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Paper 10
Date: July 3, 2024

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ARISTA NETWORKS, INC.,
Petitioner,

v.

CORRIGENT CORPORATION,
Patent Owner.

IPR2023-00515
Patent 7,330,431 B2

Before NATHAN A. ENGELS, CHRISTOPHER L. OGDEN, and BRENT M. DOUGAL, Administrative Patent Judges.

OGDEN, *Administrative Patent Judge*.

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

I. INTRODUCTION

In response to a Petition (Paper 17,[1] "Pet.") filed by Petitioner Arista Networks, Inc. ("Petitioner"), the Board instituted an *inter partes* review of claims 1–30 of U.S. Patent No. 7,330,431 B2 (Ex. 1001, "the '431 patent"). IPR2023-00515, Paper 7.

For trial, we consolidated this proceeding with closely related proceeding IPR2023-00169, which we separately instituted based on a petition filed by Cisco Systems, Inc., Dell Technologies Inc., and Dell Inc. ("Cisco and Dell"). Paper 14; *see also* Paper 3 (Cisco and Dell petition). Patent Owner Corrigent Corporation ("Patent Owner") filed a Patent Owner Response (Paper 28 ("PO Resp.")) to both petitions, Petitioner along with Cisco and Dell filed a joint Reply to the Patent Owner Response (Paper 34 ("Pet. Reply")), and Patent Owner filed a Sur-reply (Paper 36 ("PO Sur-reply")). We held an oral hearing on April 10, 2024, for the consolidated cases, and the transcript is in the record ("Tr."). Paper 41.

Because the consolidated cases have overlapping, but different, grounds and evidence, this is a final written decision under 35 U.S.C. § 318(a) solely in the IPR2023-00515 proceeding as to whether the claims challenged in the *inter partes* review are unpatentable under the grounds of the Petition in that proceeding. For the reasons below, we conclude that Petitioner has shown that claims 1–10, 12–22, and 24–30 are unpatentable, but has not shown that claims 11 or 23 are unpatentable.

[1] Unless otherwise indicated, all paper and exhibit numbers are to filings in the related IPR2023-00169 proceeding, to which this proceeding was consolidated for trial.

II. BACKGROUND

A. RELATED PROCEEDINGS

As related matters, the parties identify *Corrigent Corp. v. Dell Techs., Inc.*, No. 1:22-cv-00496-RGA (D. Del. filed Apr. 19, 2022); *Corrigent Corp. v. Arista Networks, Inc.*, No. 1:22-cv-00497-RGA (D. Del. filed Apr. 19, 2022), and *Corrigent Corp. v. Cisco Systems, Inc.*, No. 6:22-cv-00396-ADA (W.D. Tex. filed Apr. 19, 2022). Pet. 89; IPR2023-00515, Paper 4, 2.

B. THE '431 PATENT (EX. 1001)

The '431 patent describes "[a] method for assigning bandwidth in a network including nodes coupled by links arranged in a physical topology," where the network also includes logical links arranged in a topology different from the physical topology. Ex. 1001, code (57). Figure 3, reproduced below, is a schematic diagram of logical and physical links between a set of network nodes:

FIG. 3

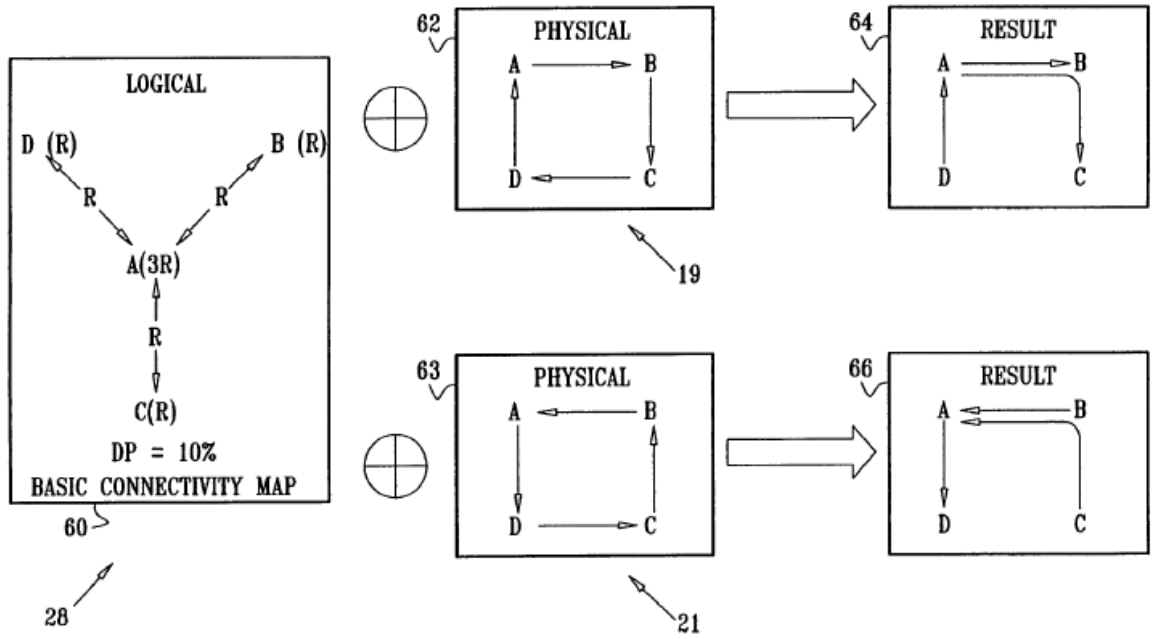


Figure 3 depicts a ring network as shown in boxes 62 and 63, which comprise clockwise (19) and counterclockwise (21) physical links, respectively, connecting nodes A–D. Basic connectivity map 60 shows the same nodes logically connected in a hub-and-spoke arrangement. *See* Ex. 1001, 7:66–8:20. Boxes 64 and 66 indicate the physical links from each network 19 and 21, respectively, that correspond to each unidirectional link in logical map 60. Basic connectivity map 60 indicates that each connection between A and the other nodes has bandwidth requirement R, and there is also a correction factor or "deviation parameter (DP)" of 10% that comes into play when assigning actual bandwidths. *Id.* at 7:22–28, 8:2–20.

The process of determining actual bandwidths for each physical link proceeds as shown in Figure 2, reproduced below:

FIG. 2

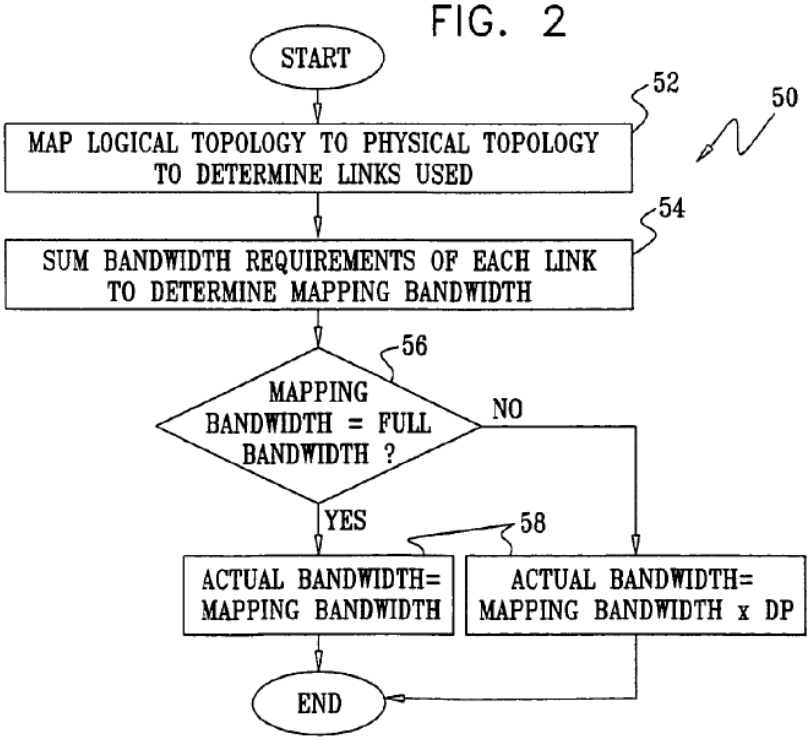


Figure 2, above, is a flowchart that begins with step 52, which maps a logical topology to the physical topology to determine the physical links to be used in the network. Ex. 1001, 7:38–41, 8:21–51. Step 54 then sums the bandwidth requirements for each of the physical links identified in step 52 to determine "mapping bandwidths" for each link. *Id.* at 7:42–44, 8:52–9:17. Next, step 56 compares each mapping bandwidth with a corresponding "full" bandwidth that would be available "if every possible [logical] connection in the network is provided for." *Id.* at 7:45–54, 9:18–44. If the "mapping" and "full" bandwidths are equal, then in step 58 the actual bandwidth is the mapping bandwidth; otherwise, the actual bandwidth is the mapping bandwidth multiplied by DP. *Id.* at 7:55–62, 9:46–10:7. Thus, in Figure 3, the "full" bandwidths for physical links B–C in network 19 and C–

B in network 21 are 2R,[2] which differs from mapping bandwidths R, so the actual bandwidths for these physical links would be 1.1R (mapping bandwidth R multiplied by correction factor 1.10 corresponding to the DP of 10%). *See id.*, col. 9, Table IV.

