

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

JUNIPER NETWORKS, INC.,
Petitioner,

v.

WSOU INVESTMENTS, LLC D/B/A
BRAZOS LICENSING AND DEVELOPMENT,
Patent Owner.

IPR2021-00768
Patent 7,483,998 B2

Before THU A. DANG, ROBERT J. WEINSCHENK, and
JOHN D. HAMANN, *Administrative Patent Judges*.

DANG, *Administrative Patent Judge*.

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

I. INTRODUCTION

A. Background

In response to a Petition (Paper 1, “Pet.”) filed by Juniper Networks, Inc. (“Petitioner”), we instituted *inter partes* review of claims 17–19, 21–23, 25, and 26 (the “challenged claims”) of U.S. Patent No. 7,483,998 B2 (Ex. 1001, “the ’998 patent”). See Paper 9 (“Dec. Inst.”). During the trial, WSOU Investments, LLC d/b/a Brazos Licensing and Development (“Patent Owner”) filed a Response (Paper 13, “PO Resp.”), to which Petitioner filed a Reply (Paper 15, “Pet. Reply.”). In turn, Patent Owner filed a Sur-Reply. Paper 17 (“PO Sur-Reply”). An oral hearing was held with the parties on August 17, 2022. A transcript of the hearing has been entered into the record. Paper 19 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This Decision is a Final Written Decision under 35 U.S.C. § 318(a) as to the patentability of the claims on which we instituted trial. Based on the record before us, Petitioner has shown by a preponderance of the evidence that claims 17–19, 21–23, 25, and 26 of the ’998 patent are unpatentable.

B. The ’998 Patent

The ’998 patent, titled “Software Configurable Cluster-Based Router Using Heterogeneous Nodes as Cluster Nodes,” issued on January 27, 2009, from Application No. 10/712,104, with a filing date of November 14, 2003. Ex. 1001, codes (54), (45), (21), (22). The ’998 patent provides a cluster router architecture for performing distributed routing, which includes off-the-shelf Personal Computer (PC) hardware-based router cluster nodes interconnected in an intra-connection network in multiple dimensions. *Id.* at code (57). Each PC-based router cluster node is provided with the same

routing functionality and a router-cluster-node-centric configuration enabling each router cluster node to provide routing responses for packets pending processing. *Id.* The equivalency between router cluster nodes in the cluster router provides a scalable router. *Id.* at 7:29–30.

An illustration of an embodiment of the '998 patent's cluster-based router architecture is depicted in Figure 4A, reproduced below:

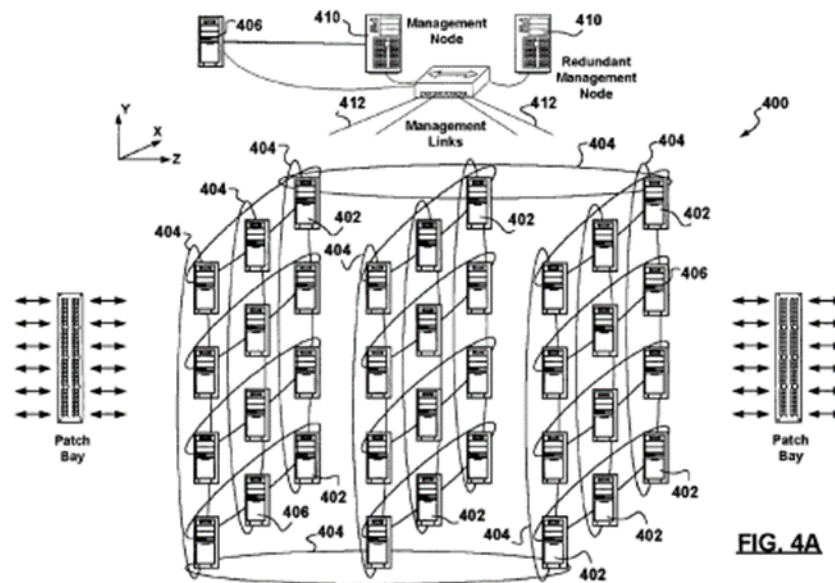


Figure 4A shows an exemplary cluster-based router implementation 400 which includes 3x4x3 (cluster) arrangement of PC-based router cluster nodes 402 interconnected in accordance with a toroidal topology. *Id.* at 9:17–21. In Figure 4A, selected cluster router nodes 406 represent special purpose router cluster nodes providing special packet processing responses. *Id.* at 9:21–27.

In the embodiment shown in Figure 4A, individual router cluster nodes 402(/406) are arranged in x, y, and z slices, wherein each router cluster node 402(/406) is physically connected 404 to adjacent closure nodes

402 in the x, y, and z directions. *Id.* at 9:49–53. Wraparound internal interconnection links 404 complete toroidal interconnectivity ensuring that every router cluster node 402(/406) has, in accordance with the toroidal topology employed, six adjacent router cluster nodes 402(/406) to ensure path diversity, wherein, should any router cluster node 402(/406) or internal interconnecting link 404 fail, the toroidal topology ensures that other paths between any source and destination router cluster node 402(/406) exist. *Id.* at 9:66–10:6.

Employing toroidal interconnectivity between the router cluster nodes 402 enables all router cluster nodes 402 to be equivalent, wherein the equivalency between router cluster nodes 402 enables each router cluster node 402 to have external physical links providing physical connectivity to communications network(s) in which cluster router 400 participates. *Id.* at 10:7–20. Accordingly, each of the router cluster nodes 402 may act as an entry, core, and/or exit router cluster node 402 with respect to the packet traffic processed by cluster router 400. *Id.* at 10:20–24. The router cluster node equivalency provides a scalable packet routing capacity and port count increasing monotonically, wherein additional capacity may be added by adding another x, y, or z slice or router cluster nodes 402 without requiring replacement of expansion of the existing infrastructure. *Id.* at 10:25–34.

C. The Challenged Claims

Of the challenged claims, claims 17 and 25 are independent. Independent claim 17 is illustrative of the challenged claims, and is reproduced below:

17. A router cluster node of a plurality of router cluster nodes interconnected in a cluster router, each router cluster node comprising:

a. a plurality of cluster router internal interconnecting links connected thereto, the internal interconnecting links enabling the exchange of packets with adjacent cluster nodes in the cluster router;

b. at least one cluster router external link connected to each of the cluster router nodes interconnected in the cluster router, the at least one external link enabling exchange of packets between communications network nodes external to said cluster router and the cluster router;

c. a router-cluster-node-centric configuration to effect distributed routing of the conveyed packets, and

wherein the inclusion of said at least one external link in each of the router cluster nodes in the cluster router provides a scalable router.

