

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GOOGLE LLC,
Petitioner,

v.

LS CLOUD STORAGE TECHNOLOGIES, LLC,
Patent Owner.

IPR2023-00777
Patent 6,549,988 B1

Before NEIL T. POWELL, ARTHUR M. PESLAK, and
KRISTIL R. SAWERT, *Administrative Patent Judges*.

SAWERT, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Google LLC (“Petitioner”) filed a petition to institute *inter partes* review of claims 1–6 of U.S. Patent No. 6,549,988 B1 (Ex. 1001, “the ’988 patent”). Paper 1 (“Pet.”). LS Cloud Storage Technologies, LLC (“Patent Owner”) filed a Preliminary Response. Paper 6 (“Prelim. Resp.”).

We have authority under 35 U.S.C. § 314 to determine whether to institute an *inter partes* review. The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted unless “there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” If the Board institutes trial, it “will authorize the review to proceed on all of the challenged claims and on all grounds of unpatentability asserted for each claim.” 37 C.F.R. § 42.108(a); *see also PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (interpreting the statute to require “a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition”).

Applying those standards, and upon considering the Petition, the Preliminary Response, and the evidence of record, we determine the information presented shows a reasonable likelihood that Petitioner would prevail in establishing the unpatentability of at least one of the challenged claims of the ’988 patent. Accordingly, we institute an *inter partes* review of claims 1–6 of the ’988 patent on the grounds asserted in the Petition.

The following preliminary findings of fact and conclusions of law are made solely for determining whether to institute review. Any final decision will be based on the full trial record.

II. BACKGROUND

A. *Related Matters*

Petitioner identifies the following district-court proceedings as related matters: *LS Cloud Storage Technologies, LLC v. Google LLC*, Case No. 1:22-cv-00853 (W.D. Tex.); *LS Cloud Storage Technologies, LLC v. Amazon.com, Inc. et al.*, Case No. 1:22-cv-01167 (W.D. Tex.) (dismissed with prejudice on March 16, 2023); *LS Cloud Storage Technologies, LLC v. Cisco Systems, Inc.*, Case No. 6:22-cv-00845 (W.D. Tex.); *LS Cloud Storage Technologies, LLC v. Microsoft Corporation*, Case No. 1:22-cv-00974 (W.D. Tex.). Pet. 3. Petitioner also identifies *Microsoft Corporation v. LS Cloud Storage Technologies, LLC*, IPR2023-00622, as a related matter. *Id.* Patent Owner identifies the following as related matters: *LS Cloud Storage Technologies, LLC v. Amazon.com, Inc., Amazon Web Services, Inc. and Amazon.com Services, Inc.*, 6:22-cv-00316 (W.D. Tex.); *LS Cloud Storage Technologies, LLC v. Cisco Systems, Inc.*, 6:22-cv-00319 (W.D. Tex.); *LS Cloud Storage Technologies, LLC v. Microsoft Corporation*, Case No. 6:22-cv-00321 (W.D. Tex.); and *LS Cloud Storage Technologies, LLC v. Cisco Systems, Inc.*, 6:22-cv-00845 (W.D. Tex.). Paper 4, 2.

B. *Real Parties in Interest*

Petitioner identifies Google LLC as its real party in interest. Pet. 2. Patent Owner identifies LS Cloud Storage Technologies, LLC as its real party in interest. Paper 4, 2.

C. *Overview of the '988 Patent*

The '988 patent, titled "Data Storage System Comprising a Network of PCs and Method Using Same," relates "generally to the field of cached data storage systems and more particularly to a data storage system that

permits independent access from local hosts connected via I/O channels and independent access from remote hosts and remote storage systems connected via network links.” Ex. 1001, code (54), 1:8–13. According to the ’988 patent, the disclosed data storage systems improve over prior art by using “standard hardware and software components” versus specialized operating systems and custom programming. *Id.* at 1:35–40, 1:66–2:1.

Figure 1, reproduced below, illustrates a data storage system according to the ’988 patent. *Id.* at 4:39.

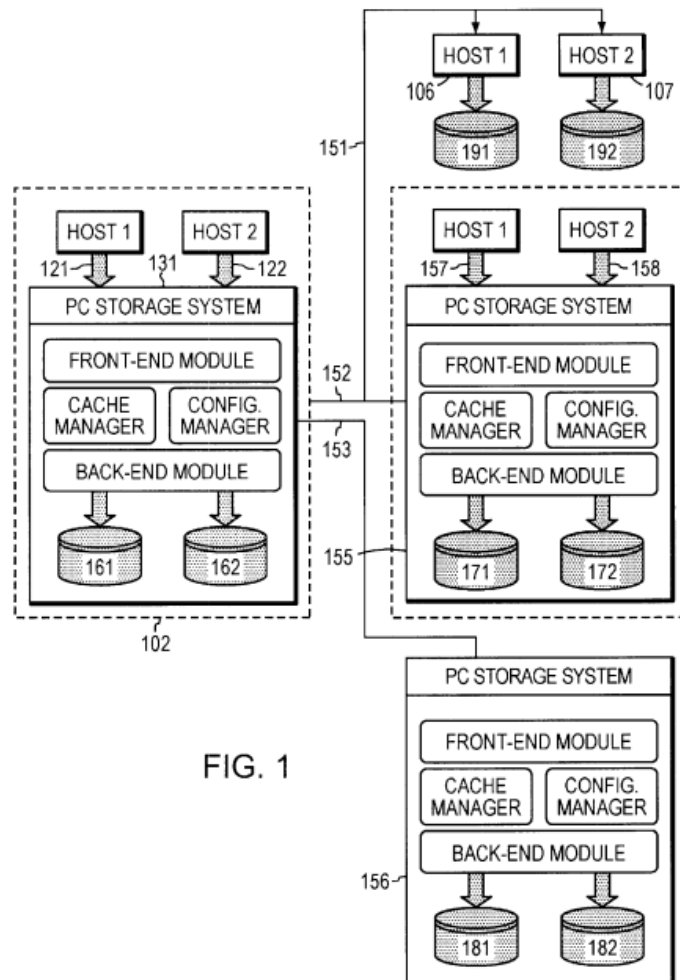


FIG. 1 is a block diagram of the data storage system configurations according to the ’988 patent.