C. CHALLENGED CLAIMS AND GROUNDS

Representative claim 1 is as follows:

[1.0] 1. A method for assigning bandwidth in a network including nodes coupled by links arranged in a physical topology, the method comprising:

[1.1] defining between the nodes logical connections associated with a data transmission service to be provided over the network,

[1.2] the logical connections having a connection topology different from the physical topology;

[1.3] determining respective bandwidth requirements for the logical connections based on parameters of the service;

[1.4] mapping the connection topology to the physical topology, so that each of the logical connections is associated with one or more links of the physical topology; and

[1.5] allocating a bandwidth for the service on each of the links in response to the bandwidth requirements of the logical connections and to the mapping.

Ex. 1001, 13:36–52 (Petitioner's reference numbers added).

[2] This is because, in calculating the "mapping" bandwidths for physical links B–C and C–B, the method only relies on links associated with logical connections between nodes A and C in map 60 of Figure 3, whereas the "full" bandwidth also includes potential logical connections (not shown) directly between nodes B and C. *See* Ex. 1001, col. 9, Tables II, III, Fig. 3.

Petitioner argues four grounds for *inter partes* review, as summarized in the following table:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–5, 7–11, 25, 26	103(a)[3]	Baker,[4] Wright,[5] Holender '699[6]
12–16, 18–24, 27–30	103(a)	Baker, Wright, Holender '699, Holender '894[7]
6	103(a)	Baker, Wright, Holender '699, Zheng[8]
17	103(a)	Baker, Wright, Holender '699, Holender '894, Zheng

Pet. 4.

D. EXPERT TESTIMONY

Petitioner submits two declarations by Dr. Tal Lavian. Exs. 1021, 1038. Cisco and Dell also submitted two declarations by Dr. Henry Houh to support the grounds raised in the IPR2023-00169 petition, to which Petitioner relies. Exs. 1003, 1036. Patent Owner submits a declaration by Dr. Edwin Hernandez-Mondragon. Ex. 2008.

[3] 35 U.S.C. § 103(a) (2006), *amended by* Leahy–Smith America Invents Act ("AIA"), Pub. L. No. 112-29 § 103, sec. (n)(1), 125 Stat. 284, 287, 293 (2011) (effective Mar. 16, 2013). We apply this pre-AIA version of § 103 because the '431 patent issued from an application filed before the effective date of the AIA amendments. *See* Ex. 1001, code (22).

[4] Baker, US 2004/0095946 A1 (published May 20, 2004) (Ex. 1005).

[5] Wright, US 2004/0174884 A1 (published Sept. 7, 2004) (Ex. 1006).

[6] Holender et al., US 6,104,699 (issued Aug. 15, 2000) (Ex. 1007).

[7] Holender et al., US 6,069,894 (issued May 30, 2000) (Ex. 1020).

[8] Zheng et al., US 6,757,247 B1 (issued June 29, 2004) (Ex. 1008).

III. GROUNDS OF THE PETITION

For the reasons below, we determine that Petitioner has shown, by a preponderance of the evidence, that claims 1–10, 12–22, and 24–30 are unpatentable, but has not shown that claims 11 or 23 are unpatentable.

A. LEVEL OF ORDINARY SKILL IN THE ART

The level of ordinary skill in the pertinent art at the time of the invention is a factor in how we construe patent claims. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc). It is also one of the factors we consider when determining whether a patent claim is obvious over the prior art. *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

To assess the level of ordinary skill, we construct a hypothetical "person of ordinary skill in the art," from whose vantage point we assess obviousness and claim interpretation. *See In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998). This legal construct "presumes that all prior art references in the field of the invention are available to this hypothetical skilled artisan." *Id.* (citing *In re Carlson*, 983 F.2d 1032, 1038 (Fed. Cir. 1993)).

Relying on Dr. Houh's testimony, Petitioner argues that a person of ordinary skill in the art "would have had a working knowledge of the networking art that is pertinent to the '431 patent, including network communications techniques and bandwidth management methodologies," and "would have had a bachelor's degree in computer science, computer engineering, electrical engineering, or an equivalent, and two years of professional experience relating to network communications including the use of logical topologies and bandwidth management. Lack of professional

experience can be remedied by additional education, and vice versa." Pet. 3 (citing Ex. 1003 ¶¶ 18–20).

Patent Owner adopts Petitioner's proposed definition of the level of ordinary skill. PO Resp. 3. Because Petitioner's articulation of that level of skill is uncontested, supported by testimonial evidence, and appears consistent with the types of problems and solutions in the '431 patent, we adopt it for this decision. *See, e.g.*, Ex. 1001, 1:5–6:14.

B. Claim Construction

In an *inter partes* review, we construe a patent 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)." 37 C.F.R. § 42.100(b). This generally includes "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." *Id.* The ordinary and customary meaning of a claim term "is its meaning to the ordinary artisan after reading the entire patent," and "as of the effective filing date of the patent application." *Phillips*, 415 F.3d at 1313, 1321. There are only two circumstances in which a construction departs from the ordinary and customary meaning: "1) when a patentee sets out a definition and acts as [their] own lexicographer, or 2) when the patentee disavows the full scope of a claim term either in the specification or during prosecution." *Thorner v. Sony Comput. Entm't Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012). Any such special meaning of a term "must be sufficiently clear in the specification that any departure from common usage would be so understood

by a person of experience in the field of the invention." *Multiform Desiccants Inc. v. Medzam Ltd.*, 133 F.3d 1473, 1477 (Fed. Cir. 1998).

To construe the claim terms, "we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006).

Petitioner argues that "no claim term requires express construction" for this proceeding. *See* Pet. 3.

Patent Owner argues that the phrase *in response to* in limitation 1.5 has its ordinary and customary meaning, which we should construe as either "based on information from" or "using information from." PO Resp. 12 (citing Ex. 2008 ¶¶ 28–29). Patent Owner interprets the Petition to imply that the phrase simply means "after," but Patent Owner disagrees with that interpretation. *Id.* at 12–13 (citing Pet. 34–36; Ex. 2009, 28:10–29:14 (cross-examination testimony of Dr. Houh); Ex. 2008 ¶ 29). Patent Owner points to the '431 patent to support its proposed construction. *Id.* at 13–17 & n.8 (citing Ex. 1001, 7:38–41, 7:55–56, 8:21–10:7, 10:47–67, 11:1–29, 11:35–45, Figs. 2, 3; Ex. 2009, 14:19–19:8; Ex. 2008 ¶¶ 30–31, 33–36).

In its Reply, Petitioner argues that no construction of *in response to* is necessary because the construction does not resolve any contested issues. Pet. Reply 8–10 (citing Ex. 1005 ¶¶ 16, 62; Ex. 1006 ¶¶ 5, 24; Ex. 1003 ¶ 96; Ex. 1036 ¶¶ 49–50). But if a construction is necessary, Petitioner argues that the we should construe *in response to* as "using," consistent with how the claimed invention is described in the '431 patent. *Id.* at 10–11 (citing Ex. 1001, 2:52–6:10, 8:52–9:2; Ex. 1036 ¶¶ 7–11). Petitioner disagrees that the term means "based on" because limitation 1.3 uses the

phrase *based on*, suggesting that the applicant made a conscious decision to use different language in limitation 1.5. *Id.* at 11 (citing Ex. 1036 ¶ 11).

Patent Owner responds that its two proposed constructions are synonymous, and argues that Petitioner agrees that *in response to* encompasses "using" or "using *information from*." PO Sur-reply 8 (citing Ex. 1001, 2:22–26). Patent Owner contends that its proposed construction resolves a controversy because in Patent Owner's view, the Baker–Wright combination does not use information from the recited mapping to allocate bandwidth. *Id.* at 9–12 (citing Ex. 1006 ¶¶ 5, 17, 24; Ex. 2009, 52–56; Ex. 2008 ¶¶ 62–76). Similarly, Patent Owner contends that Holender '699 does not teach mapping. *Id.* at 12–13 (citing Ex. 1007, 3:15–17; Ex. 2008 ¶¶ 89–92).