Ex. 1001, 22:49–65.

D. Asserted Grounds of Unpatentability

We instituted *inter partes* review all claims and all grounds in the Petition. Petitioner asserts that claims 17–19, 21–23, 25, and 26 of the '998 patent are unpatentable on the following grounds (Pet. 9):

Claim(s) Challenged	35 U.S.C. § ¹	Reference(s)/Basis
17, 18, 21, 22	102	Passint ²

¹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. §§ 102, 103, effective March 16, 2013. Because the application from which the '998 patent issued was filed before this date, the pre-AIA versions of §§ 102, 103 apply.

² U.S. Patent No. 6,101,181, issued August 8, 2000, filed November 17, 1997 (Ex. 1004, “Passint”).

Claim(s) Challenged	35 U.S.C. § ¹	Reference(s)/Basis
19, 21, 23	103	Passint, Chen ³
17, 18, 21, 22	103	Dally ⁴
25, 26	102	Dally

Petitioner relies on the Declaration of Jon Weissman, Ph.D.
(Ex. 1003) in support of its unpatentability contentions.

II. ANALYSIS

A. *Level of Ordinary Skill in the Art*

In determining whether an invention would have been obvious at the time it was made, we consider the level of ordinary skill in the pertinent art at the time of the invention. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966). Relying on the declaration of Dr. Weissman, Petitioner contends that a person of ordinary skill in the art (“POSITA”) related to the ’998 patent would have “at least a master’s degree in computer science or electrical engineering in the field of computer networking,” wherein “[a]dditional graduate education could substitute for professional experience, or significant experience in the field of computer networking could substitute for formal education.” Pet. 16–17 (citing Ex. 1003 ¶ 33).

³ “Proceedings of the 2001 USENIX Annual Technical Conference,” USENIX Association, June 25–30, 2000 (Ex. 1008, “Chen”).

⁴ U.S. Patent Application Publication No. 2002/0044560 A1, published April 18, 2002, filed December 14, 2001 (Ex. 1005, “Dally”).

Patent Owner replies that it “does not offer a competing definition,” because Petitioner “would still not meet its burden to prove unpatentability of any challenged claim.” PO Resp. 5.

We adopt and apply Petitioner’s definition of the level of ordinary skill in art at the time of the claimed invention because, based on the record, this proposal appears to be consistent with the ’998 patent, the asserted prior art, and is supported by the testimony of Dr. Weissman.

B. Claim Construction

We construe each claim “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), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b) (2020). Under this standard, claim terms are generally given their plain and ordinary meaning as would have been understood by a person of ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc) (“*Phillips*”).

Only those terms in controversy need to be construed, and only to the extent necessary to resolve the controversy. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Matal*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

Petitioner contends that “no terms require construction because the claims encompass the prior-art mappings under any construction consistent with *Phillips*.” Pet. 17. Patent Owner similarly submits that “the Board

need not expressly construe any claim term in a particular manner.” *See* PO Resp. 6–8.

We determine that it is unnecessary to construe any claim term expressly to resolve the disputed issues before us. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those 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)).

C. Principles of Law

To establish anticipation, each and every element in a claim, arranged as recited in the claim, must be found in a single prior art reference. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008). Even in an anticipation setting, it is proper to take into account not only the literal and specific teachings of the reference, but also the inferences which one skilled in the art would reasonably be expected to draw therefrom. *In re Preda*, 401 F.2d 825, 826 (CCPA 1968). For anticipation, the dispositive question is whether one skilled in the art would reasonably understand or infer from a prior art reference that every claim element is disclosed in that reference. *Eli Lilly and Co. v. Los Angeles Biomedical Research Inst. at Harbor-UCLA Med. Ctr.*, 849 F.3d 1073, 1074–75 (Fed. Cir. 2017).

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) objective evidence of nonobviousness. *See Graham*, 383 U.S. at 17–18.

D. Claims 17, 18, 21 and 22 as Anticipated by Passint and Claims 19, 21, and 23 as Obvious over Passint and Chen

Petitioner contends that claims 17, 18, 21, and 22 of the '998 patent are anticipated by Passint (Pet. 21–36), and that claims 19, 21, and 23 would have been obvious over Passint in view of Chen. *Id.* at 37–46. In response, Patent Owner contends that Petitioner fails to 1) prove anticipation “based on Passint’s multiple, distinct teachings” (PO Resp. 11–13), and 2) show that Passint teaches every limitation of independent claim 17. *Id.* at 14–26.

1. Passint

Passint, titled “Virtual Channel Assignment in Large Torus Systems,” issued on August 8, 2000, with a filing date of November 17, 1997. Ex. 1004, codes (54), (45), (22). Passint discloses a multiprocessor computer system that includes processing element nodes interconnected by physical communication links, wherein routers route message between processing element nodes on the physical communication links. *Id.* at code (57). In exemplary hypercube topologies, the multiprocessor computer system employs eight-port routers to form up to a six-dimensional hypercube system. *Id.* at 7:30–31. An illustration of Passint’s multiprocessor system is depicted in Figure 4, reproduced below.

