antecedent basis in claim 3. Pet. 46. Petitioner argues that the subject matter of claim 6 would have been obvious whether claim 6 is considered to depend from claim 3 or claim 5. Pet. 46–48.

Patent Owner does not separately address the additional limitations recited in claim 6 and does not respond to the antecedent basis issues raised by Petitioner. *See generally* PO Resp.

Notwithstanding the antecedent basis issues identified by Petitioner, we address claim 6 as dependent from claim 3 based on the express language of claim 6. As discussed above in § II.D.4 for claim 3, Carter explains that its “virtual space spans each storage device (e.g., RAM and hard disk) connected to the network” and that “all data stored on the network can be stored within the virtual space and the actual physical location of the data can be in any of the storage devices connected to the network.” Ex. 1005, 3:11–16. Thus, we agree that Carter discloses physical storage media that are in different computer systems communicating over a network. Having considered the full record developed during trial, we are persuaded by Petitioner’s contentions and evidence, summarized above, and we determine that Petitioner has proven by a preponderance of the evidence that claim 6 of the ’642 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over the teachings of Carter.

8. *Independent Claim 16*

Independent claim 16 is directed to a “method of storing data in a virtual file-based non-volatile storage comprising” steps that are similar to those recited in claim 1 with one additional wherein clause, which recites

that “the physical non-volatile storage media form parts of different computer systems in communication with each other via a communication network.” This additional language is similar to language in claim 6, discussed above in § II.D.7, reciting that first and second physical non-volatile storage media “form part of different computer systems in communication one with the other via a communication network.” Similar to its argument for claim 6, Petitioner argues that “the physical storage that forms *Carter*’s globally addressable storage is comprised of physical media from different ‘network nodes’ that communicate with each other across a network.” Pet. 50 (citing Ex. 1005, 3:1–5, 3:9–16, 6:37–51, Figs. 1, 6; Ex. 1002 ¶ 105). For the reasons explained above in § II.D.7 for claim 6, we agree that *Carter* teaches this additional subject matter recited in claim 16.

Patent Owner does not raise additional arguments concerning claim 16 but, rather, argues that Petitioner’s contentions fail for the reasons addressed above with respect to claim 1. *See generally* PO Resp.

Having considered the full record developed during trial, we are persuaded by Petitioner’s contentions and evidence for the reasons given above in this section and in § II.D.2 for claim 1, and we determine that Petitioner has proven by a preponderance of the evidence that independent claim 16 of the ’642 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over the teachings of *Carter*.

*E. Obviousness over the Combination of Carter and Cannon
(Claims 7, 10, 17, 20)*

Petitioner asserts claims 7, 10, 17, and 20 of the ’642 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over the combined teachings of *Carter* and *Cannon*. Pet. 11, 59–69.

1. Cannon

Cannon relates to file storage and discloses various file management techniques, including data migration and archiving. Ex. 1008, 1:9–18, 5:35–37, 6:24–29, 17:50–18:9.

2. Claims 7 and 17

Claim 7 recites the following:

The method as defined in claim 1 comprising the steps of:

monitoring access to stored data;

determining from the monitored access a location within the virtual file-based non-volatile storage medium for the stored data;

moving the stored data to the determined location; and

updating the index data to reflect the new storage location of the stored data *being the determined location*.

Ex. 1001, 8:53–62 (emphasis added). Claim 17 depends from claim 16 and recites everything in claim 7 except for the phrase “being the determined location,” which is italicized above.

Petitioner first argues that Carter alone teaches this subject matter. Pet. 60–62. In particular, Petitioner relies on the following disclosure in Carter:

Further the system can include a migration controller for selectively moving portions of the addressable memory space between the local persistent memory devices of the plural computers. The migration controller can determine and respond to data access patterns, resource demands or any other suitable criteria or heuristic. Accordingly, the migration controller can balance the loads on the network, and move data to nodes from which it is commonly accessed.