We see no significant difference between Petitioner's proposed construction of *in response to* as "using" and Patent Owner's proposed construction as "using information from." Thus, it does not appear that the construction of *in response to* is in controversy. Thus, we need not construe the term for this decision. *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.'" (alteration in original) (quoting *Vivid Techs., Inc. v. Am. Sci & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))). To the extent that we need to interpret any other claim language, we address that language below in the context of the prior art.

C. GROUND BASED ON BAKER AND WRIGHT (CLAIMS 1–5, 7–11, 25, AND 26)

Petitioner's first ground challenges claims 1–5, 7–11, 25, and 26 as obvious over Baker and Wright. Pet. 4.

A claim is unpatentable under § 103 for obviousness "if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains." 35 U.S.C. § 103; *see KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007).

We base our obviousness inquiry on factual considerations 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 skill in the art, and (4) any objective indicia of obviousness or non-obviousness that may be in evidence. *See Graham*, 383 U.S. at 17–18.

Considering these factors,[9] we determine that Petitioner has shown, by a preponderance of the evidence, that claims 1–4, 7–9, 25, and 26 are unpatentable under § 103(a) as obvious over Baker in view of Wright, but has not shown that claim 11 is unpatentable.

1. Overview of Baker

Baker describes "[a] logical star architecture imposed on an underlying non-star network" such as a ring network. Ex. 1005, code (57), ¶ 30. Figure 1, reproduced below, depicts an example of such a network:

[9] Neither party presents evidence of objective indicia of obvious or non-obviousness, so no such evidence factors into our decision.

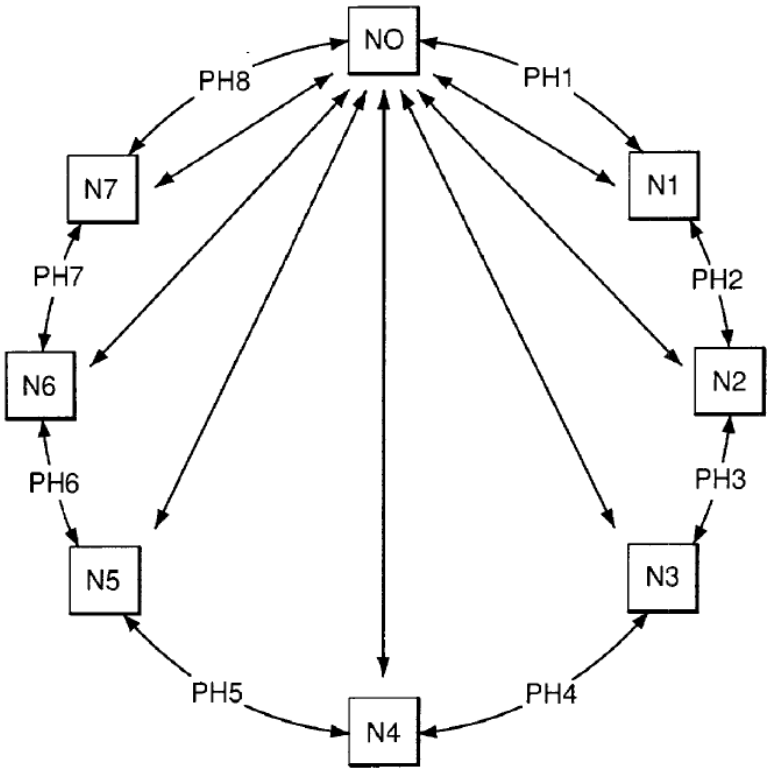


FIG. 1

Figure 1, above, "illustrates a bidirectional physical communications ring where N0 through N7 represent routing and switching nodes, PH1 through PH8 represent bidirectional physical links between nodes, and VP1 through VP7 represent bidirectional virtual paths associated with a logical star topology overlaid on the physical ring." Ex. 1005 ¶ 31. Head node N0 "manage[s] the network feeder utilization" so that "resources such as bandwidth can be more effectively managed." *Id.* ¶ 62.

In one example, head node N0 performs an "Administer Ring" routine as outlined in Figure 3, reproduced below:

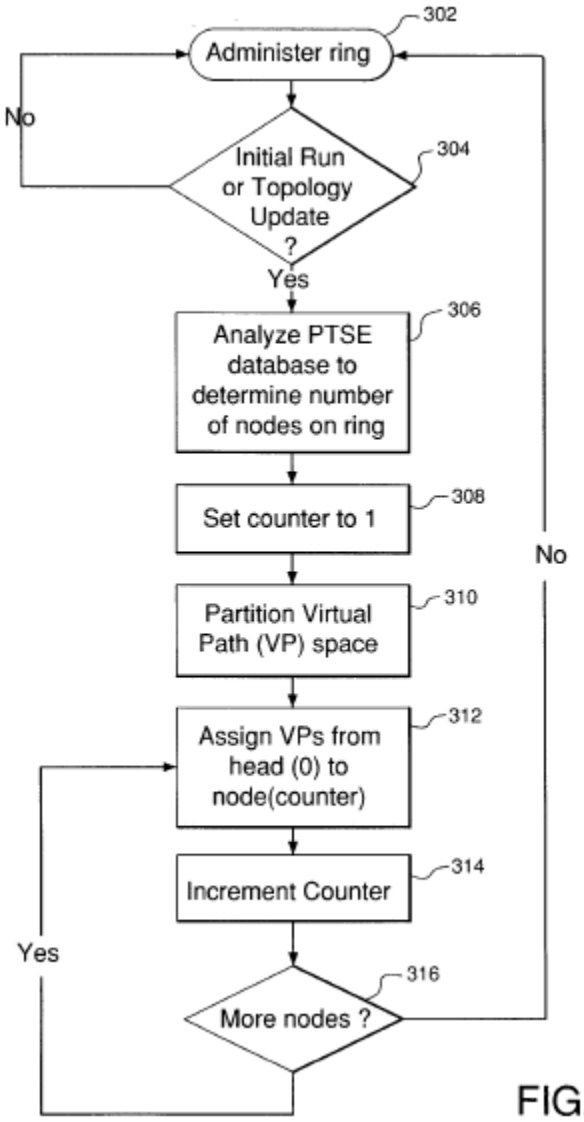


FIG. 3

As illustrated above, Administer Ring loops indefinitely after the initial run (steps 302, 304). Ex. 1005 ¶ 52. For the initial run, head node N0 analyzes a database to determine the number of nodes currently on the ring (step 306), sets a counter to 1 corresponding to the first node (i.e., N1) beyond head node N0 (step 308), and partitions the required memory required to keep track of each virtual path ("VP") based on the number of nodes (step 310). *Id.* ¶ 53. Head node N0 then loops while incrementing the counter from 1 to the number of nodes, and it assigns a VP from itself to each node corresponding to the counter (steps 312, 314, 315). *Id.* "The result of the

Administer Ring routine is the assignment of one or more virtual paths from the head node [N0] to each of the other nodes in the ring," which "equates to a star topology that is overlaid on the underlying ring network."

Baker includes another embodiment for assigning virtual paths to physical links in a ring network is shown in Figure 11, reproduced below:

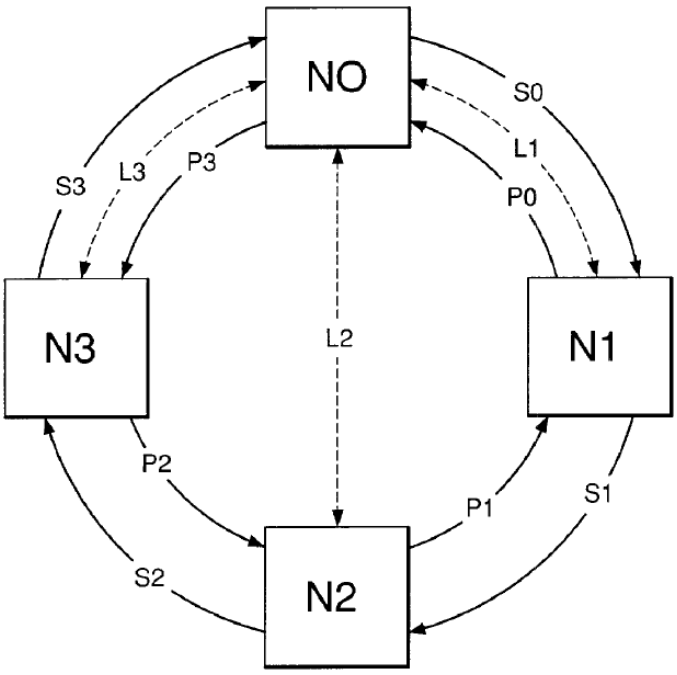


FIG. 11

The figure depicts a ring network with nodes N0–N3, clockwise physical "service" links S0–S3, and counterclockwise physical "protection" links P0–P3[10] "overlaid with virtual bidirectional paths L1, L2, and L3" which "constitute a logical star topology." Ex. 1005 ¶ 80. According to Baker,

[10] "Protection" links are provided so that, "[i]f communications on the ring are disrupted (e.g., by a node or link failure), then all traffic previously serviced by the failed node or link will be routed in the opposite direction." Ex. 1005 ¶ 72.