The '988 patent states that PC data storage system 131 services: (1) a plurality of channel attached host processors 111, 112¹ using channels 121, 122; (2) a plurality of network attached host processors 106, 107 using network link 151; and (3) a plurality of network attached data storage systems 132, 133 using network links 152, 153. *Id.* at 4:66–5:5. “PC storage system 132 services channel attached hosts 157, 158.” *Id.* at 5:5–6. The '988 patent further states that “[h]osts 157 and 158 access data storage system 131 indirectly via network attached data storage system 132, thereby off loading communications protocol overhead from remote hosts 157, 158.” *Id.* at 5:6–10. “Hosts 106 and 107 directly access storage system 131 via network link 151 thereby incurring communications protocol overhead on hosts 106, 107 and therefore decreasing performance of applications running on said hosts.” *Id.* at 5:10–14.

Next, the '988 patent states that “[h]ost 111 accesses remote disk 181 via local data storage system 131, network link 153, and remote data storage system 133 without incurring protocol overhead on host 111.” *Id.* at 5:14–16. “Host 157 accesses disk 161 via data storage system 133, network link 152, and data storage system 131 without incurring protocol overhead on host 157” and “[h]ost 106 directly accesses local disk 161 via network link 151 thereby incurring protocol overhead.” *Id.* at 5:17–22. Finally, as to Figure 1, the '988 patent states that “disks 191, 192 that are attached to hosts 106, 107 without a data storage system, cannot be accessed by outside hosts.” *Id.* at 5:22–24.

¹ We note that several numerical labels recited in the '988 patent's written description of Figure 1 do not actually appear in Figure 1. *Compare* Ex. 1001, 4:66–5:24, *with id.* at Fig. 1.

Figure 3, reproduced below, illustrates “software architecture and modules of a PC data storage system corresponding to the data storage system 131 in FIG. 1.” *Id.* at 5:38–40.

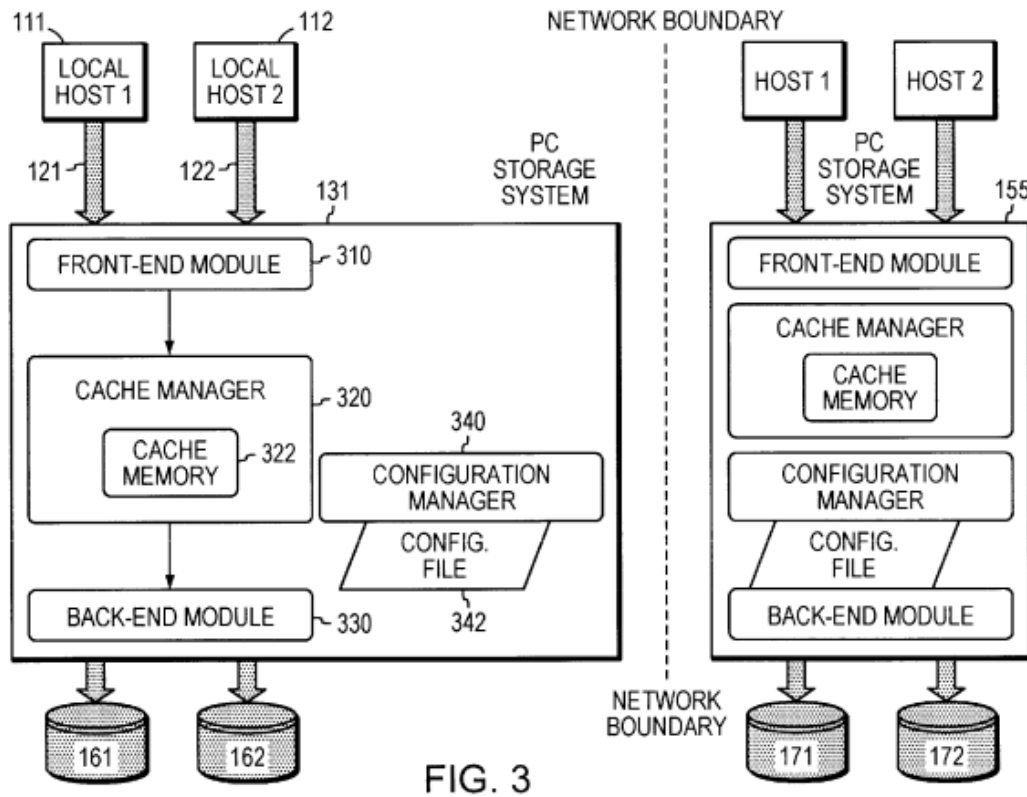


FIG. 3

FIG. 3 is a block diagram of a PC data storage system according to the '988 patent.

As to Figure 3, the '988 patent states that “[d]ata is received from the hosts 111, 112 via I/O channels 121, 122 in front-end software module 310.” *Id.* at 5:40–42. “The front-end module 310 handles channel commands and places the results in cache memory 322 in the form of new data or modification to data.already [*sic*] stored on the disk 161.” *Id.* at 5:42–45. Next, “[t]he cache manager software module 320 calls routines in the configuration manager 340 to ensure consistency of the cache memory in other network attached data storage systems.” *Id.* at 5:45–48. Later, “the

back-end software module 342 invokes a page flusher module to write modified data to disks 161 and 162 and free up cache memory.” *Id.* at 5:48–51.

D. The Challenged Claims

Petitioner challenges claims 1–6 of the ’988 patent. Pet. 1. Of the challenged claims, claims 1 and 6 are independent. Claim 1 is illustrative of the claimed subject matter and is reproduced below with Petitioner’s added identifiers bolded and in brackets.

1. **[1.pre]** A computer suitable for use in a data storage system comprising a network interconnecting a plurality of such computers, the computer comprising:
 - [1.a]** an I/O channel adapter for accepting an incoming I/O request from a host;
 - [1.b]** configuration manager software for enabling said I/O channel adapter to decide whether (i) to route said request to cache, (ii) to route said request to disk, or (iii) to reject said request;
 - [1.c]** a network adapter for handling network control traffic;
 - [1.d]** a cache memory;
 - [1.e]** front-end software for handling I/O requests arriving at the I/O channel adapter or the network adapter;
 - [1.f]** cache manager software, responsive to said front-end software, for handling data stored in said cache memory; and
 - [1.g]** back-end software, responsive to said configuration manager software, for handling reads and writes to disks corresponding to the I/O requests but without communication over the I/O channel adapter, thereby separating disk operations from network and I/O traffic.

Ex. 1001, 9:11–33.