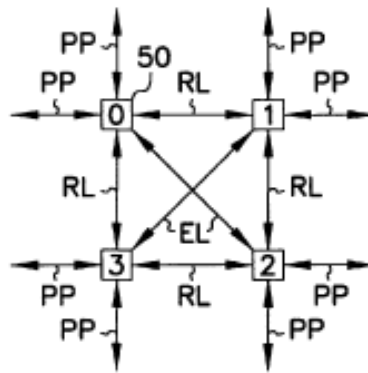
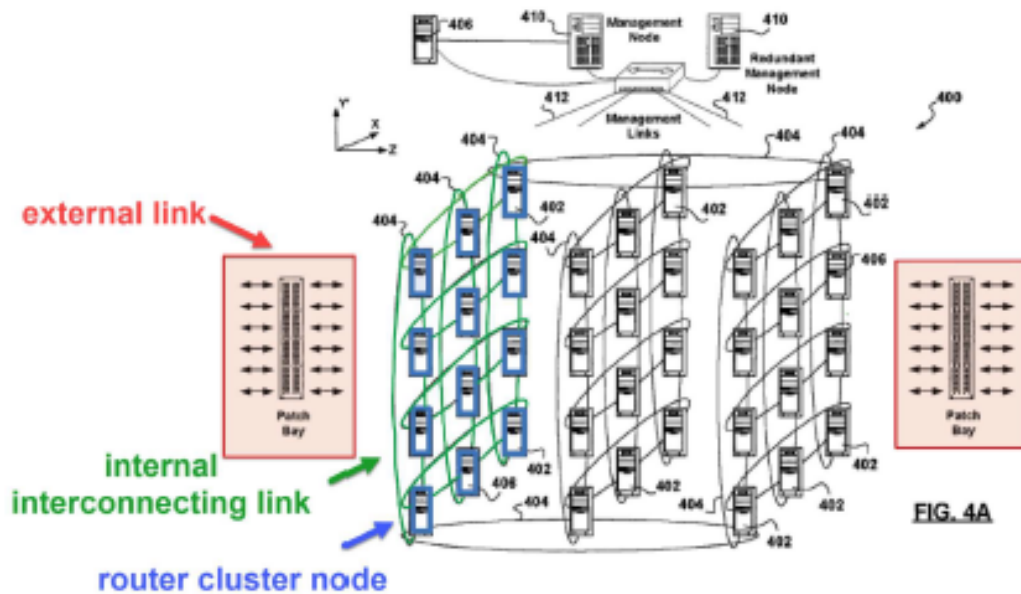


FIG. 4

Figure 4 shows a two dimensional (2D) hypercube topology multiprocessor system. *Id.* at 7:36–38. As shown in Figure 4, four router chips 50 are employed and numbered 0 through 3, wherein there are two processor ports PP from each router to couple each router to two nodes to create a double-bristled technology. *Id.* at 7:37–44. Thus, the double-bristled 2D topology process an eight-node multiprocessor system having 16 processors in a two-processor-per-node system or 32 processors in a four-processor-per-node system. *Id.* Router links RL from node 0 to nodes 1 and 3, form the 2D hypercube topology, and in addition, extra ports at each router are used to form express links EL from node 0 to node 2, resulting in a doubling of the bisection bandwidth of the system. *Id.* at 7:45–49.

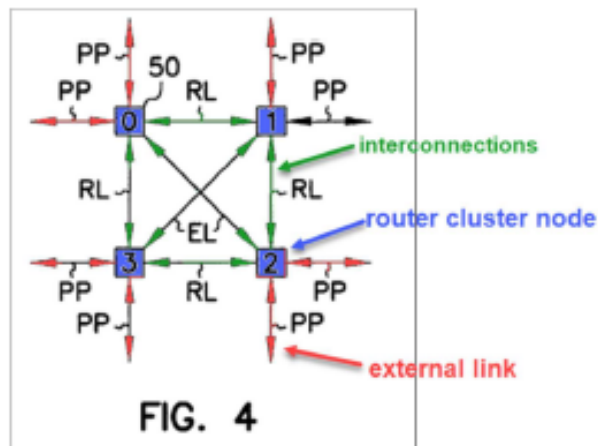
2. Analysis

Petitioner contends that the challenged claims “are directed to the prior art concept of clustering routers to scale routing functionality.” Pet. 13 (citing Ex. 1003 ¶ 50). Petitioner provides an annotated Figure 4A of the ’998 patent, shown below, to illustrate its contentions.



Annotated Figure 4A of the '998 patent, according to Petitioner, illustrates “patch bays” (labeled as “external link”) that are highlighted in red, and “exemplary *internal* link (404) and router cluster node (402) [that] are annotated in green and blue, respectively.” Pet. 13 (citing Ex. 1001, 10:16–20, Fig. 4A).

Petitioner contends that, like the '998 patent, Passint also discloses external links, internal links and router cluster nodes. Pet. 17–18. In particular, according to Petitioner, Passint discloses routers, each including “input ports for receiving messages, output ports [i.e. ‘external links’] for sending message from the router, two types of virtual channels, a lookup table associated with the input port having a lookup table virtual channel number, and a virtual channel assignment mechanism.” *Id.* at 18 (citing Ex. 1004, 3:52–57). Petitioner provides an annotated Figure 4 of Passint, shown below, to illustrate its contentions.



Annotated Figure 4 of Passint, according to Petitioner, illustrates an exemplary cluster of four nodes (blue) interconnected (green), including “external links” (red). Pet. 18.

Having reviewed Petitioner’s arguments and supporting evidence in the complete record, we determine Petitioner has demonstrated by a preponderance of the evidence that claims 17, 18, 21 and 22 are anticipated by Passint; and that claims 19, 21, and 23 are obvious over Passint in further view of Chen, notwithstanding Patent Owner’s arguments to the contrary. We address in detail Petitioner’s arguments and Patent Owner’s responses with respect to the preamble and limitations of illustrative claim 17.

- i. *Preamble: a “router cluster node of a plurality of router cluster nodes interconnected in a cluster router” (claim 17)*

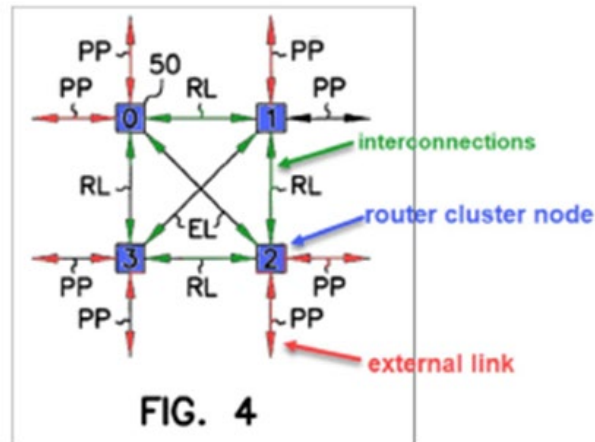
Petitioner contends that, “FIG. 4 of Passint discloses four router cluster nodes,” wherein each of the router cluster nodes “are interconnected to one another,” and thus, “[t]he four interconnected router cluster nodes form a cluster router.” Pet. 21–22 (citing Ex. 1003 ¶¶ 75–76). In particular, Petitioner contends that Passint’s Figure 4 shows a system in which “four

router chips 50 are employed and are numbered 0 through 3,” wherein Passint’s “router cluster nodes” are “nodes . . . interconnected by a scalable interconnect network.” *Id.* at 22 (citing Ex. 1004, 5:52–58, 7:36–49, Fig. 4; Ex. 1003 ¶ 77).