"service traffic logically carried on L1 of the star overlay from N0 to N1 is carried on path S0 of the underlying ring topology, while service traffic logically carried on L1 . . . from N1 to N0 is carried on the combination of service paths S1, S2, and S3." *Id.* "Similarly, service traffic logically carried on L2 of the star overlay from N0 to N2 is carried on the combination of S0 and S1 . . . , while service traffic logically carried on L2 . . . from N2 to N0 is carried on the combination of S2 and S3." *Id.* ¶ 81.

2. Overview of Wright

Wright teaches "[a] method for traffic engineering of connectionless virtual private network (VPN) services" which creates a "restricted topology" based on "physical connectivity data" and "[l]ogical connectivity data," and "[a] bandwidth requirement for each link in the restricted topology is calculated." Ex. 1006, code (57).

Wright's Figure 1 is reproduced below:

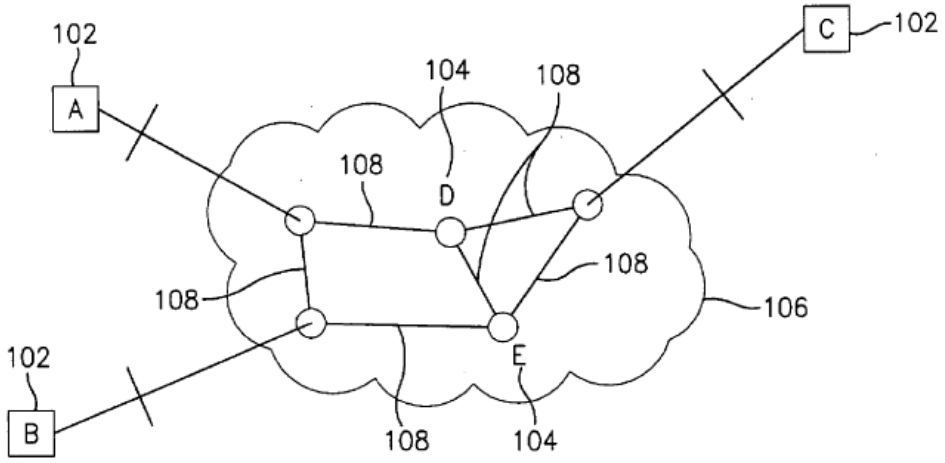


FIG. 1

As shown, Figure 1 "includes several edge nodes 102, service nodes 104, a VPN 106 and internal transport links 108." Ex. 1006 ¶ 15. Edge nodes 102

are a subset of service node 104 that interface directly to the customer. *Id.* Transport links 108 comprise "all the possible physical routes for sending packets through the VPN 106" between its associated service nodes 104. *Id.*

Wright's Figure 2, reproduced below, is a block diagram of a logical connectivity mesh associated with the connectionless VPN of Figure 1:

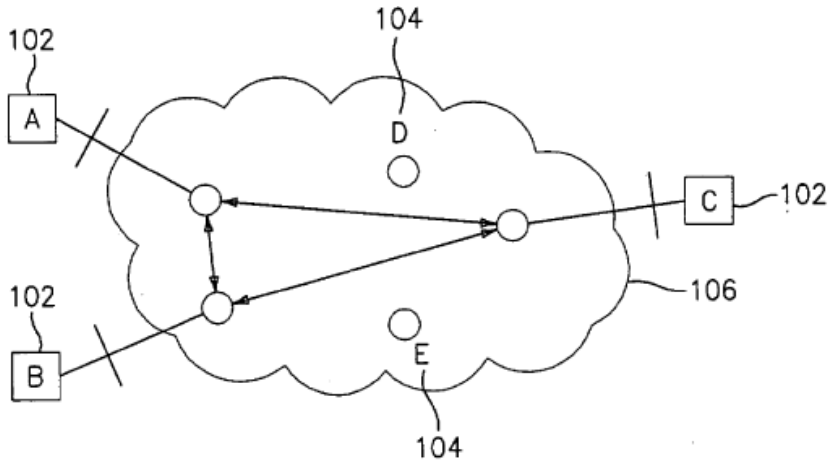


FIG. 2

Figure 2 indicates "the logical connectivity without regard to the physical implementation." Ex. 1006 ¶ 16. It includes three edge nodes 102 ("A," "B," and "C") which communicate with each other through VPN 106. *Id.* According to Wright, "[u]sing a full logical mesh" as depicted in Figure 1 "may result in a requirement to reserve more bandwidth than is required and is available." because "each link 108 would be required to reserve a [particular] bandwidth . . . for exclusive use by the VPN." *Id.*

An alternative logical arrangement is shown in Figure 3, reproduced below:

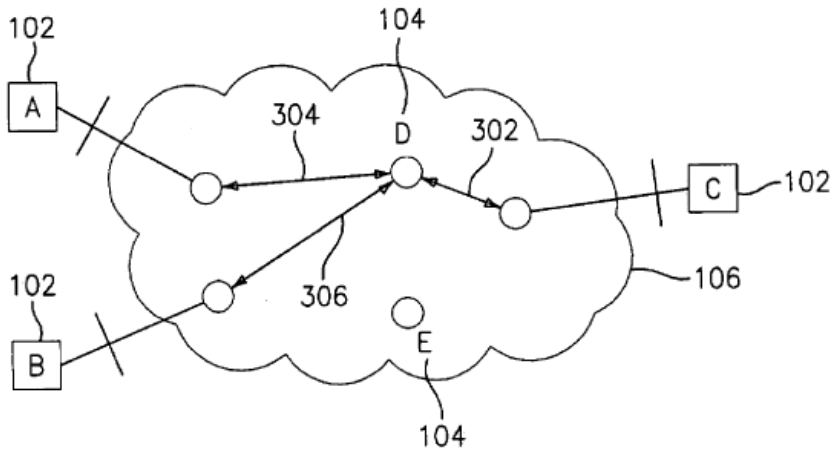


FIG. 3

In Figure 3, the logical connectivity mesh "is constrained to a specific restricted topology (e.g., a virtual topology" through the physical VPN 106" depicted in Figure 1. Ex. 1006 ¶ 16. All packets within VPN 106 travel along a subset (302, 304, 306) of links 108. *Id.* "Bandwidth is reserved along this subset of links to support a bandwidth [quality of service]," and "a single path is created between each pair of edge nodes." *Id.* This arrangement "is selected to minimize the amount of bandwidth reserved on the links 108 to provide a [quality of service]." *Id.* ¶ 17.