Ex. 1005, 16:32–40, *cited in* Pet. 60. Petitioner argues that responding to data access patterns by moving data to nodes where it is commonly accessed

teaches the “monitoring,” determining,” and “moving” steps of claims 7 and 17. Pet. 60–61. Petitioner argues that Carter discloses that the index information is updated when files are moved so that the system can locate data. Pet. 61 (citing Ex. 1005, 17:65–18:13; Ex. 1002 ¶ 133).

Patent Owner argues that Carter’s migration controller deals with volatile storage, not “non-volatile” storage as recited in the claims. PO Resp. 31 (quoting Ex. 1005, 17:21–24) (citing Ex. 1005, 16:32–40). The passage of Carter quoted by Patent Owner states that “[t]he systems can include additional elements including a . . . migration controller for moving portions of addressable memory space between the local volatile memory devices of the plural computers.” Ex. 1005, 17:12–24. Although this passage discusses a migration controller for volatile memory, Petitioner relies on Carter’s “migration controller for selectively moving portions of the addressable memory space between the local *persistent memory devices* of the plural computers.” Ex. 1005, 16:32–35 (emphasis added), *quoted in* Pet. 60. As discussed above in § II.D.2.a.ii, Carter’s disclosure of data storage on persistent memory devices such as hard disks teaches a “non-volatile storage medium.” Thus, Patent Owner’s argument is unavailing because it is directed to a different migration controller.

Patent Owner also argues that Carter’s migration controller for network load balancing “moves data to a node where it is commonly accessed,” which, according to Patent Owner, “does not qualify as ‘determining from the monitored access a **location** within the virtual file-based non-volatile storage medium.’” PO Resp. 31 (citing Ex. 2001 ¶ 64). Neither Patent Owner nor Dr. Melendez, who testifies similarly, explains this assertion, and we disagree with it because Carter discloses that

its “migration controller can determine and respond to data access patterns, resource demands or any other suitable criteria or heuristic” and “move data to nodes from which it is commonly accessed.” Ex. 1005, 16:35–40, *cited in* Pet. 60. Thus, Carter discloses monitoring access to data and determining from that monitored access a new location to which to move the data, such as nodes from which the data are commonly accessed.

Based on Petitioner’s persuasive evidence and argument and in view of the foregoing discussion, we are persuaded, and we find, that Carter’s disclosures relating to its persistent storage migration controller teach the subject matter of claims 7 and 17. *See* Ex. 1005, 16:32–40.

Petitioner notes that its arguments that Carter teaches the subject matter of claim 7 are “based on the understanding that claim 7 is not limited to migrating data to archive it,” and Petitioner further argues that “if one were to narrowly read claim 7 to require archiving, *Cannon* provides this teaching and it would have been obvious to incorporate it into *Carter*’s system.” Pet. 62.

Claims 7 and 17 do not recite archiving, and we do not interpret claims 7 and 17 as requiring archiving. Nonetheless, we are persuaded by Petitioner’s contentions based on the combination of *Cannon* with *Carter*. *See* Pet. 62–66. In particular, Petitioner relies on *Cannon*’s disclosure of “automatic data migration.” Pet. 62–64 (citing Ex. 1008, 5:35–37, 6:25–26, 7:4–7, 7:20–21, 17:23–29, 17:50–18:7, Fig. 4; Ex. 1002 ¶¶ 135–137). *Cannon* discloses that “a migration operation” may “start[] automatically in response to the existence of a predetermined condition,” which “may be related to the data’s recency of use, frequency of use, age, etc.” Ex. 1008, 17:58–62. *Cannon* discloses that, in response to the condition, the files are

copied to “target locations,” which “may be selected under many different techniques, considering factors such as the size of the data, availability of potential target locations, etc.” Ex. 1008, 17:67–18:2. Cannon further discloses “updat[ing] the database . . . to reflect the new locations of the managed files.” Ex. 1008, 18:3–4.