Patent Owner replies that Petitioner maps the claimed “cluster router” to Passint’s multiprocessor system with a plurality of processing nodes (PO Resp. 15 (citing Pet. 21)), but, despite use of the term “nodes,” “nodes 22, 24, and 26 in Passint cannot be mapped to the claimed router cluster nodes because Passint’s nodes do not contain routers or even perform routing functions.” *Id.* at 16. Although Patent Owner acknowledges that Petitioner also relies on router chips 50 in Figure 4 of Passint for disclosing “four router cluster nodes” that form a cluster router, (*id.* at 18 (citing Pet. 21–22)), Patent Owner contends that the Petition then reverts to pointing to nodes 22, 24, and 26 to teach that the nodes are “interconnected by a scalable interconnect network.” *Id.* In other words, “the portion of Passint quoted at page 22 of the Petition plainly shows that the interconnected ‘nodes’ are nodes 22, 24, and 26, which as explained above, are not router cluster nodes,” according to Patent Owner. *Id.* (citing Ex. 1004, 5:52–58).

We have reviewed Petitioner’s arguments and the underlying evidence cited in support and determine that Petitioner establishes the above recited claim element, notwithstanding Patent Owner’s arguments to the contrary. In particular, as Patent Owner acknowledges (PO Resp. 18), Petitioner relies on Passint’s Figure 4 for teaching “four router cluster nodes,” wherein each of the router cluster nodes “are interconnected to one another,” and thus, “[t]he four interconnected router cluster nodes form a cluster router.” Pet.

21–22. That is, Petitioner points to Figure 4 of Passint for teaching the claimed “router cluster nodes.” *Id.*



Pet. 18. Annotated Figure 4, as discussed in the Petition, illustrates a plurality of router chips 50 (blue) interconnected (green) in a “cluster.” *Id.*

Further, according to Petitioner, Passint discloses that “each node within the cluster has a plurality of ports coupled to communication links: ‘scalable interconnect network 28 includes router chips, such as indicated at 50.’” Pet. 31 (citing Ex. 1004, 6:13–25). We find persuasive Petitioner’s contention that “[r]outer chip 50 includes eight ports” wherein, “these eight ports of router node (50) can connect to links to other router nodes,” such that “these ports of the router chip ‘permit additional bristling of nodes or the adding of dimensions,’ i.e., the router may be scaled via these external links.” *Id.* (citing Ex. 1004, 7:8–28, 7:36–44, Fig. 8).

Although Patent Owner contends that the teachings of Passint’s Figure 1 should not be ignored and when relying on Figure 4 (PO Resp. 18–21; PO Sur-Reply 15), as Petitioner explains in its Reply, even if Petitioner’s citations to other figures were not considered, “each limitation of Claim 17 would nonetheless be anticipated by Passint’s disclosure of

FIG. 4.” Pet. Reply 7. That is, even if “the parties do not dispute that Figure 1 applies to the Passint invention as a whole” (PO Sur-Reply 15), Petitioner has met its burden of establishing anticipation if it shows that each and every element in claim 17 is found in the single embodiment set forth in Figure 4 of Passint. Thus, although Patent Owner argues that “Petitioner never explains why Passint’s nodes 22, 24, and 26 are alleged to be router cluster nodes in a cluster router” (*id.*), Petitioner nevertheless can establish anticipation by showing that Figure 4 of Passint discloses router cluster nodes in a cluster router, as recited in claim 17. As Petitioner persuasively points out, contrary to Patent Owner’s contention, “the Petition does not cite Passint’s FIG. 1 as disclosing the ‘router cluster node,’” but rather, “specifically refers to Passint’s router chips 50/150 as disclosing the ‘router cluster node’ of the ‘router cluster’ of Passint’s FIG. 4.” Pet. Reply 12.

Here, as illustrated in annotated Figure 4 of Passint set forth in the Petition, Passint discloses four router chips 50 numbered 0 through 3 coupled to one another. Pet. 22; *see also* Ex. 1004, Fig. 4, 7:36–49. We are persuaded by Petitioner’s clear reliance on Passint’s four router chips 50 for disclosing the claimed “plurality of router cluster nodes interconnected in a cluster router.” Pet. 22 (citing Ex. 5:52–58).

Petitioner does also cite to the description of Figures 1–3 of Passint, which states that “scalable interconnect network 28 includes router chips, such as indicated at 50;” however, as Petitioner points out, these portions of Passint also describe that these “router chips” include ports that “‘permit additional bristling of nodes or the adding of dimensions,’ i.e., the router may be scaled via these external links.” Pet. 31 (citing Ex. 1004, 6:13–25, 7:8–28). That is, these portions of Passint are describing “router chip

50/150” in general, wherein the router chip “can easily scale and accommodate various topologies” such as the “hypercube topology” shown in Figure 4. *See* Ex. 1004, 7:5–38. In particular, these portions of Passint state that, although in Figures 2 and 3 the networks are double bristled, alternatively, additional ports can be added to the router chip to permit additional bristling and “can be used to create up to six-dimensional hypercube topologies,” such as that shown in Figure 4. *Id.* We are persuaded by Petitioner’s contentions, supported by Dr. Weissman’s declaration that a POSITA, reading Passint, “would find that FIGs. 2 and 3 are interchangeably used for Passint’s topologies such as FIG. 4.” Pet. Reply 6 (citing Ex. 1003 ¶¶ 75–102).

We also find unpersuasive Patent Owner’s contention that Passint’s description of Figure 4 “does not relate[] to ‘nodes’ at all but instead separate router chips, which are not part of the ‘nodes.’” PO Resp. 19, PO Sur-Reply 16. In particular, as discussed above, we find unavailing Patent Owner’s argument that nodes 22, 24, and 26 in Passint cannot be mapped to the claimed router cluster nodes, without addressing Petitioner’s reliance on Passint’s router chips.