E. Evidence

Petitioner submits evidence including:

Evidence	Exhibit No.
Declaration of Dr. Paul Franzon	1004
U.S. Patent No. 6,173,374 B1 (“Heil”)	1006
U.S. Patent No. 5,920,893 (“Nakayama”)	1007
Rick Macklem, “Not Quite NFS, Soft Cache Consistency For NFS,” PROC. OF THE WINTER 1994 USENEX CONF., Jan. 1994 (“Macklem”)	1009
V. Srinivasan and Jeffery C. Mogul, “Spritely NFS: Experiments with Cache Consistency Protocols,” PROC. OF THE TWELFTH ACM SYMPOSIUM ON OPERATING SYSTEMS PRINCIPLES, Dec. 1989 (“Srinivasan”)	1018

F. Asserted Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability:

Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1	1–4, 6	103(a) ²	Heil, Nakayama
2	5	103(a)	Heil, Nakayama, Macklem, Srinivasan

Pet. 5. Patent Owner disputes Petitioner’s asserted grounds of unpatentability. *See generally* Prelim. Resp.

G. Overview of the Asserted Prior Art

We now provide brief summaries of the asserted references.

² Congress amended 35 U.S.C. § 103, among other sections, when it passed the Leahy-Smith America Invents Act (“AIA”). Pub. L. No. 112–29, § 3(c), 125 Stat. 284, 287 (2011). Petitioner indicates that its challenges are based on the pre-AIA version of 35 U.S.C. Pet. 5. Because the application that resulted in the ’988 patent was filed before March 16, 2013, Ex. 1001, code (22), we apply the pre-AIA version of 35 U.S.C. Our decision would be the same were we to apply the AIA version of the statute.

1. *Heil (Ex. 1006)*

Heil, titled “System and Method for Peer-to-Peer Accelerated I/O Shipping Between Host Bus Adapters in Clustered Computer Network,” relates “to an apparatus and method for I/O request shipping operable using peer-to-peer communications within host bus adapters of the clustered systems.” Ex. 1006, code (54), 1:11–14. Heil states that the disclosed invention satisfies an existing need “for an improved apparatus and method to provide cluster computing disk sharing (or more generally resource sharing) with high I/O throughput performance, low host system processing overhead, and lower cost/complexity as compared to prior host-based techniques.” *Id.* at 3:58–63.

Heil discloses that the disclosed invention provides “for I/O shipping of block level requests to peer intelligent host bus adapters” or “HBAs.” *Id.* at 3:66–4:3. Heil defines an “HBA” as “a device which adapts (connects) a host computer system to an I/O device.” *Id.* at 4:3–4. Heil discloses that the HBA “contains a directory within memory for storing location information regarding blocks of data stored within the plurality of storage devices in the cluster,” along with “circuits and software for searching the directory to determine whether to locally or remotely retrieve blocks of data.” *Id.* at 4:8–13. The HBA also distributes I/O block requests as well as “establish[es] and maintain[s] communications with at least one other host bus adapter to query and request another host bus adapter to retrieve and transfer I/O requested data blocks from a storage subsystem within said clustered computing network.” *Id.* at 4:15–20.

Figure 1, reproduced below, illustrates a host system according to Heil. *Id.* at 6:7–9.

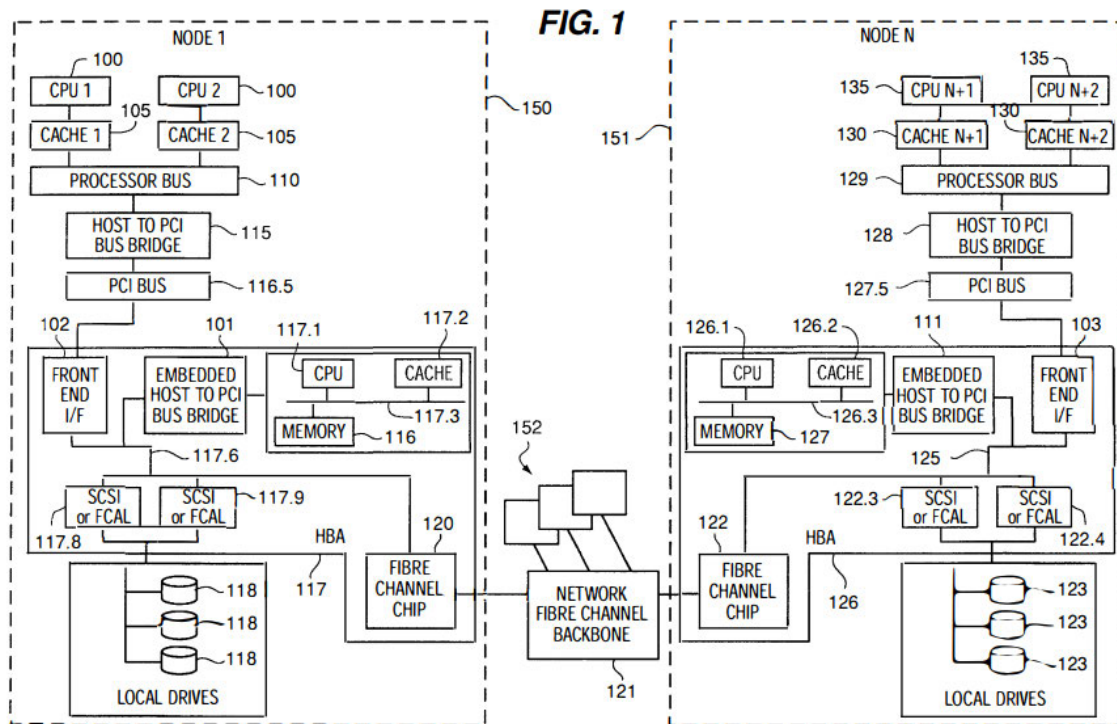


FIG. 1 is a block diagram of a host system according to Heil.

As shown in Figure 1, host system includes CPU 1 and CPU 2 connected to cache 1 and cache 2, respectively. *Id.* at 6:34–47, 8:8–22. CPU 1 and CPU 2 are also coupled to a local processor bus 110, which in turn is connected to HBA 117. *Id.* at 6:34–47, 8:8–22. According to Heil, HBA 117 “has embedded intelligence that allows it to function . . . as a disk drive controller for local disks 118.” *Id.* at 6:65–67. The HBA 117 also includes a cache memory 117.2 that “can be accessed much faster than information within disk drives 118.” *Id.* at 7:9–24. Each CPU within node 150 (Node 1), node 151 (Node N), and nodes 152 does not have direct connectivity to a peer CPU within another node, but are connected via a network communications medium such as fibre channel backbone 121. *Id.* at 8:8–22.