Figure 5, reproduced below, is a flowchart for performing traffic engineering for a restricted topology within a VPN:

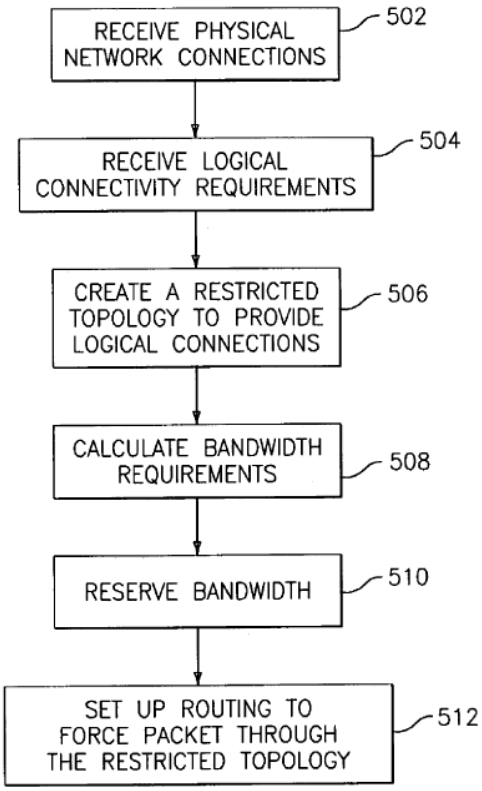


FIG. 5

As shown in the figure above, the method begins in step 502 with receiving physical network connections, which "may include data such as nodes and links included in the VPN." Ex. 1006 ¶ 24. Step 504 involves receiving logical connectivity requirements "in terms of edge nodes and communication requirements between edge nodes." *Id.* Then step 506 involves "creating a restricted topology to provide logical connections," which "may be based on a tree structure and includes a single path between each pair of endpoints." *Id.* The final steps involve calculating bandwidth requirements (508), reserving bandwidth (510), and directing routing software to force packets in the VPN to only travel through the restricted topology (512). *Id.*

3. Overview of Holender '699

Holender '699 describes the "partition[ing of] physical transmission resources on a physical network" in which "a set of logical networks is established on top of the physical network." Ex. 1007, code (57). Separate logical networks are designed to support different services with different demands such as "bandwidth, grade of service or congestion control functions," and where "service classes are arranged into groups in such a way that only those of similar properties are handled together in a logical network." *Id.* at 3:60–4:4.

Holender '699 discloses that after the logical networks are established, "the capacities of the logical links of the logical networks are determined such that the route blocking probability on each individual route in each one of the logical networks is less than or equal to a maximum allowed blocking probability for each individual route." Ex. 1007, code (56). Then, "the physical transmission resources are allocated among the logical links of the logical networks according to the determination." *Id.*

4. Independent Claim 1

We address each limitation of claim 1 below, although Patent Owner only specifically contests Petitioner's arguments relating to limitations 1.4 and 1.5.

(a) Preamble (1.0) and Limitations 1.1 and 1.2

The preamble (1.0) recites "[a] method for assigning bandwidth in a network including nodes coupled by links arranged in a physical topology." Ex. 1001, 13:36–38.

Petitioner argues that "Baker discloses the preamble, to the extent it is limiting" because Baker's network includes a topology of nodes coupled by physical links and bandwidth is among the network resources to be assigned to the network elements. Pet. 15–17 (citing Ex. 1005 ¶¶ 16, 19, 30–32, 62, Figs. 1, 2; Ex. 1003 ¶¶ 50–54).

Limitations 1.1 and 1.2 recite a step of "defining between the nodes logical connections associated with a data transmission service to be provided over the network, the logical connections having a connection topology different from the physical topology." Ex. 1001, 13:39–42.

Petitioner argues that Baker discloses logical connections for a data transmission service (i.e., "data traffic" and "signals") defined between nodes in a star pattern which differs from the physical ring topology, as shown in Baker's Figures 1, 4, 5, and 11. Pet. 17–21 & n.2 (citing Ex. 1001, 1:20–30, 7:29–31; Ex. 1005 ¶¶ 12, 30–32, 38, 54, 76, 80, 88, Figs. 1, 4, 11; Ex. 1003 ¶¶ 55–64); Pet. 22–24 (citing Ex. 1005 ¶¶ 13, 22, 30–31, 54, Figs. 1, 5; Ex. 1003 ¶¶ 69–73).

Also, for limitation 1.1, Petitioner contends that Wright further teaches using logical connections associated with data transmission services in the form of a VPN, video on demand (VOD), or video conferencing. Pet. 21–22 (citing Ex. 1001, 1:60–2:1; Ex. 1006 ¶¶ 2–3, 5–7, 14–16, 25; Ex. 1003 ¶¶ 65–68). According to Petitioner, "Baker is agnostic to the types of services supported by" its traffic, and a person of ordinary skill in the art would have turned to Wright for "additional examples of the types of service whose traffic traverses Baker's network." Pet. 9 (citing Ex. 1005 ¶¶ 12, 37–38, 80; Ex. 1006 ¶ 3, 15, 25; Ex. 1003 ¶ 41).

Patent Owner does not specifically contest these arguments. *See* PO Resp.; *see* PO Sur-reply 17 (arguing that Baker's Administer Ring routine is "similar to" limitation 1.1). Because Petitioner persuasively shows that Baker discloses a method for assigning bandwidth to resources of a physical ring network, we need not decide whether the preamble is limiting. *See, e.g.*, Ex. 1005 ¶ 62, Fig. 1. Also, Petitioner has persuasively shown that Baker, alone or in view of Wright, teaches defining a logical, star-shaped overlay associated with application traffic. *See, e.g.*, Ex. 1005 ¶ 30, Figs. 1, 11; Ex. 1006 ¶¶ 2–3. Thus, we determine that Baker, alone or in light of Wright, teaches the preamble of claim 1 and limitations 1.1–1.2.

(b) Limitation 1.3

Limitation 1.3 recites "determining respective bandwidth requirements for the logical connections based on parameters of the service." Ex. 1001, 13:43–44.

Petitioner argues that Baker discloses managing network resources that include bandwidth, and that a person of ordinary skill in the art would have understood this to include "ma[king] decisions based on the bandwidth needed, desired, or used by the services operating over Baker's virtual paths." Pet. 24–25 (citing Ex. 1005 ¶¶ 16, 54, 62; Ex. 1003 ¶¶ 74–76). Petitioner also argues that making the recited bandwidth determinations would have been obvious in view of Wright's teachings "to identify the required bandwidth and to provide guarantees for that bandwidth." Pet. 25 (quoting Ex. 1006 ¶ 18) (citing Ex. 1003 ¶¶ 77–78); *see also* Pet. 25–26 (citing Ex. 1006 ¶¶ 5–7, 17, 24, Figs. 3, 5; Ex. 1003 ¶¶ 78–80) (arguing that Wright calculates bandwidth requirements for a set of logical connections).

As to the requirement in limitation 1.3 that the bandwidth requirements are determined "based on parameters of the service," Petitioner argues that in the method shown in Wright's Figure 5 (reproduced *supra* Section III.C.2), step 508 calculates bandwidth requirements "based on the 'restricted topology,' which is in turn created from the 'logical connectivity requirements.'" Pet. 26 (quoting Ex. 1006 ¶ 24, Fig. 5). Thus, according to Petitioner, a person of ordinary skill in the art would have understood that the bandwidth requirements are based on the logical connectivity requirements, which are parameters of the service. Pet. 26–27 (citing Ex. 1006 ¶¶ 17, 24, Fig. 3; Ex. 1003 ¶¶ 80–81).

Petitioner also points to alleged teachings in Wright to base the bandwidth requirements on such things as a specified minimum or maximum bandwidth, quality of service guarantees, the number of supported active calls, whether the service is symmetric or asymmetric, whether the service is a dynamic session-based service, or whether it is a high-bandwidth service like VoIP. Pet. 27–28 (citing Ex. 1006 ¶¶ 18, 20, 25; Ex. 1003 ¶¶ 82–85).

Alternatively, Petitioner argues that the Baker–Wright combination teaches limitation 1.3 in light of Holender '699. Pet. 28–30. According to Petitioner, Holender '699 teaches that logical link capacities are determined so that the "route blocking probability" on each individual route is not greater than the maximum allowed blocking probability value given for each route, by distributing the route blocking evenly among the logical links used by the route. Pet. 28–29 (citing Ex. 1007, 1:53–55, 3:9–15, 6:4–10, Fig. 4; Ex. 1021 ¶¶ 120–123). Petitioner argues that the "maximum allowed blocking value" is a type of parameter of service, so the bandwidth

requirements are "based on parameters of the service." Pet. 29–30 (citing Ex. 1007, 3:9–15, 6:4–10, 6:48–8:58; Ex. 1003 ¶¶ 80–81; Ex. 1021 ¶¶ 121–122).

Patent Owner does not specifically contest these arguments. *See* PO Resp. For the reasons presented in the Petition, we determine that Baker, in view of Wright and Holender '699, teaches limitation 1.3. In particular, Petitioner persuasively shows that a person of ordinary skill in the art would have had reason, and sufficient technical background, to determine bandwidth requirements based on parameters such as minimum or maximum bandwidth, quality of service guarantees, or the needs of a high-bandwidth service such as VoIP or VOD.

(c) Limitation 1.4

Limitation 1.4 recites "mapping the connection topology to the physical topology, so that each of the logical connections is associated with one or more links of the physical topology." Ex. 1001, 13:45–48.