As Petitioner pointed out during oral arguments, the ’998 provides no “definitional-type statement” with respect to “router cluster nodes,” but rather does describe as to what qualifies as router cluster nodes, such as “dedicated hardware routers” or “PC-based routers.” Tr. 34:21–35:16. We find persuasive Petitioner’s contention that a POSITA would recognize that a user is using a “router cluster node” inside a personal computer “that is actually capable of doing the routing functionality.” *Id.* at 35:17–23. As Petitioner persuasively explains, “a routing chip that’s programmed to do the

routing function . . . maps very closely, if directly, to what’s disclosed in Passint.” *Id.* at 36:1–3.

We find unpersuasive Patent Owner’s contention during oral arguments that, to be a router cluster node, “there needs to be some logic,” wherein the router cluster node “has to have some addressing scheme.” Tr. 50:24–51:8. That is, we find unpersuasive that “router cluster node” would need “some logic” or “addressing scheme,” given its plain and ordinary meaning as would have been understood by a POSITA at the time of the invention and in the context of the entire patent disclosure. *Id.*

As Petitioner points out, the ’998 patent does not provide any explicit definition for “router cluster node,” but states that it proposes a “solution” wherein “multiple routing elements are configured to operate a single routing entity seeking cost reductions and improvements in scalability, and easy re-configurability.” *See* Ex. 1001, 9:4–6. Thus, we agree with Petitioner that in the context of the disclosure of the ’998 patent, “router cluster nodes” are “routing elements” that are configured to operate a “router cluster” seeking cost reduction and improvements in scalability. Pet. Reply 11–12. In fact, in arguing that Passint’s “nodes” 22, 24, and 26 are not “router cluster nodes,” Patent Owner argues that the claimed router cluster “nodes” must “contain routers or even perform routing functions.” PO Resp. 16.

We agree that a POSITA “would understand that a ‘router cluster node’ would be met by a ‘routing element,’ such as the ‘router chip’ of Passint.” Pet. Reply 12. Accordingly, we are persuaded by Petitioner’s contention that Passint’s router chips “are ‘router cluster nodes’ within the plain meaning of the Challenged Claims.” *Id.* at 11.

Based on the complete record presented, we are persuaded that Petitioner has demonstrated that Passint teaches “a plurality of router cluster nodes interconnected in a cluster router,” as recited in claim 17, regardless of whether or not the preamble is limiting.⁵

- ii. *“at least one cluster router external link connected to each of the cluster router nodes interconnected in the cluster router, the at least one external link enabling exchange of packets between communications network nodes external to said cluster router and the cluster router” (claim 17)*

Petitioner contends that, as shown in the annotated Figure 4 of Passint set forth in the Petition, Passint discloses “two cluster router external links” (annotated in red) “connected to each router cluster node” (annotated in blue), wherein the external links enable the exchange of packets between communication network nodes external to the cluster router and the cluster router itself. Pet. 26 (citing Ex. 1003 ¶¶ 85–86). In particular, Petitioner contends that “Passint discloses ‘processor ports’ labeled ‘PP’ (annotated in red) in FIG. 4 that are the claimed ‘external links,’” wherein “these external links are on each node of Passint’s cluster router” and “include ‘input ports’ and ‘output ports.’” *Id.* (citing Ex. 1004, 3:50–57). During oral arguments, Petitioner contends that Patent Owner does not dispute that “the external PP connects to something that is external to this cluster of router chips.” Tr. 9:3–6.

⁵ Because Petitioner presents evidence that the prior art teaches the recitation in the preamble, we need not decide whether the preamble is limiting.

Petitioner further contends that processor ports PP enable exchange of messages, pointing out that Passint describes the routers as being provided to “route messages between the plurality of processing element nodes on the physical communication links,” wherein “[e]ach router includes input ports for receiving messages,” and “output ports for sending messages from the router.” Pet. Reply 13–14 (citing Ex. 1004, 3:50–57).

Patent Owner contends that Passint’s processor ports (PP) “do not connect to anything external to what Petitioner alleges is the cluster router – namely the processor nodes or the multiprocessor computer system itself.” PO Resp. 22. In particular, Patent Owner contends that “[n]owhere are Passint’s different routers referred to or described as a cluster router.” *Id.* at 23. According to Patent Owner, although Dr. Weissman testifies that the router chips in Figure 4 of Passint are four interconnected router cluster nodes that form a cluster router, “Passint does not describe them as such.” *Id.* at 25 (citing Ex. 1003 ¶¶ 75–76).

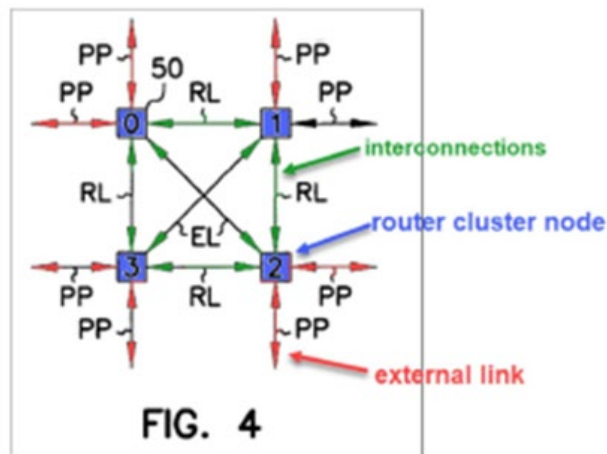
Patent Owner also argues that Petitioner maps “external link” as Passint’s router links RL in Figure 7 but then maps “internal link” as Passint’s router links RL in Figure 4. PO Resp. 23 (citing Pet. 27–28). Patent Owner contends that Passint’s router links RL cannot be mapped to “external” and “internal” in different embodiments. *Id.* at 23. Thus, Patent Owner contends that Petitioner provides conflicting arguments. *Id.*

We have reviewed Petitioner’s arguments and the underlying evidence cited in support and determine that Petitioner establishes the above recited claim element, notwithstanding Patent Owner’s arguments to the contrary. Although Patent Owner contends that Passint’s router links RL cannot be mapped to “external” and “internal” in different embodiments (PO resp. 23),

Patent Owner also acknowledges that Petitioner relies on Passint's processor ports PP of Figure 4 for claim 17's "external links." *Id.* at 22. That is, Petitioner contends that "Passint discloses 'processor ports' labeled 'PP' (annotated in red) in FIG. 4 that are the claimed 'external links.'" Pet. 26 (citing Ex. 1004, 3:50–57).