2. Nakayama (Ex. 1007)

Nakayama, titled “Storage Control and Computer System Using the Same,” relates to a “storage control system which enables data on various storage media for storing input/output data to/from host computers to be shared among said host computers having various host computer input/output interfaces.” Ex. 1007, code (54), 1:5–10. Figure 3, reproduced below, illustrates a computer system including a disk subsystem according to Nakayama. *Id.* at 3:13–15.

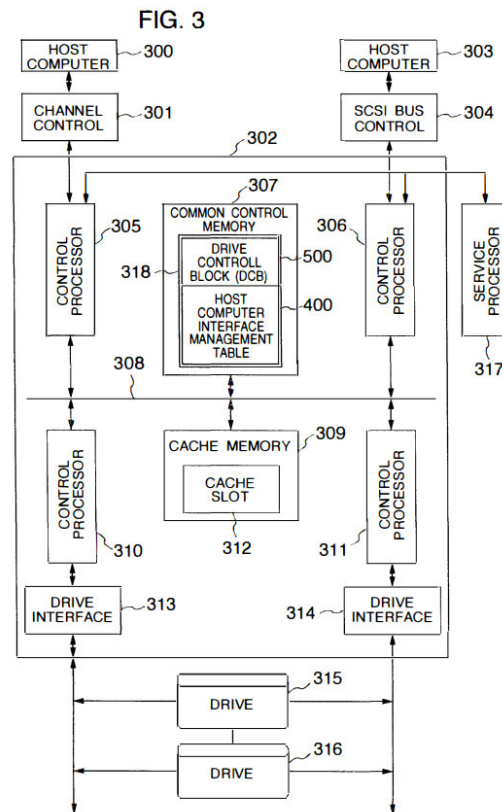


FIG. 3 is a block diagram of a data processing system including a disk subsystem according to Nakayama.

As shown in Figure 3, a disk control 302 is connected to a host computer 300 via a channel control 301 on a host side and is also connected to a host computer 303 via a small computer system interface (SCSI). *Id.* at

4:39–42. The disk control 302 is also connected to drives 315 and 316, which are magnetic storage mediums. *Id.* at 4:47–48. According to Nakayama, “control processors 305 and 306 mainly perform data transfer between the host computers 300 and 303 and the cache memory 309.” *Id.* at 4:61–63. And “[c]ontrol processors 310 and 311 mainly perform data transfer between the cache memory 309 and the drives 315 and 316.” *Id.* at 4:63–65.

3. *Macklem (Ex. 1009)*

Macklem, titled “Not Quite NFS, Soft Cache Consistency for NFS,” provides an overview of cache design and performance, especially in high performance workstation environments. Ex. 1009, 261. Macklem explains that, “[w]hen a client wishes to access a file’s data it must hold one of three types of lease: read-caching, write-caching or non-caching.” *Id.* at 264. According to Macklem, “[a] read-caching lease allows for client data caching but no modifications may be done.” *Id.* “A write-caching lease permits delayed write caching, but requires that all data be pushed to the server when the lease expires or is terminated by an eviction callback.” *Id.* Finally, “read and write leases are replaced by a non-caching lease when there is the potential for write sharing.” *Id.*

4. *Srinivasan (Ex. 1018)*

Srinivasan, titled “Spritely NFS: Experiments with Cache-Consistency Protocols,” provides an overview of the “NFS” and “Sprite” cache-management strategies. Ex. 1018, 45–48. Srinivasan states that “[c]ache management strategies are central to performance, reliability, and correctness of distributed file services.” *Id.* at 45. Srinivasan describes an experiment where the Sprite cache consistency protocols were transplanted

into the NFS file access protocol, called “Spritely NFS.” *Id.* Srinivasan concludes that “the Sprite approach to consistency is superior to that used in NFS,” and that “Sprite’s performance advantage over NFS comes mostly from its delayed write-back policy.” *Id.* at 56.

III. DISCUSSION

The Board may authorize an *inter partes* review if we determine that the information presented in the Petition and Patent Owner’s Preliminary Response shows that there is a reasonable likelihood that Petitioner will prevail with respect to at least one of the claims challenged in the petition. 35 U.S.C. § 314(a). In an *inter partes* review, “the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). Petitioner ultimately bears the burden of persuasion to prove unpatentability of each challenged claim by a preponderance of the evidence. 35 U.S.C. § 316(e). This burden never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

Petitioner contends that claims 1–6 of the ’988 patent are unpatentable under 35 U.S.C. § 103(a) for obviousness. A claim is unpatentable as obvious 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. 35 U.S.C. § 103(a) (1994 Ed. and Supp. IV 1999); *see also KSR Int’l Co. v.*

Teleflex Inc., 550 U.S. 398, 406 (2007). The question of obviousness is resolved based on 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 objective indicia of nonobviousness.³ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). An obviousness determination requires finding a reason to combine accompanied by a reasonable expectation of achieving what is claimed in the challenged patent. *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367 (Fed. Cir. 2016). “[A]ny need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.” *KSR*, 550 U.S. at 419–20.

We organize our discussion into three sections. First, we address the level of ordinary skill in the art. Second, we address claim construction. And third, taking account of the information presented, we consider whether the Petition satisfies the threshold requirement for instituting an *inter partes* review under 35 U.S.C. § 314(a).

A. Level of Ordinary Skill in the Art

We consider the asserted grounds of unpatentability in view of the understanding of a person of ordinary skill in the art. In assessing the level of ordinary skill in the art, various factors may be considered, including (1) educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology, and

³ Patent Owner does not presently assert objective indicia supporting nonobviousness of the challenged claims. *See generally* Prelim. Resp.

(6) educational level of workers active in the field. *Environmental Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 696–97 (Fed. Cir. 1983). Not all of these factors may be present in every case, and one or more of these or other factors may predominate in a particular case. *Id.* Moreover, these factors are not exhaustive but are merely a guide to determining the level of ordinary skill in the art. *Daiichi Sankyo Co. Ltd, Inc. v. Apotex, Inc.*, 501 F.3d 1254, 1256 (Fed. Cir. 2007).