Petitioner argues that Baker discloses this limitation because it includes "multiple disclosures and examples of overlaying or mapping virtual paths to a physical topology," including Baker's Administer Ring procedure. Pet. 30–32 (citing Ex. 1005 ¶¶ 32, 51, 53–54, 69–70, 78–85, Figs. 1, 4, 10; Ex. 1003 ¶¶ 87–89).

(1) Whether Baker Discloses Any "Mapping" Distinct from "Defining . . . Logical Connections"

Patent Owner disagrees that Baker discloses the recited mapping because Baker's "Administer Ring routine does not establish links to the physical topology," and instead merely assigns "virtual paths from the head

node to each of the other nodes in the ring." PO Resp. 20–21 (citing Ex. 1005 ¶ 54; Ex. 2008 ¶ 47). Patent Owner's implication is that the "mapping" step of limitation 1.4 must be different from the "defining . . . logical connections" step of limitation 1.1, and Baker's Administer Ring routine cannot perform both steps. *See* PO Sur-reply 17 (citing Ex. 2008 ¶¶ 42–47) (arguing that the Administer Ring routine is "more similar to 'defining . . . logical connections' and not the recited 'mapping.'" (alteration in original)).

Petitioner disagrees that it relies on the same teachings for limitations 1.1 and 1.4. Pet. Reply 12–13 n.1. According to Petitioner, "[t]he Petition identified the act of creating multiple virtual paths as teaching [limitation 1.1], and the act of overlaying virtual paths to a physical topology as teaching [limitation 1.4]." *Id.* (citing Ex. 1036 ¶¶ 17–18). Petitioner also argues that nothing in claim 1 requires a step of "establishing links." *Id.* at 17–18 (citing Ex. 1036 ¶ 19).

We agree with Petitioner that Baker separately describes both (1) "defining . . . logical connections" of a particular logical connection topology as per limitation 1.1, and (2) mapping that logical connection topology to the physical topology as per limitation 1.4. For example, in Figure 11, Baker describes defining a series of logical connections between nodes forming a logical star topology (i.e., bidirectional paths L1, L2, and L3 in Figure 11) and this logical star topology is "overlaid on the underlying ring topology" as shown in Table 2. Ex. 1005 ¶ 80, Fig. 11.

(2) Whether Baker's Overlay Constitutes "Mapping"

Patent Owner next argues that Baker does not actually "map" the logical connection topology to the physical topology because "the logical star overlay process includes instructing nodes to simply forward *any* traffic that is labeled with a logical path that does not terminate at that node" rather than, for example, having the head node perform "explicit mapping determinations." PO Resp. 21–22 (citing Ex. 1005 ¶¶ 76, 80, 83–84, 87; Ex. 1003, 36–38; Ex. 2011; Ex. 2008 ¶¶ 48–49); *see also* PO Sur-reply 17–18 (citing Ex. 1008 ¶ 52). According to Patent Owner, references to "mapping" and descriptions of the logical data paths are merely "to facilitate understanding to the reader," and to not constitute an actual mapping step. PO Resp. 22–23 (citing Ex. 1005 ¶¶ 45, 69–70, 78–86, 87, Figs. 8, 9, 11; Ex. 2008 ¶¶ 50–53); *see also* PO Sur-reply 17 (citing Ex. 2008 ¶¶ 48–49), 19 (citing Ex. 1005 ¶ 65).

Petitioner responds that Baker explicitly describes the Administer Ring procedure as creating a "mapping between logical paths and physical paths," and resulting in "a star topology . . . overlaid on the underlying ring network." Pet. Reply 12–13 (first quoting Ex. 1005 ¶ 83; and then quoting *id.* ¶ 54) (citing Ex. 1005 ¶ 51; Ex. 1003 ¶ 88; Ex. 1036 ¶¶ 16, 20). Petitioner also argues that Baker's Figures 8–11 clearly depict a "mapping." *Id.* at 13–15 (citing Ex. 1005 ¶¶ 14, 69, 80, Figs. 8–11; Ex. 1036 ¶¶ 21–22). Petitioner also points to Tables 2 and 3 as depicting mappings between logical and physical topologies in which logical paths are associated with one or more links in the physical topology. *Id.* at 15–16 (citing Ex. 1005 ¶¶ 80, 84; Ex. 1003 ¶ 88; Ex. 1036 ¶¶ 28, 30–31). Petitioner contends that Baker's

disclosure in this regard is equivalent to the mapping associations depicted in Table 1 of the '431 patent. *Id.* at 16–17 (citing Ex. 1001, 2:19–22; 8:39–48; Ex. 1037, 50:8–15; Ex. 2008 ¶ 30).

Petitioner also argues that Patent Owner confuses Baker's alleged mapping process, which occurs "in advance of a communication" (e.g., during the Administer Ring routine) with regular traffic flow, which occurs after the "mapping" is already complete. Pet. Reply 18 (emphasis omitted) (quoting Ex. 1005 ¶ 76) (citing Ex. 1005 ¶¶ 51–52; Ex. 1036 ¶¶ 32–34).

Patent Owner argues that Baker discloses the port forwarding procedure as "'one aspect of the logical star overlay process,' . . . so this disclosure is relevant to interpreting whether Baker performs the claimed mapping." PO Sur-reply 18 (quoting Ex. 1005 ¶ 87). Patent Owner acknowledges Baker's disclosure that "[c]reating a virtual path through a network amounts to predefining a route through the network in advance of a communication," but according to Patent Owner, "Baker does not describe the head node as predefining this route in advance of communication," and the paragraph otherwise "teaches away from a head node that predefines any route." *Id.* at 18–19 (alteration in original) (quoting Ex. 1005 ¶ 76) (citing Ex. 2008 ¶ 48). Thus, "[a]t the very least, Petitioners have failed to show that Baker discloses or suggests" a "controller" as recited in claim 25. *Id.* at 19.[11]

Considering the evidence of record on both sides, we find Petitioner's argument persuasive that Baker teaches a "mapping" as recited in limitation 1.4. Baker's disclosure of a "mapping" is explicit. *See, e.g.*, Ex. 1005 ¶¶ 69,

[11] Claim 25 includes limitations similar to claim 1 and is addressed below. *See infra* Section III.C.3.

83. And the evidence shows that this mapping occurs "in advance of a communication," and may, for example, take place in the head node as part of the Administer Ring routine. *See, e.g.*, Ex. 1005 ¶¶ 51–56, 76. That intermediate rings are ultimately configured to simply forward traffic "according to preconfigured rules" (Ex. 1005 ¶ 87) rather than to perform more complicated routing has no pertinent bearing on the process corresponding to the recited "mapping" step, which occurs "in advance" of the communication and any such forwarding (*id.* ¶ 76).

Thus, for the reasons outlined above and the reasons set forth in the Petition, we find Petitioner's arguments persuasive that Baker discloses limitation 1.4.

(d) Limitation 1.5

Limitation 1.5 recites "allocating a bandwidth for the service on each of the links in response to the bandwidth requirements of the logical connections and to the mapping." Ex. 1001, 13:49–51.

Petitioner argues that Baker discloses a method for automatically allocating network resources, and teaches that "bandwidth" is one of those resources. Pet. 32 (citing Ex. 1005 ¶¶ 16, 62). According to Petitioner, "Baker's resource and bandwidth allocation techniques are executed as part of an overlay procedure that includes the 'Administer Ring' routine." *Id.* (citing Ex. 1005 ¶¶ 51–56, Fig. 3; Ex. 1003 ¶¶ 90–91). Petitioner also argues that Baker teaches that one should ensure that "sufficient bandwidth is available." *Id.* (citing Ex. 1005 ¶ 9).

Petitioner then turns to Wright for "provid[ing] further details on ensuring the available bandwidth is sufficient for the service." Pet. 32 (citing Ex. 1003 ¶ 92). In particular, Petitioner argues that Wright teaches

calculating bandwidth requirements for physical links within the "restricted topology" defined in part by the logical connectivity requirements. *See* Pet. 33 (citing Ex. 1006 ¶¶ 5, 15–16, 24; Ex. 1003 ¶¶ 93–94). According to Petitioner, "[t]he bandwidth reservations are for the physical links even if Wright's 'links within the restricted topology' . . . references the virtual links: 'only the bandwidth actually required is reserved on the *links 108*' (i.e., physical links 108)." *Id.* (first quoting Ex. 1006 ¶ 24; and then quoting *id.* ¶ 17). Petitioner contends that "[i]t would have been obvious for reserving bandwidth on those virtual links to include reserving bandwidth on the underlying physical links ('*in response to . . . the mapping*')." *Id.* (omission in original) (citing Ex. 1003 ¶¶ 94–95).