Patent Owner argues that Cannon’s data migration disclosure is directed to archiving, which, according to Patent Owner, “only is performed when there is ‘no access’ and the new/determined location is predetermined rather than determined as a function of the monitored access.” PO Resp. 32 (citing Ex. 2001 ¶ 65). This description of archiving, however, is Patent Owner’s characterization of how archiving operates in the ’642 patent. For example, Patent Owner argues that “[i]n the archiving example of the ’642 Patent, the location for archiving is predetermined independent of monitoring access to stored data.” PO Resp. 30 (citing Ex. 2001 ¶ 63). Regardless of whether the ’642 patent performs archiving in a certain way in the Specification, the relevant inquiry is whether Cannon teaches the claimed subject matter. Petitioner relies on Cannon’s disclosure of selecting target locations for the data. Pet. 64 (citing Ex. 1008, 17:64–18:2; Ex. 1002 ¶ 137). Patent Owner’s argument that “Cannon’s storage archive hierarchy locations are predetermined” (PO Sur-reply 22) ignores Cannon’s disclosure of selecting target locations for the data. Ex. 1008, 17:67–18:2.

We are persuaded, and we find, that the combination of Carter and Cannon teaches the subject matter recited in claims 7 and 17. As discussed above, we find Carter alone teaches the subject matter of claims 7 and 17. We likewise are persuaded, and we find, that Carter’s disclosures, discussed above, in combination with Cannon’s disclosure of migrating data in

response to conditions such as frequency of use and recency of use of the data, teach monitoring access to the data and determining where to move the data from that monitoring. Ex. 1008, 17:58–18:2. We also find that Cannon’s disclosure of “updat[ing] the database . . . to reflect the new locations of the managed files” (Ex. 1008, 18:3–4) teaches updating the index data, as recited in claims 7 and 17. We also are persuaded by Petitioner’s contention that a person of ordinary skill in the art would have been motivated to combine the teachings of Carter and Cannon to “allow[] less-frequently used data to be moved to slower, cheaper, or less-utilized storage areas, as taught in *Cannon*,” which “would result in optimized performance for the more frequently used data, which could reside on faster or more expensive media because the less used data would all migrate to the slower or cheaper media.” Pet. 64–65 (citing Ex. 1002 ¶¶ 134–138). During the trial, Patent Owner did not challenge Petitioner’s reasons to combine Carter and Cannon. *See generally* PO Resp.

Having considered the full record developed during trial, we are persuaded by Petitioner’s contentions and evidence, and we determine that Petitioner has proven by a preponderance of the evidence that dependent claims 7 and 17 of the ’642 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over the combined teachings of Carter and Cannon.

3. *Claims 10 and 20*

Claim 10 recites the following:

The method as defined in claim 1 comprising the steps of:

- monitoring access to stored data;
- archiving stored data that is not accessed for more than a predetermined amount of time.

Claim 20 depends from claim 16 but otherwise adds the same limitations as recited in dependent claim 10.

Petitioner argues that the combination of Carter and Cannon teaches “monitoring access to stored data” for the same reasons discussed with respect to the same limitation of claims 7 and 17 (*see* Pet. 66), and we agree for the reasons discussed above in § II.E.2.

Petitioner argues that Cannon’s disclosure of moving data downward in the file hierarchy based on the data’s recency of use teaches “archiving stored data that is not accessed for more than a predetermined amount of time.” Pet. 66–67 (citing Ex. 1008, 7:39–43, 17:20–21, 17:60–62, 18:54–60; Ex. 1002 ¶¶ 134–141). Referring to Figure 7, Cannon discloses that “a storage pool backup operation 700 is performed in response to various conditions (step 704).” Ex. 1008, 18:54–55. As discussed above in § II.E.2, Cannon discloses that “predetermined condition[s]” in step 704 of Figure 7 “may be related to the data’s recency of use, frequency of use, age, etc.” Ex. 1008, 17:58–62. Petitioner refers to its reasons to combine the teachings of Carter and Cannon discussed with respect to claims 7 and 17. Pet. 67.