Relying on the declaration testimony of Dr. Franzon, Petitioner contends that an ordinarily skilled artisan for the '988 patent “would have a bachelor’s degree in Computer Science, Computer Engineering, or Electrical Engineering, or an equivalent course of study, as well as 2 or more years of academic or industry experience in the field of computer networking, computer architecture and storage management.” Pet. 17 (citing Ex. 1004 ¶¶ 33–35). Petitioner also contends that “[m]ore education can supplement practical experience, and vice versa,” and that an ordinarily skilled artisan “would also have had knowledge of the prior art admitted by the '988 Patent.” *Id.* Patent Owner states that, “[f]or purposes of this Response,” it “adopt[s] Petitioner’s proffered level of ordinary skill in the art because it comports with the technology and claims of the '988 Patent as well as the asserted prior art.” Prelim. Resp. 7.

Based on the current record presented, including our review of the '988 patent and cited prior art, we agree with Petitioner’s proposed definition. Thus, we apply Petitioner’s definition for this decision. *See, e.g.*, Ex. 1001, 1:8–3:30 (describing in the “BACKGROUND OF THE INVENTION” section of the '988 patent various conventional methods of storage and their alleged deficiencies).

B. Claim Construction

Next, we turn to claim construction. In interpreting the claims of the '988 patent, we “us[e] the same claim construction standard that would be used to construe the claim[s] in a civil action under 35 U.S.C. [§] 282(b).” 37 C.F.R. § 42.100(b). The claim construction standard includes construing claims in accordance with the ordinary and customary meaning of such claims as would have been understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. *See id.*; *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–14 (Fed. Cir. 2005) (*en banc*).

Petitioner states “[f]or the purposes of this Petition, Petitioner interprets all terms of claims 1–6 in accordance with their ordinary and customary meaning.” Pet. 17–18; *see also id.* at 42–43 (contending that “the term ‘volume access table’ should be construed broadly without reading any particular embodiment of the '988 Patent into the construction”). Patent Owner states that the terms of the '988 patent “are clear on their face” except for “volume access table.” Prelim. Resp. 5.

Specifically, Patent Owner argues that “volume access table” means “a table used to manage a data storage system, comprising a mapping between hosts and volumes specifying an access mode value. [*sic*] wherein the access mode value is shared or exclusive during cache processing.” *Id.* at 7. In arriving at this construction, Patent Owner argues that “volume access table” “does not have an ordinary meaning,” and thus, its construction “must align with the patent’s description of the invention.” *Id.* at 6. Patent Owner relies on a passage from the '988 patent stating:

Volume access table (450) in FIG. 4 contains a mapping between hosts and volumes specifying an access mode value. If the access mode is set to neither shared nor exclusive configuration

manager forwards I/O requests directly to disk. In addition to the access mode said volume access table may contain other values that help to manager [*sic*] and improve performance of said data storage system.

Id. at 6–7 (citing Ex. 1001, 6:15–21). Patent Owner argues that “[t]he intrinsic record thus clearly indicates the ’988 Patent’s precise conception, which here must control the construction.” *Id.* at 7.

In construing the term “volume access table,” we start with the words of the claim itself. *See, e.g., Veritas Techs. LLC v. Veeam Software Corp.*, 835 F.3d 1406, 1411 (Fed. Cir. 2016) (claim construction begins with the plain language of the claims). Claim 2 recites “a volume access table employed by the configuration manager to ensure consistency of data stored on the network.” Ex. 1001, 9:39–41. From this language, we discern that the volume access table contains at least some information that allows the configuration manager to ensure consistency of stored data. The parties appear to dispute the type of information required. Petitioner contends that, at most, a volume access table need only contain “additional data specifying an access mode,” Pet. 42–43, whereas Patent Owner contends that the volume access table must store “a mapping between hosts and volumes specifying an access mode value” where “the access mode value is shared or exclusive during cache processing,” Prelim. Resp. 7.

At the outset, we are not persuaded on this record that the construction of “volume access table” must include that “the access mode value is shared or exclusive during cache processing,” as Patent Owner argues. The ’988 patent expressly describes an embodiment where a user can set the values and parameters in a volume access table to neither shared nor exclusive modes in order to improve performance of the data storage system.

Ex. 1001, 6:29–42. Thus, we decline to limit the access mode value to shared or exclusive in the construction of “volume access table” on this record and for institution.

Our analysis, then, narrows down to whether the “volume access table” must include “a mapping between hosts and volumes specifying an access mode value.” We determine that it does based on the written description of the ’988 patent. *See Phillips*, 415 F.3d at 1315 (the specification is the single best guide to the meaning of a disputed term”).

Specifically, the ’988 patent appears to teach that the purpose of the “volume access table” is to map hosts to volumes for the purpose of determining host access to the volumes. *See* Ex. 1001, 6:6–8 (stating that “[d]epending upon the status of the value in a volume access table 450 the requests are routed as shown in” Figures 4A through 4D); *id.* at 6:15–17 (“Volume access table (450) in FIG. 4 contains a mapping between hosts and volumes specifying an access mode value.”); *id.* at 8:45–49 (“Configuration manager, 560 provides concurrency [*sic*] control for accessing virtual devices that are mapped to the same physical device 161. The configuration manager uses a volume access table 450 that has been shown in FIG. 4.”). For these reasons, we construe “volume access table” for institution to mean “a table containing a mapping between hosts and volumes specifying an access mode value.” Ex. 1001, 6:15–17. The parties may further address the construction of “volume access table” as necessary during trial, and in particular, address what mapping hosts to volumes means in the context of the ’988 patent.

We determine that no other claim terms require express construction at this time. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*,

868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))). Any final written decision entered in this case may include a final claim construction based on the full trial record that differs from any discussion of claim scope provided in our analysis below.

C. Asserted Grounds of Unpatentability

We now consider whether the Petition satisfies the threshold requirement for instituting an *inter partes* review under 35 U.S.C. § 314(a) by addressing Petitioner’s asserted grounds of unpatentability below.