Petitioner also argues that according to Wright's Figure 5, the "reserve bandwidth" step (510) occurs after the restricted topology is created to provide logical connections (step 506). Pet. 34–35 (citing Ex. 1006, Fig. 5; Ex. 1003 ¶ 96). According to Petitioner, a person of ordinary skill in the art "would have implemented Wright's [allocation of bandwidth] as part of Baker's 'special "star overlay" procedures' that includes 'Administer Ring' (the '*mapping*')." *Id.* In this combination, Petitioner argues, the bandwidth allocation would have occurred after, and used the results of, Baker's Administer Ring routine. Pet. 35–36 (citing Ex. 1005 ¶¶ 16, 51–56, 62; Ex. 1006 ¶ 24, Fig. 5; Ex. 1003 ¶¶ 96–98).

Petitioner contends that a person of ordinary skill in the art would have modified Baker based on Wright's teachings because "Wright provides further details about" Baker's concepts "including the overlaying of a logical topology onto a physical topology, assigning and managing network resources, and conveying traffic between nodes." Pet. 8–9 (citing Ex. 1005

¶¶ 12, 16–18, 24, 37–38, 62, 80; Ex. 1006 ¶¶ 3, 5, 15, 25; Ex. 1003 ¶¶ 39–41; Ex. 1021 ¶¶ 95–96). Petitioner argues that there would have been a reasonable expectation of success because Wright's teachings are compatible with Baker's teachings and they use compatible network technologies and hardware. Pet. 9–12 (citing Ex. 1005 ¶¶ 13, 16, 30, 37, 46–47, 51–52; Ex. 1006 ¶¶ 3–7, 14–18, 24; Ex. 1007, 5:12–35, Fig. 3; Ex. 1009 ¶ 15; Ex. 1003 ¶¶ 42–48; Ex. 1021 ¶¶ 100–104).

Alternatively, Petitioner contends that the Baker–Wright combination teaches limitation 1.5 in light of Holender '699, which discloses allocating physical transmission resources (e.g., link bandwidth) after logical link capacities are determined, based on those capacities. Pet. 36–38 (citing Ex. 1007, 2:26–32, 3:15–17, 5:63–6:2, 6:10–13, 9:4–7, 9:22–25, Fig. 4; Ex. 1021 ¶¶ 126–129).

According to Petitioner, a person of ordinary skill in the art would have had reason to combine Baker's system with the teachings of Holender '699 because Holender '699 "pertain[s[to the same field of endeavor of partitioning physical resources of an underlying physical topology for overlaying logical topologies." Pet. 12 (citing Ex. 1005 ¶¶ 5, 16, 30; Ex. 1007, 1:6–8, 3:54–58; Ex. 1003 ¶ 185; Ex. 1021 ¶ 105). Petitioner argues that a person of ordinary skill in the art would have turned to Holender '699 for "a well-known alternative for overlaying different logical network types, such as Baker's, onto a physical network," which "would have been nothing more than applying Baker's multiple overlaying logical networks onto a physical network at the same time and in parallel." Pet. 12–13 (citing Ex. 1005 ¶¶ 30, 64, 66; Ex. 1007, 1:12–27, 3:63–67, 4:22–30, Fig. 1; Ex. 1003 ¶¶ 187, 195; Ex. 1021 ¶¶ 106–107).

Petitioner also argues that a person of ordinary skill would have "[r]ecogniz[ed] the drawbacks of supporting different services with very different demands (e.g., bandwidth, grade of service, etc., and difficulty of network management) on the same logical network," and would have turned to Holender '699 to offer separate logical networks for different services, grouped based on similarity of the demands, with "the benefit of simplified network management at a higher level." Pet. 13 (citing Ex. 1007, 3:60–4:14, 4:66–5:1; Ex. 1003 ¶ 188); Pet. 15 (citing Ex. 1003 ¶ 193–194).

According to Petitioner, this combination would have been with the skillset of a person of ordinary skill in the art, and they would have had a reasonable expectation of success, as Baker, Wright, and Holender '699 all apply similar concepts in compatible ways. Pet. 13–15 (citing Ex. 1005 ¶¶ 12, 30, 37–38, 80; Ex. 1006 ¶¶ 5–7; Ex. 1007, 3:60–4:8, 4:22–26, 4:66–5:37, 6:14–22, Figs. 1, 3; Ex. 1003 ¶¶ 189–194; Ex. 1021 ¶¶ 107–112).

In response, Patent Owner first argues that Wright's "restricted topology is not a 'mapping' of a logical topology to a physical topology," but is merely the logical topology *itself*. *See* PO Resp. 27–28 (citing Ex. 1006 ¶ 17; Ex. 1003 ¶ 119; Ex. 1021 ¶¶ 81, 97; Ex. 2009, 42; Ex. 2008 ¶¶ 67–68). Patent Owner argues that steps 502–508 of Wright's Figure 5—the steps leading up to "reserve bandwidth" step 510—do not establish a mapping as recited in claim 1, and it is only at step 512 that a "mapping" occurs. *Id.* at 28–30 & n.9 (citing Ex. 1003, 54; Ex. 2009, 47, 52–56, 58; Ex. 2008 ¶¶ 70–75). But according to Patent Owner, "Wright's mapping in step 512 . . . is performed *after* determining and reserving bandwidth," so the mapping could not be "in response to" the bandwidth allocation. *Id.* at 30 (citing Ex. 1006, Fig. 5; Ex. 2008 ¶ 76).

Patent Owner also argues that Petitioner has not sufficiently explained why a person of ordinary skill in the art would have modified Baker based on Wright's disclosures. PO Resp. 31 (citing Ex. 2008 ¶ 77). According to Patent Owner, Petitioner's argument that Wright provides more detail than Baker is "based on impermissible hindsight and fail[s] to connect Wright's allocating process with Baker's alleged mapping." *Id.* (citing Pet. 8–9; Ex. 2009, 47; Ex. 2008 ¶¶ 76, 78).

Patent Owner also contends that Petitioner has failed to explain how an ordinarily skilled artisan would have applied Wright's bandwidth allocation process to Baker's system (including how Baker's head node N0 would have been modified) to arrive at limitation 1.5. PO Resp. 31–32 (citing Ex. 1006 ¶ 17; Ex. 2008 ¶¶ 79–87).

In reply, Petitioner argues that it relies not just on the Baker–Wright combination, but also on Baker alone for teaching "allocating a bandwidth," and that this teaching is uncontested. Pet. Reply 20–21 (citing Ex. 1005 ¶¶ 16, 51–56).

Petitioner also argues that "Wright teaches reserving the required bandwidth on each physical link after determining the bandwidth requirements," and 'a [person of ordinary skill in the art] would have expected the bandwidth requirement determination to occur after mapping between the logical and physical topologies." Pet. Reply 21 (citing Ex. 1006 ¶ 24; Ex. 1003 ¶ 93; Ex. 1036 ¶¶ 46–48). According to Petitioner, this is because Wright's bandwidth allocations are designed to reserve only bandwidth that is "actually required" on Wright's physical links. *Id.* at 22 (quoting Ex. 1007 ¶ 17) (citing Ex. 1006 ¶¶ 14–17, 24; Ex. 1003 ¶¶ 94–96). Yet "the corresponding physical links are only known once the logical

connections are mapped to the physical topology." *Id.* (citing Ex. 1003 ¶ 93). Thus, Petitioner argues a person of ordinary skill in the art "would have found it obvious for allocations to be based on the bandwidth requirements (to know how much to allocate) and the mapping (to know where in the network to allocate the bandwidth)." *Id.* at 23 (citing Ex. 1036 ¶¶ 49–51).

Petitioner also contests Patent Owner's argument that in Wright's Figure 5, a mapping does not occur until step 512, which is after the bandwidth allocation. Pet. Reply 25–26. According to Petitioner, this is irrelevant because the Petition does not rely on Wright for teaching a mapping. *Id.* at 25. Moreover, Petitioner argues that the argument is nonsensical because "[i]f '*mapping*' occurred at step 512, the reserve [bandwidth] step 510 would not have the necessary information to reserve 'only the bandwidth actually required'—specifically, it would not have information about *where* to reserve bandwidth." *Id.* (citing Ex. 1006 ¶ 17; Ex. 1036 ¶ 45). Petitioner contends that Dr. Hernandez-Mondragon's testimony, supporting Patent Owner's interpretation of Wright, should be entitled to little weight because he has not explained "how Wright could allocate 'only the bandwidth actually required' without first determining what the bandwidth requirements are and—crucially—*where* that bandwidth is required. *Id.* at 25–26.