Further, although Patent Owner repeats its contention that "[n]owhere are Passint's different routers referred to or described as a cluster router" (PO Resp. 23), as discussed above in section II(D)(2)(i), we find persuasive Petitioner's reliance on Passint's router chips 50 in Figure 4 for teaching "four router cluster nodes" that "form a cluster router." Pet. 21–22.

As illustrated in annotated Figure 4 of Passint set forth in the Petition, Passint discloses four router chips 50 coupled to one another in a 2D hypercube ("cluster").



Pet. 18. Annotated Figure 4, as discussed in the Petition, illustrates a plurality of router chips 50 (blue) interconnected RL, EL (green), with connections PP to outside of the 2D hypercube (red). *Id.*

As shown in Figure 4, Passint discloses that router links RL from node 0 to nodes 1 and 3 form the 2D hypercube topology, that extra ports are

used to form express links EL from node 0 to node 2 for doubling the bisection bandwidth, and that there are two processor ports PP from each router chip 50 “to couple each router to two nodes to create a double bristled topology.” Ex. 1004, 7:36–41, 7:44–49. We are persuaded by Petitioner’s reliance on Passint for disclosing router chips 50 interconnected in a 2D hypercube via internal router links RL and express links EL, and processor ports PP connected to each of router chips 50 that enables exchange of messages external to the 2D hypercube.⁶ See Ex. 1004, 3:50–57, 7:36–41.

Based on the complete record presented, we are persuaded that Petitioner has demonstrated that Passint teaches a “cluster router external link connected to each of the cluster router nodes interconnected in the cluster router,” that enables “exchange of packets between communications network nodes external to said cluster router and the cluster router,” as recited in claim 17.⁷

⁶ As Patent Owner points out, Petitioner also maps “external link” as Passint’s router links RL in Figure 7. PO Resp. 23; *see also* Pet. 27–28. Because we are persuaded by Petitioner’s reliance on Passint’s processing port PP for teaching the “external links,” we need not address Petitioner’s alternative reliance on router links RL.

⁷ Petitioner also relies on the prosecution history of U.S. Patent No. 7,436,775 (“the ’775 patent”) to contend that “the applicants for the ’775 patent, conceded that the Passint discloses the claimed ‘external links.’” Pet. 1–2, 15–16, 25. Because we are persuaded by Petitioner’s contention that Passint’s processing port PP teaches the “external links,” we need not address Petitioner’s alternative reliance on the prosecution history of the ’775 patent.

*iii. Remaining limitations of claim 17, and
claims 18, 21, and 22*

Petitioner provides detailed explanations as to how Passint teaches the remaining claim limitations as recited in independent claim 17, and dependent claims 18, 21, and 22, citing Dr. Weissman’s testimony for support. Pet. 23–24 (citing Ex. 1004, 3:48–57, 6:33–37, 7:36–49, Fig. 4; Ex. 1003 ¶¶ 80–83), 29–36 (citing Ex. 1004, 3:50–52, 6:13–25, 7:8–28, 7:36–44, 8:18–31, 8:66–9:14, 10:62–66, 11:5–57, 13:21–28, Figs. 4–8, 18; Ex. 1003 ¶¶ 94–95, 98–100, 103–106, 108–115). For example, Petitioner contends that Passint discloses “four router cluster nodes” (annotated in blue), wherein each of the router cluster nodes has “three internal interconnecting links” (annotated in green). Pet. 23 (citing Ex. 1003 ¶¶ 80–81).

Patent Owner does not address separately Petitioner’s explanations and supporting evidence regarding the remaining limitations in claim 17 and the dependent claims. *See generally* PO Resp.

Having reviewed Petitioner’s arguments and supporting evidence in the complete record, we determine Petitioner has demonstrated by a preponderance of the evidence that independent claim 17, and dependent claims 18, 21, and 22 depending from claim 17, are anticipated by Passint.

*iv. Claims 19, 21, and 23 over Passint and
Chen*

Petitioner provides detailed explanations as to how Passint in further view of Chen renders the limitations as recited in claims 19, 21, and 23 as obvious, contending that it would have been obvious to combine the references and citing Dr. Weissman’s testimony for support. Pet. 37–46

(citing Ex. 1004, 5:52–58, 11:9–16, 12:1–4, 12:39–43, 13:21–28; Ex. 1008, 6, 7, 13; Ex. 1003 ¶¶ 116–136).

Patent Owner does not address separately Petitioner’s explanations and supporting evidence regarding claims 19, 21, and 23. *See generally* PO Resp.

Having reviewed Petitioner’s arguments and supporting evidence in the complete record, we determine Petitioner has demonstrated by a preponderance of the evidence that claim 19, 21, and 23 are obvious over the combination of Passint and Chen. Further, we find Petitioner’s reasons to combine the references are sufficient to support a finding of obviousness. *See KSR*, 550 U.S. at 418 (an invention “composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art”); *Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1366–67 (Fed. Cir. 2012) (holding that “some kind of motivation must be shown from some source, so that the [trier of fact] can understand why a person of ordinary skill would have thought of either combining two or more references or modifying one to achieve the patented [invention]”)).

E. Claims 17, 18, 21, and 22 as obvious over Dally, and claims 25 and 26 as anticipated by Dally

Petitioner contends that claims 17, 18, 21, and 22 of the ’998 patent would have been obvious over Dally (Pet. 46–57), and that claims 25 and 26 of the ’998 patent are anticipated by Dally. Pet. 57–63. In response, Patent Owner contends that Petitioner fails to meet its burden of presenting anticipation or obviousness of the challenged claims in view of Dally. PO Resp. 26–32.

1. Dally

Dally, titled “Internet Switch Router,” published on April 18, 2002, with a filing date of December 14, 2001. Ex. 1005, codes (54), (43), (22). Dally discloses an internet router implemented as a network fabric of fabric routers and links. *Id.* at code (57). To permit machines to scale to larger numbers of processors, direct and indirect interconnection networks are used. *Id.* ¶ 33. That is, direct and indirect multicomputer networks are scalable. *Id.* ¶ 37. Direct networks are generally preferred for large machines because of the scalability, wherein, while indirect network is usually built for a fixed number of nodes, a direct network grows with the nodes, with the more nodes added, the more network is added as well since a small piece of the network, one router, is included within each node. *Id.* ¶ 35. An illustration of Dally’s three-dimensional (3D) fabric is depicted in Figure 7, reproduced below.