1. Alleged Obviousness of Claims 1–4 and 6 by Heil and Nakayama

Petitioner contends that claims 1–4 and 6 of the ’988 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Heil in view of Nakayama. Pet. 18–53. Petitioner contends that the combination of Heil and Nakayama teaches or suggests all limitations of the challenged claims, and that an ordinarily skilled artisan would have had a reason to combine the teachings of Heil and Nakayama with a reasonable expectation of success to achieve the claimed subject matter. *Id.* Patent Owner disputes Petitioner’s contentions. Prelim. Resp. 13–27. Having considered the arguments and evidence before us, we find that the record establishes a reasonable likelihood that Petitioner would prevail on this asserted ground of unpatentability.

a) Claim 1: Currently undisputed limitations 1.pre-1.a and 1.c–1.g

Taking claim 1 as illustrative, Petitioner provides a limitation-by-limitation analysis contending that the combination of Heil and Nakayama

teaches or suggests each and every limitation of the claim. Pet. 21–39. We have reviewed Petitioner’s contentions and supporting evidence regarding the currently undisputed limitations of claim 1, and are satisfied that the record establishes sufficiently for institution that the combination of Heil and Nakayama discloses these limitations. Thus, we agree with and preliminarily adopt Petitioner’s detailed mapping of: the preamble,⁴ *see id.* at 21 (citing Ex. 1006, 1:36–37, 4:2–4, 4:29–30, 6:65–7:15; Ex. 1004 ¶¶ 76–81); limitation [1.a], *see id.* at 21–23 (citing Ex. 1006, Fig. 1, 2:59–65, 4:40–41, 4:50–53, 4:63–69, 6:35–40, 7:36–37, 12:4–6; Ex. 1004 ¶¶ 59–60); limitation [1.c], *see id.* at 29–31 (citing Ex. 1006, Fig. 1, 8:33–38; Ex. 1004 ¶¶ 89–93); limitation [1.d], *see id.* at 31 (citing Ex. 1006, Fig. 1, 7:9–15; Ex. 1004 ¶¶ 94–96); limitation [1.e], *see id.* at 31–34 (citing Ex. 1006, Fig. 2, 2:59–62, 6:65–7:7, 8:24–38, 10:43–49, 10:57–58, 11:54–12:7, 12:30–34; Ex. 1004 ¶¶ 97–103); limitation [1.f], *see id.* at 34–36 (citing Ex. 1006, Fig. 2, 5:1–6, 10:66–11:11, 12:19–34; Ex. 1004 ¶¶ 104–108); and limitation [1.g], *see id.* at 36–39 (citing Ex. 1006, Fig. 2, 5:1–6, 10:66–11:11, 12:19–34; Ex. 1004 ¶¶ 109–114).

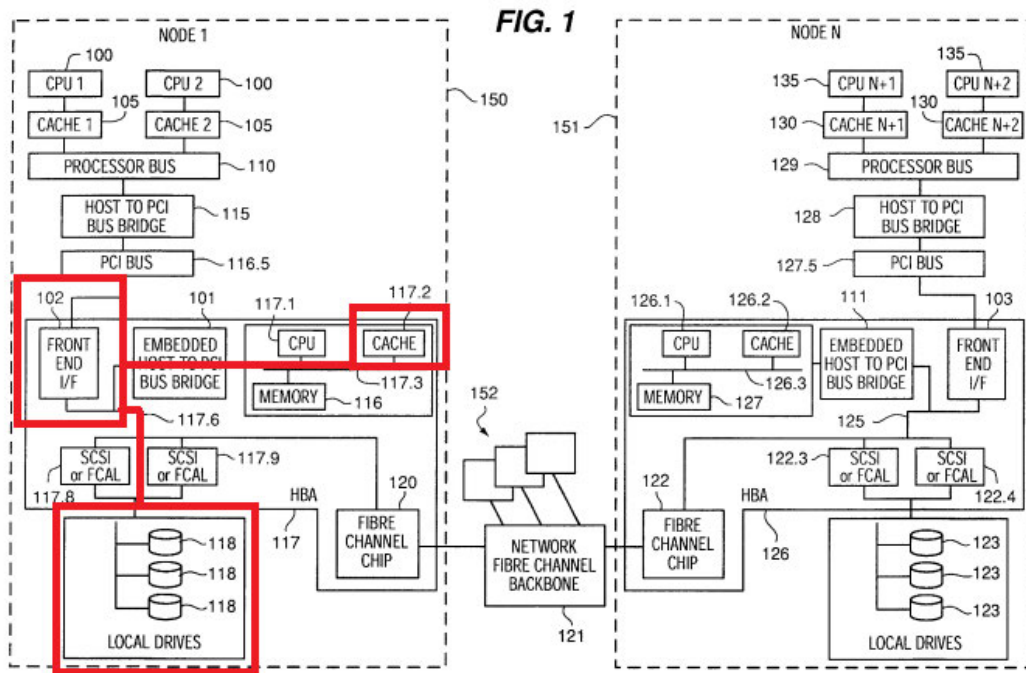
b) Claim 1: Disputed Limitation [1.b]

We now turn to the disputed limitation. Limitation [1.b] recites “configuration manager software for enabling said I/O channel adapter to decide whether (i) to route said request to cache, (ii) to route said request to disk, or (iii) to reject said request.” Ex. 1001, 9:16–19. Petitioner contends

⁴ Neither party takes a position on whether the preambles to the claims are limiting. At this stage of the proceeding, we accept Petitioner’s showing that the preambles are taught by the prior art, without deciding whether the preambles are limiting.

that Heil in view of Nakayama renders this limitation obvious. Pet. 23 (citing Ex. 1004 ¶¶ 82–88).

Specifically, for this limitation, Petitioner relies on an annotated version of Heil’s Figure 1, which we reproduce below:



Id. at 24. Figure 1 depicts Heil’s host system. In its annotated version of Figure 1, Petitioner draws in red boxes around front-end interface 102, cache 117.2, and local drives 118. *Id.*

As to routing read requests to cache or disk, Petitioner contends that I/O requests are routed from the front-end interface to either cache or the local drives, as shown by the added red line. *Id.* at 23–24 (citing Ex. 1006, 7:24–30, 11:66–12:5 Ex. 1004 ¶¶ 83–85). Petitioner contends that Heil discloses a “managing means,” including I/O redirector software, that coordinates the retrieval of data from either cache or disk storage “based on whether the requested data is found in cache or not.” *Id.* at 25–26 (citing Ex. 1006, Fig. 2, 5:1–6, 11:66–12:1, 12:19–34; Ex. 1004 ¶¶ 83–84).