Patent Owner does not dispute Petitioner’s contentions with respect to claims 10 and 20 and acknowledges that Cannon teaches archiving. *See* PO Resp. 32 (“[T]he archiving discussed in Cannon may disclose the archiving limitations of dependent claims 10 and 20 but cannot disclose the localized storage limitations of dependent claims 7 and 17 of the ’642 Patent.”).

Having considered the full record developed during trial, we are persuaded by Petitioner’s contentions and evidence, discussed above in this section and discussed above in § II.E.2, and we determine that Petitioner has

proven by a preponderance of the evidence that dependent claims 10 and 20 of the '642 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over the combined teachings of Carter and Cannon.

*F. Obviousness over the Combination of Carter and Mutalik
(Claims 3–5)*

Petitioner asserts claims 3–5 of the '642 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over the combined teachings of Carter and Mutalik. Pet. 11, 54–59. Petitioner argues that “under this alternative ground, instead of *Carter*’s virtual-to-physical mappings providing the claimed ‘corresponding locations within said physical non-volatile storage medium for the stored data,’ *Carter*’s pages would be modified to directly map virtual locations to physical locations, as taught in *Mutalik*.” Pet. 55 (citing Ex. 1002 ¶ 118).

Petitioner argues that Mutalik discloses storing a file in multiple disks that make up a logical volume. Pet. 55 (citing Ex. 1007, 5:66–6:4). For example, Mutalik discloses that a file is stored in a “logical volume” and that a “file may include several portions which are distributed among one or more disks and one or more series of blocks, which are referred to herein as disk ‘extents’ on each disk.” Ex. 1007, 5:66–6:5. Petitioner also relies on Mutalik’s disclosure that “[e]ach extent comprising [a file] is identified by an identifier or ‘extent descriptor,’ identifying the disk storage device 16(s) on which it is stored, the first block in the series of blocks comprising the extent and the number of successive blocks comprising the extent.” Ex. 1007, 6:52–56, *quoted in* Pet. 55. Petitioner argues that “modify[ing] *Carter*’s mapping to pages in the virtual media to a mapping to extents in the physical media like in *Mutalik*” would have allowed the removal of one

layer of Carter’s index information and provided for a more direct mapping to the data’s physical location, which, according to Petitioner, “would have enhanced the functionality of *Carter*’s system by avoiding storing, maintaining, and consulting a second mapping from the virtual location to the physical location.” Pet. 56–57 (citing Ex. 1002 ¶ 122).

Patent Owner’s argument as to this ground is based on its argument as to the challenge to claim 3 based on Carter alone that claim 3 eliminates the need for a lookup table. See PO Resp. 32–35. Patent Owner argues that Petitioner’s proposed modification “creates the very lookup table to translate virtual addresses that the ’642 Patent aims to eliminate within the embodiment of dependent claim 3.” PO Resp. 35. As discussed above in § II.D.4, claim 3 does not prohibit the use of a lookup table, and, therefore, Patent Owner’s argument is not commensurate with the scope of the claim. Patent Owner also argues that Mutalik does not disclose a “file-based system[.]” PO Sur-reply 23. First, as discussed above in § II.D.2.a.i, we find Carter discloses a file-based system. Therefore, we need not rely on Mutalik to disclose a file-based system. Second, we find Mutalik teaches a file-based system because it discloses that “[f]iles are established and managed by a file system manager portion . . . of the operating system controlling host computer.” Ex. 1007, 5:66–6:2.

As discussed above in §§ II.D.4–6, we are persuaded that the subject matter of claims 3–5 would have been obvious based on the teachings of Carter alone. We also are persuaded by Petitioner’s contentions, summarized above, that the combination of Carter and Mutalik teaches the claimed subject matter and that a person of ordinary skill in the art would have been motivated to combine the teachings of Carter and Mutalik in the

manner asserted. Having considered the full record developed during trial, we are persuaded by Petitioner's contentions and evidence, discussed above in this section and in §§ II.D.4–6, and we determine that Petitioner has proven by a preponderance of the evidence that claims 3–5 of the '642 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over the combined teachings of Carter and Mutalik.