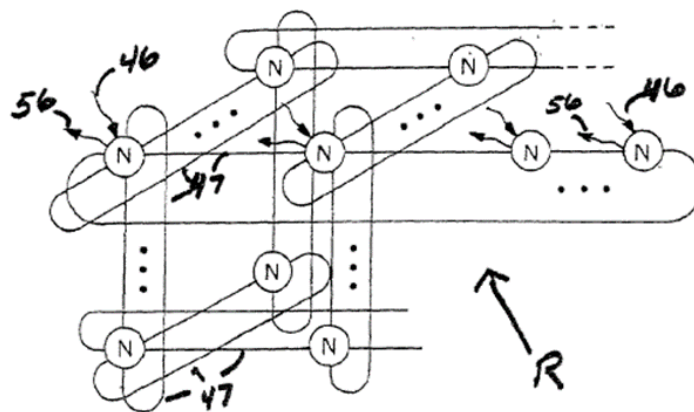


FIG. 7

Figure 7 shows router R as a 3D torus network of nodes. *Id.* ¶ 49. As shown in Figure 7, each node N comprises a line interface module that connects to incoming and outgoing internet links 46, 56, wherein each line-

interface nodes containing a switch-fabric router that includes fabric links 47 to its six neighboring nodes in the torus. *Id.*

2. Analysis

Petitioner contends that, like the '998 patent, Dally discloses external links, internal links and router cluster nodes. Pet. 18–20. In particular, according to Petitioner, Dally discloses external links from each node: “[e]ach node N comprises a line interface module that connects to incoming and outgoing SONET internet links 46, 56,” wherein each of the line-interface nodes “contains a switch-fabric router that includes fabric links 47 to its six neighboring nodes in the torus.” *Id.* at 48 (quoting Ex. 1005 ¶ 49). Petitioner provides an annotated Figure 7 of Dally, shown below, to illustrate its contentions.

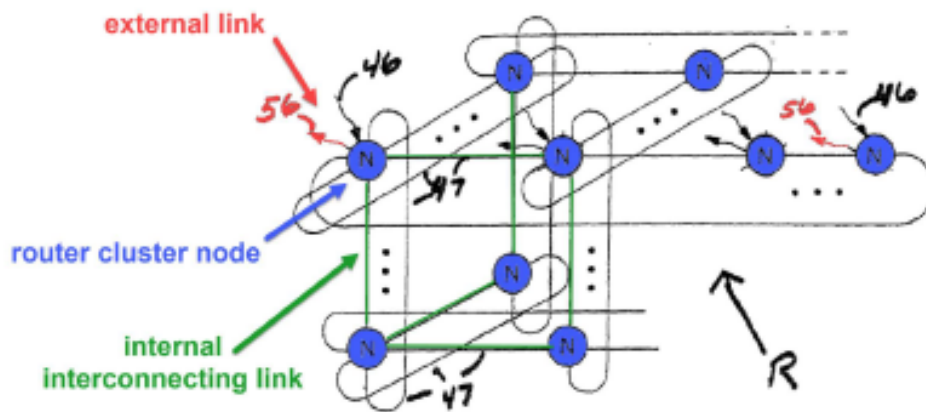


FIG. 7

Annotated Figure 7 of Dally, according to Petitioner, illustrates external links (red) for each router cluster node (blue). Pet. 19 (citing Ex. 1005, Fig. 7; Ex. 1003 ¶ 71).

Having reviewed Petitioner’s arguments and supporting evidence in the complete record, and Patent Owner’s arguments and evidence to the contrary, we determine Petitioner has demonstrated by a preponderance of

the evidence that claims 17, 18, 21, and 22 are obvious over Dally; and that claims 25 and 26 are anticipated by Dally. We address in detail Petitioner's arguments and Patent Owner's responses with respect to the limitations of illustrative claim 17.

- i. *“at least one cluster router external link connected to each of the cluster router nodes interconnected in the cluster router”
“wherein the inclusion of said at least one external link in each of the router cluster nodes in the cluster router provides a scalable router” (claim 17)*

Petitioner contends that, “Dally discloses at least one external link for each of the router cluster nodes,” wherein “Dally describes a router that ‘overcomes the bandwidth and scalability limitations of prior-art bus- and crossbar-based routers by using a multi-hop interconnection,’ such as ‘a 3-dimensional torus network, as a router.’” Pet. 53 (citing Ex. 1005 ¶ 43; Ex. 1003 ¶¶ 151–152). Thus, according to Petitioner, Dally teaches that “the inclusion of said at least one external link in each of the router cluster nodes in the cluster router provides a scalable router.” *Id.*

Furthermore, according to Petitioner, even if Patent Owner were to argue that this limitation is not “expressly disclosed by Dally,” a person of ordinary skill in the art in light of these disclosures would have been “motivated to use the expressly disclosed ‘external links’ [of Dally] in order to achieve Dally’s objective of ‘overcom[ing] bandwidth and scalability limitations’ of the prior art.” Pet. 53 (citing Ex. 1003 ¶ 153).

During oral arguments, Petitioner explained that, in Dally, adding additional router cluster nodes and external links to a routing cluster provides “scal[ing of] the overall router cluster . . . to enhance or increase

the routing capability of the overall routing cluster.” Tr. 11:21–25. In response to our questioning as to whether “basically having an external link by itself, . . . provides the scalability” because the external link provides connection to other devices, Petitioner answered that such scalability is “almost inherent in the external link.” *Id.* at 12:1–5.