As to rejecting a read request, Petitioner contends that “[t]o the extent Heil’s I/O redirector software does not explicitly reject an I/O request in addition to routing an I/O request to cache or disk, incorporating this additional functionality into Heil’s I/O redirector software is suggested by Nakayama.” *Id.* at 27 (citing Ex. 1004 ¶¶ 85–86). Petitioner contends that Nakayama teaches a method of denying I/O requests when its control processor 305 fails to obtain data access rights to a drive after a data access command. *Id.* (citing Ex. 1007, 6:11–14). Petitioner also contends that “Nakayama provides several reasons why limiting access to certain drives and rejecting I/O requests directed to those drives would be advantageous, including to prevent simultaneous use of the same storage medium or to prevent a drive from being predominantly used by a single host.” *Id.* at 28 (citing Ex. 1004 ¶ 86). For these reasons, Petitioner contends, an ordinarily skilled artisan “would have been motivated to combine the teachings of Heil and Nakayama to incorporate Nakayama’s teaching of rejecting I/O requests to Heil’s I/O redirector software,” with a reasonable expectation of success. *Id.* at 28–29 (citing Ex. 1006, 1:44–52, 2:18–32; Ex. 1004 ¶¶ 85–87).

In response, Patent Owner argues⁵ that Heil and Nakayama do not disclose section (ii) of limitation [1.b]—“to route said request to disk.” *See* Prelim. Resp. 16–21. Specifically, Patent Owner argues that “to route said

⁵ We note that the formatting and presentation of Patent Owner’s arguments throughout the Preliminary Response is confusing. For example, Patent Owner appears to quote portions of the Petition without using proper block-quote formatting or even quotation marks, making it unclear which statements are Patent Owner’s and which are Petitioner’s. *See, e.g.*, Prelim. Resp. 17–18, 21–25. Going forward, Patent Owner should strive to use proper formatting for clarity.

request to disk” means to route I/O requests “*directly* to disk.” *Id.* at 17 (emphasis added) (citing Ex. 1001, 6:15–19). Patent Owner argues that Heil’s host bus adaptor (HBA) “does not route the request to disk *directly*,” but instead “first route[s] the request to its HBA cache, if the blocks of data are not within cache, then directly from the remote HBA’s local disk.” *Id.* at 18 (emphasis added). Patent Owner also argues that Nakayama’s I/O channel adaptor is only connected to disk storage “through cache memory.” *Id.* at 18–19 (citing Ex. 1007, 4:56–65).

We have considered the parties’ respective arguments and evidence, and determine, on this record and for institution, that Petitioner has met the reasonable likelihood standard for moving forward with trial. As an initial matter, we observe that the plain language of section (ii) of limitation [1.b] does not recite “directly,” and therefore does not appear to support Patent Owner’s argument that “route said request to disk” means “route said request to disk directly.” Indeed, the plain language of claim 1 stands in contrast to that of dependent claim 5, which expressly recites routing “directly to a disk without using the cache memory.” Ex. 1001, 10:15–17. On this record, the language of claim 5 provides evidence that Patent Owner knew how to claim direct routing to disk, but chose not to do so in claim 1.

The written description of the ’988 patent also does not appear to support Patent Owner’s position, because the written description discloses an embodiment where the I/O request is routed to disk through cache—that is, indirectly. Specifically, the ’988 patent discloses that I/O requests are routed depending on whether the access mode is set for “write exclusive” mode, “read exclusive” mode, “write shared” mode, or “read shared” mode (or none of those modes). Ex. 1001, 6:4–10. If the access mode *is not set* to

any of these “shared” or “exclusive” modes, then the configuration manager forwards the I/O request “directly to disk.” *Id.* at 6:15–19. But—in one embodiment—where the access mode *is set* to “read exclusive” mode, then the configuration manager checks whether the I/O request is in cache before routing the request to disk. *Id.* at 6:65–7:6; *see also* Fig. 4B. The ’988 patent states that if the read request is not in cache, then “the cache manager starts an operation to read from a hard disk driver.” *Id.* at 7:4–6.

Thus, although one embodiment of the ’988 patent involves forwarding I/O requests *directly* to disk, at least one other embodiment involves forwarding I/O requests *indirectly* to disk, e.g., after first checking whether the request is in cache. On this record, Patent Owner does not provide persuasive reasoning or evidence for limiting the plain language of limitation [1.b] to “direct” routing to disk, and we decline to do so at this stage of the proceeding. *See, e.g., WesternGeco LLC v. ION Geophysical Corp.*, 889 F.3d 1308, 1323–24 (Fed. Cir. 2018) (“It is well established that claims are not limited to preferred embodiments, unless the specification clearly indicates otherwise.”).

For these reasons, we are satisfied that the record establishes sufficiently for institution that the combination of Heil and Nakayama discloses the disputed limitation [1.b].

c) Claims 2, 4, and 6

Because we determined above that Petitioner has demonstrated a reasonable likelihood of prevailing in its challenge to at least claim 1 of the ’988 patent, we institute *inter partes* review on all claims, including claims 2, 4, and 6. 37 C.F.R. § 42.108(a). In this section, we will focus on Patent Owner’s arguments with respect to the claim term “volume access table,”

which appears in these claims. *See* Ex. 1001, 9:39–41 (claim 2), 10:4–6 (claim 4), 10:29–30 (claim 6).

Briefly, Petitioner relies on Heil alone to disclose “volume access table” when that term is “construed broadly,” Pet. 41–42, but on Heil in combination with Nakayama when construing volume access table more narrowly—i.e., “to the extent a volume access table contains additional data specifying an access mode,” *id.* at 42–43 (citing Ex. 1004 ¶¶ 125–126).

Patent Owner argues that neither Heil nor Heil combined with Nakayama teaches or suggests “a volume access table” as recited in the challenged claims. Prelim. Resp. 21–25. As to Heil, Patent Owner argues that Petitioner errs by equating Heil’s “directory” to the claimed “volume access table” because these components have “different structures and functions.” *Id.* at 23. And, as to Nakayama, Patent Owner argues that Petitioner has “confused ‘interhost exclusive information’ of Nakayama with ‘shared/exclusive’ access mode in the ’988 Patent.” *Id.* at 25.