*G. Obviousness over the Combinations of Carter and Frey
and Carter, Mutalik, and Frey
(Claim 5)*

Petitioner asserts claim 5 of the '642 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over the combinations of Carter and Frey and Carter, Mutalik, and Frey. Pet. 11, 51–54, 58–59. As discussed above in § II.D.6, Petitioner contends, and we are persuaded, that the subject matter of claim 5 would have been obvious based on the teachings of Carter alone. In this ground, Petitioner additionally asserts that the subject matter of claim 5 would have been obvious based on Carter in combination with Frey's disclosure of striped file systems in which data can be distributed across multiple nodes in a network. Pet. 51–54 (citing Ex. 1006, 1:50–56, 2:52–54, 3:1–5, 3:10–16, 5:43–52, 5:62–6:11, 6:24–31, 9:51–54; Ex. 1002 ¶¶ 43, 107–115). Frey discloses the following:

a first block of records in a file is placed in a data node 42 that is determined by data for that file in the table entry 49 and “starts” the file. The next file data block being placed in the next node 42 as also indicated by that table entry 49, etc. In one example of a data block distribution method, consecutive data blocks are placed on consecutively numbered nodes 42 until the last node of pre-specified span is reached. This distribution method is called “striping”

Ex. 1006, 5:62–6:8. We find that Frey’s disclosure of striping teaches “a portion of the stored data less than the whole is stored on a first physical non-volatile storage medium and another portion of the stored data less than the whole is stored on a second physical non-volatile storage medium,” as recited in claim 5.

Petitioner argues that Frey identifies benefits of striping and that “[a] person of ordinary skill in the art would have . . . been motivated to modify *Carter*’s system to implement striping techniques disclosed by *Frey* based on *Frey*’s own descriptions of the benefits of striping in general and its form of striping in particular.” Pet. 52, 54 (citing Ex. 1006, 1:50–56, 2:52–54; Ex. 1002 ¶¶ 109, 113–114). For example, Frey discloses the following:

A striped network file system with multiple servers offers the potential to achieve very high performance using multiple collections of inexpensive computers and disks. Also, distributing file data across a plurality of servers and storage devices provides the potential for improved data recovery in the event of a failure of any server or storage device if redundancy is added to critical data.

Ex. 1006, 1:50–56. We are persuaded by Petitioner’s contentions that a person of ordinary skill in the art would have been motivated to combine Frey’s striping teachings with the teachings of Carter to achieve the benefits identified of striping identified in Frey, such as improved fault tolerance and high performance using inexpensive disks. *See* Ex. 1006, 1:50–56; Ex. 1002 ¶ 114. Petitioner contends, and we are persuaded, that a person of ordinary skill in the art would have been motivated to combine the teachings of Frey with the teachings of Carter and Mutalik for the same reasons. Pet. 58–59.

During the trial, Patent Owner did not challenge Petitioner's assertions as to Frey or Petitioner's reasons to combine Frey with Carter and Carter and Mutalik. *See generally* PO Resp.

Having considered the full record developed during trial, we are persuaded by Petitioner's contentions and evidence, discussed above, and we determine that Petitioner has proven by a preponderance of the evidence that claim 5 of the '642 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over the combined teachings of Carter and Frey and over the combined teachings of Carter, Mutalik, and Frey.

III. CONCLUSION¹¹

For the reasons discussed above, we determine Petitioner has proven, by a preponderance of the evidence, that the challenged claims are unpatentable, as summarized in the following table:

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–6, 16	103(a)	Carter	1–6, 16	
5	103(a)	Carter, Frey	5	
3–5	103(a)	Carter, Mutalik	3–5	
5	103(a)	Carter, Frey, Mutalik	5	
7, 10, 17, 20	103(a)	Carter, Cannon	7, 10, 17, 20	
Overall Outcome			1–7, 10, 16, 17, 20	

¹¹ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner’s attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

IV. ORDER

Accordingly, it is:

ORDERED that claims 1–7, 10, 16, 17, and 20 of the '642 patent have been shown to be unpatentable; and

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

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