Patent Owner replies that “[t]here is no argument that there is any connection between Dally’s alleged external link and any benefits in scalability.” PO Resp. 26. In particular, according to Patent Owner, Petitioner merely provides “conclusory statements” that the person of ordinary skill in the art would have been motivated to use the “external links” to achieve Dally’s objective, without explanation. *Id.* at 27 (citing Pet. 53–54). Although Patent Owner acknowledges that Petitioner relies on the testimony of Dr. Weissman, Petitioner contends that Dr. Weissman’s testimony “merely parrots the statements in the Petition” and provides no “basis for such opinion, leaving them entitled to little or no weight.” *Id.* That is, “Dally does not attribute improved scalability *to an external link*, and the Petition does not attempt to make a connection either.” *Id.* at 28. According to Patent Owner, “[t]his failure highlights the conclusory nature of the assertion and testimony, and the failure to meet Petitioner’s burden.” *Id.*

We have reviewed Petitioner’s arguments and the underlying evidence cited in support and determine that Petitioner establishes the above recited claim element, notwithstanding Patent Owner’s arguments to the contrary. In particular, Patent Owner acknowledges that Dally discloses “external links” and that Dally’s system provides scalability, as Petitioner asserts. PO

Resp. 26–27. We are unpersuaded by Patent Owner’s contention that “Dally does not attribute improved scalability *to an external link*.” *Id.* at 28.

As we found in our Decision on Institution, which Patent Owner does not refute (*see* PO Resp. 28–31), Dally discloses using direct and indirect interconnection networks, wherein “[d]irect networks are generally preferred for large machines because of the scalability” since “a direct network grows with the nodes,” with “[the] more nodes added, [the] more network is added.” *See* Dec. Inst. 31 (citing Ex. 1005 ¶ 35).

Although Patent Owner contended Dally “doesn’t say that the external link provides scalability” (PO Resp. 28; *see also* Tr. 32:13–16 (citing Ex. 1005 ¶ 37)), Dally discloses that the adding of nodes to the network provides the scalability. *See* Ex. 1005 ¶ 35. We find persuasive Dr. Weissman’s explanation that a POSITA would have readily understood the available external links of Dally’s nodes could be used to achieve the desired scalability of Dally by using one of those external links to form an interconnection with an additional node, resulting in scaling of Dally’s cluster router. Ex. 1003 ¶¶ 70–71, 144–147 (citing Ex. 1005, Abstract, ¶¶ 16, 49–50, Figs. 1, 7); *see also* Ex. 1005 ¶ 35. That is, as Petitioner contended during oral arguments, Dr. Weissman supports its contention that “Dally actually discloses this idea that the external links improve scalability.” Tr. 12:5–9. In fact, the ’998 patent itself describes that interconnectivity between the router cluster nodes 402 enables all router cluster nodes 402 to be equivalent, wherein the router cluster node equivalency provides a scalable packet routing capacity with its port count increasing monotonically. *See* Ex. 1001, 10:7–34. Accordingly, we find

availing Petitioner's contention that Dally's interconnection of networks using links therebetween provides scalability. Pet. 53.

Based on the complete record presented, we are persuaded that Petitioner has demonstrated persuasively that a person of ordinary skill in the art in light of these disclosures would have been motivated to use the "external links" of Dally to interconnect the networks in order to achieve Dally's objective of "overcom[ing] bandwidth and scalability limitations' of the prior art." Pet. 53 (citing Ex. 1003 ¶ 153).

ii. Remaining limitations of claim 17, and claims 18, 21, and 22

Petitioner provides detailed explanations as to how Dally teaches the remaining claim limitations as recited in independent claim 17, and dependent claims 18, 21, and 22, citing Dr. Weissman's testimony for support. Pet. 46–52, 54–57 (citing Ex. 1005 ¶¶ 16, 30, 34, 49–51, 67–69, 81, Figs. 1, 7–8; Ex. 1003 ¶¶ 138–150, 154–161). Patent Owner does not address separately Petitioner's explanations and supporting evidence regarding the remaining limitations in claim 17 and the dependent claims. *See generally* PO Resp.

Having reviewed Petitioner's arguments and supporting evidence in the complete record, we determine Petitioner has demonstrated by a preponderance of the evidence that that independent claim 17, and dependent claims 18, 21, and 22 depending from claim 17, would have been obvious over Dally.

iii. Claims 25 and 26 as Anticipated by Dally

Petitioner provides detailed explanations as to how Dally discloses the limitations as recited in claims 25 and 26, citing Dr. Weissman's testimony

for support. Pet. 57–63 (citing Ex. 1005 ¶¶ 34, 45, 49–51, Figs. 7–8; Ex. 1003 ¶¶ 162–183). Patent Owner does not address separately Petitioner’s explanations and supporting evidence regarding claims 25 and 26. *See generally* PO Resp.

Having reviewed Petitioner’s arguments and supporting evidence in the complete record, we determine Petitioner has demonstrated by a preponderance of the evidence that claims 25 and 26 are anticipated by Dally.

III. CONCLUSION⁸

For the foregoing reasons, we are persuaded on the record at hand that Petitioner has demonstrated by a preponderance of the evidence that the challenged claims 17–19, 21–23, 25, and 26 of the ’998 patent are unpatentable.

⁸ 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. 16,654 (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

For the reasons given, it is

ORDERED that, based on the preponderance of the evidence, claims 17–19, 21–23, 25, and 26 of the '998 patent have been shown to be unpatentable; and

FURTHER ORDERED that, because this is a final written decision. Parties to this proceeding seeking judicial review of our decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

In summary:

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
17, 18, 21, 22	102	Passint	17, 18, 21, 22	
19, 21, 23	103	Passint, Chen	19, 21, 23	
17, 18, 21, 22	103	Dally	17, 18, 21, 22	
25, 26	102	Dally	25, 26	
Overall Outcome			17–19, 21–23, 25, 26	

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For PETITIONER:

Todd M. Briggs
Nima Hefazi
James M. Glass
Kevin Johnson
QUINN EMANUEL URQUHART & SULLIVAN, LLP
toddbriggs@quinnemanuel.com
nimahefazi@quinnemanuel.com
jimglass@quinnemanuel.com
kevinjohnson@quinnemanuel.com

For PATENT OWNER:

Brett Mangrum
Ryan Loveless
Jeffrey A. Stephens
James Etheridge
Brian Koide
Jeffrey Huang
ETHERIDGE LAW GROUP
brett@etheridgelaw.com
ryan@etheridgelaw.com
jstephens@etheridgelaw.com
ipteam@etheridgelaw.com
brian@etheridgelaw.com
jeff@etheridgelaw.com

Sean Burdick
Burdick Patents
sean@burdickpatents.com