Patent Owner’s arguments are not persuasive on this record. As Petitioner explains, Heil teaches that its I/O redirector software 240 uses a directory that maps the locations of blocks in the entire cluster to determine the location of data on the network responsive to an I/O request. Pet. 41–42; Ex. 1006, 11:45–54, 12:19–25, 12:34–42. Specifically, each HBA “maps the location of data within its local storage system thereby building a directory containing the location of all locally stored data blocks.” Ex. 1006, 5:3–4. And, “each HBA uses peer-to-peer capabilities to communicate the contents of its directory to peer HBAs,” thereby creating a directory of all hosts to data blocks in the computer system. *Id.* at 5:6–8. Patent Owner appears to agree with Petitioner that Heil’s directory—to the extent it is a

table⁶—“will comprise a mapping between hosts and volumes specifying whether or not a volume is [held] by a local host or a remote host.” Prelim. Resp. 22.

Heil does not appear, at least on this record, to disclose that the directory includes access mode values. But Nakayama discloses an “interhost exclusive information” that contains access mode data. Specifically, Nakayama discloses that “[t]he interhost exclusive information 403 is used when the host computer 300 or 303 exclusively controls the drive access from the other host computer.” Ex. 1007, 5:42–44. The “interhost exclusive information” “sets the information 403 ‘on’ when the processor reserves access of the specified drive number and sets it ‘off’ when the host computer releases the access right.” *Id.* at 5:44–47.

On this record, we determine that Petitioner has shown sufficiently for institution that an ordinarily skilled artisan would have had a reason to implement Nakayama’s “interhost exclusive information” in Heil’s directory. *See* Pet. 43–44 (citing Ex. 1006, 2:18–32; Ex. 1007, 5:43–47, 5:31–34). Petitioner reasonably explains (and supports with declaration testimony and other evidence) that an ordinarily skilled artisan would have understood that “Nakayama’s access modes would improve control of access to disk drives and would help achieve Heil’s objective of controlling access to disk to maintain consistency of the stored data.” *Id.* (citing Ex. 1004 ¶¶ 125–126). Indeed, Heil expressly contemplates using the directory to

⁶ We note that Patent Owner argues that “Heil does not specify that the ‘directory’ is a kind of table.” Prelim. Resp. 22. Heil, however, expressly teaches that “the directory can be implemented as a hash table with hash computations operable to locate a block of data in the directory.” Ex. 1006, 13:11–14.

maintain the consistency of data in the storage system, and further discusses known methods for regulating host access to disk blocks, such as through the “Oracle Parallel Database Server’s” distributed lock manager (“DLM”).

Ex. 1006, 2:18–35.

We have considered Patent Owner’s argument that Heil’s directory is irrelevant because the term “‘directory’ specifies that some data volumes can be accessed by particular hosts, and does not specify the cache mode by particular hosts,” Prelim. Resp. 23, but we are not persuaded on this record. We note that, at this stage of the proceeding, Patent Owner’s arguments are not supported by citations to record evidence and/or declaration testimony. Similarly, Patent Owner’s argument that there is a distinction between ensuring the “consistency of data stored in the cache during cache processing” (purportedly the function of the volume access table) and the “consistency of data in the storage system” (purportedly the function of Heil’s directory), *id.*, also lacks record support.

Accordingly, for the reasons set forth above and based on the totality of the evidence currently in the record, we are persuaded that Petitioner has demonstrated a reasonable likelihood of prevailing in its challenge to claims 2, 4, and 6 of the ’988 patent as obvious over Heil in view of Nakayama. Given the fact-intensive nature of the parties’ dispute, we will fully evaluate these grounds on the record that is developed during trial.

d) Claim 3

We have reviewed Petitioner’s contentions and supporting evidence regarding claim 3, and are satisfied that the record establishes sufficiently for institution that Heil discloses the added limitation in this claim (i.e., “wherein the cache memory comprises a portion of a distributed cache

memory stored in the computers interconnected by the network”). *See* Pet. 44–45 (citing Ex. 1006, 5:25–28; Ex. 1004 ¶¶ 128–130). Patent Owner’s argument that claim 3 is not unpatentable “for at least the same reasons” as claim 1, Prelim. Resp. 26, is not persuasive on this record for the reasons set forth above.

e) Summary

Based on the totality of the evidence currently in the record, we are persuaded that Petitioner has demonstrated a reasonable likelihood of prevailing in its challenge to claims 1–4 and 6 of the ’988 patent as unpatentable for obviousness over Heil and Nakayama. Given the fact-intensive nature of the parties’ dispute, we will fully evaluate these grounds on the record that is developed during trial.

2. Alleged Obviousness of Claim 5 over Heil, Nakayama, Macklem, and Srinivasan

Petitioner contends that claim 5 of the ’988 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over Heil, Nakayama, Macklem, and Srinivasan. Pet. 53–71. Because we determined above that Petitioner has demonstrated a reasonable likelihood of prevailing in its challenge to at least one claim of the ’988 patent, we also institute *inter partes* review on claim 5 on this ground. 37 C.F.R. § 42.108(a). Patent Owner’s arguments about claim 5 generally relate to whether the prior art discloses a “volume access table.” Prelim. Resp. 27–32. These arguments are not persuasive on this record for the reasons discussed above. Given the fact-intensive nature of the parties’ dispute, we will fully evaluate these grounds on the record that is developed during trial.

IV. CONCLUSION

After considering the arguments presented in the parties' papers and the evidence of record, we determine that Petitioner has demonstrated at least a reasonable likelihood of success in proving that at least one claim of the '988 patent is unpatentable. See CONSOL. OFFICE PATENT TRIAL PRACTICE GUIDE, 53 (2019) ("The 'reasonable likelihood' standard is a somewhat flexible standard that allows the Board room to exercise judgment.").⁷ Thus, we institute an inter partes review of all challenged claims (i.e., claims 1–6) on all grounds set forth in the Petition. Our determinations at this stage of the proceeding are based on the evidentiary record currently before us.

This decision to institute trial is not a final decision as to patentability of any claim for which we have instituted an inter partes review. See *TriVascular, Inc. v. Samuels*, 812 F.3d 1056, 1068 (Fed. Cir. 2016) (noting that "there is a significant difference between a petitioner's burden to establish a 'reasonable likelihood of success' at institution, and actually proving invalidity by a preponderance of the evidence at trial"). We will base any final decision on the full record developed during trial.

V. ORDER

Accordingly, it is

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review is instituted for claims 1–6 of the '988 patent on the unpatentability grounds asserted in the Petition; and

⁷ Available at: <https://www.uspto.gov/sites/default/files/documents/tpgnov.pdf?MURL=TrialsPracticeGuideConsolidated>.

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FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial, which commences on the entry date of this decision.

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