Finally, Petitioner argues that Patent Owner's argument that Wright allegedly fails to disclose a mapping "improperly attacks Wright in isolation, though Petitioners demonstrated obviousness based on a Baker–Wright combination." Pet. Reply 23. Petitioner contends that it relies on Baker for the mapping step, and relies on Wright for teaching that "bandwidth is allocated to the physical links after defining the logical network in relation

to the physical links." *Id.* at 24 (quoting Ex. 1003 ¶ 96) (citing Ex. 1006, Fig. 5; Ex. 1003 ¶ 97).

In its Sur-reply, Patent Owner argues that it is undisputed that Baker does not disclose allocating a bandwidth "*in response to* anything," so Baker alone does not disclose the entirety of limitation 1.5. PO Sur-reply 21–22. And Patent Owner argues that "none of the references, including Wright, disclose allocating a bandwidth on each link of the physical topology in response to the mapping." *Id.* at 24. According to Patent Owner, "if neither Baker nor Wright disclose [limitation 1.5], then a [person of ordinary skill in the art] would not combine Baker and Wright to arrive at this limitation." *Id.*

Patent Owner also argues that Petitioner's arguments based on Wright's restricted topology only establish "that Wright would use information from the logical connections because the restricted topology, as admitted by Petitioners, is not a mapping." PO Sur-reply 25. Patent Owner contends that "Wright's reserved bandwidth is calculated based on logical connectivity and, unlike the '431 Patent, does not use information from the mapping, like mapping results." *Id.* at 26 (citing Ex. 1001, 9:51–61, Fig. 3; Ex. 1006 ¶ 17; Ex. 1002, 28).

Finally, Patent Owner argues that even if Wright "performs mapping before its bandwidth calculation and reservation steps, . . . just because Wright [allegedly] performs mapping does not mean its bandwidth calculation is based on or uses mapping," and "[a]ny interpretation of Baker or Wright that arrives at [limitation 1.5] is thus based on impermissible hindsight." PO Sur-reply 26–27 (citing Ex. 1006 ¶ 17).

We find Petitioner's arguments persuasive that Baker teaches allocating bandwidth as part of its resources and that, in light of Wright and

Holender '699, a person of ordinary skill in the art would have had reason to make this allocation for each of the links in of the physical topology (*see* Ex. 1006 ¶ 18 ("bandwidth allocation at each link")) using information from both (1) the bandwidth requirements of Baker's logical connections and (2) the mapping between Baker's logical and physical topologies. As Petitioner persuasively argues, we find that Wright's teaching of further details on ensuring the availability of bandwidth, in a similar context, would have been sufficient motivation for a person of ordinary skill in the art to incorporate Wright's teachings into Baker's method. Holender '669 provides further supporting disclosure.

We also determine that whether Wright, itself, teaches a mapping step is not the determining factor because Petitioner relies on Baker, not Wright, for teaching mapping limitation 1.4. Nevertheless, Wright does teach allocating bandwidth using the same information that would be available as a result of Baker's mapping, including the logical ("restricted") topology and the physical links associated with that topology. In particular, we agree with Petitioner that a person of ordinary skill in the art would have understood that allocating bandwidth to the physical links (step 510 of Figure 5) requires knowing which physical links correspond to Wright's restricted topology. *See* Pet. 33; Pet. Reply 22–23; Ex. 1007 ¶ 17; Ex. 1003 ¶¶ 94–96; Ex. 1036 ¶¶ 49–51.

We also disagree with Patent Owner that Petitioner has failed to adequately explain how a person of ordinary skill in the art would have modified Baker's method to apply Wright's teachings on bandwidth allocation, such as how Baker's head node N0 would have been modified. *See* PO Resp. 31–32. Based on the level of ordinary skill and the level of

detail in Baker, Wright, and the '431 patent, and crediting Dr. Houh's testimony, we find Petitioner's argument persuasive that such modification would have been within the capability of someone of ordinary skill in the art. *See* Pet. 9–12 (citing Ex. 1003 ¶¶ 42–46, 48; Ex. 1021 ¶¶ 100–101). And we agree with Petitioner that modifying Baker with Wright's teachings would have been "nothing more than the combination of known elements . . . according to known methods . . . to yield predictable results." Pet. 11–12 (citing Ex. 1003 ¶ 47; Ex. 1021 ¶¶ 102–104).

Thus, for the reasons above and the reasons provided by Petitioner, we determine that Petitioner has shown that Baker teaches limitation 1.5 in light of the teachings of Wright and Holender '699.

(e) Conclusion as to Claim 1

For all the above reasons, we find Petitioner's arguments persuasive that the combination of Baker, Wright, and Holender '699 teach all the limitations of claim 1 and that a person of ordinary skill in the art would have had reason to combine the references as Petitioner proposes, with a reasonable expectation of success. Thus, by a preponderance of the evidence, we determine that claim 1 is unpatentable under § 103(a) as obvious over the combination of Baker and Wright.

5. Claim 2–5 and 8–10

Claim 2 depends from claim 1 and further recites "wherein the network comprises a ring network, and wherein the physical topology comprises a ring topology." Ex. 1001, 13:53–55.

Claim 3 depends from claim 1 and further recites "wherein the connection topology is chosen from one of a hub-and-spoke topology and a full mesh topology." Ex. 1001, 13:56–58.

Claim 4 depends from claim 1 and further recites "wherein the data transmission service comprises a guaranteed bandwidth service." Ex. 1001, 13:59–61.

Claim 5 depends from claim 1 and further recites "wherein the data transmission service comprises a class of service defined by a protocol under which the network operates." Ex. 1001, 13:62–64.

Claim 8 depends from claim 1 and further recites "wherein parameters of the service comprise respective node-bandwidths required by each of the nodes to provide the service." Ex. 1001, 14:4–6.

Claim 9 depends from claim 1 and further recites "and comprising monitoring traffic generated in the network by the data transmission service, and adjusting the bandwidth in response to the traffic." Ex. 1001, 14:7–10.

Claim 10 depends from claim 1 and further recites "wherein the data transmission service comprises a plurality of subclasses of traffic, and wherein allocating the bandwidth comprises allocating a reserved bandwidth to one of the subclasses." Ex. 1001, 14:11–14.

Patent Owner makes no particular arguments for claims 2–5 or 8–10. *See* PO Resp. For the reasons articulated in the Petition, Petitioner has shown by a preponderance of the evidence that claims 2–5 and 8–10 are unpatentable as obvious over Baker in view of Wright and Holender '699.

6. Claim 7

Claim 7 depends from claim 1 and further recites "wherein mapping the connection topology to the physical topology comprises generating a bandwidth requirement for each of the links." Ex. 1001, 14:1–3.

Petitioner relies on its arguments for claim 1 and further argues that "Wright explains that the bandwidth requirement for a link may be calculated as a sum of virtual path bandwidths on a physical link or as the maximum of the virtual path bandwidths on the physical link," and performing calculations in this way would have resulted in Baker's head node N0 generating a bandwidth requirement for each of the links as part of the mapping step. Pet. 44–46 (citing Ex. 1006 ¶¶ 15–17, 24, Figs. 1, 2; Ex. 1003 ¶¶ 116–124).

In response, Patent Owner reiterates previous general arguments discussed above, and in particular contends that Petitioner has "failed to explain how the head node and/or Baker's overlay instructions include generating a bandwidth requirement." PO Resp. 36 (citing Ex. 2008 ¶ 102). According to Patent Owner, Baker's "nodes simply forward *any* traffic that is labeled with a logical path that does not terminate at that node." *Id.* (citing Ex. 1005 ¶ 87; Ex. 2008 ¶ 102).

Petitioner replies that Patent Owner's argument "relates to how Baker's nodes operate *after* Baker's overlay procedure has concluded" during regular traffic flow, and thus don't apply to the combination as proposed and discussed. Pet. Reply 38–39 (citing Ex. 1005 ¶¶ 51–52, 76; Ex. 1006 ¶¶ 17, 24; Ex. 1036 ¶¶ 32–34; Ex. 1003 ¶¶ 122–123).

As we discuss above, we find Petitioner's arguments persuasive that Baker's mapping step occurs prior to regular traffic flow and includes

generating bandwidth requirements for each link. *See supra* Section III.C.4(d). For the reasons given above for claim 1 and the additional reasons articulated in the Petition for claim 7, Petitioner has shown by a preponderance of the evidence that claim 7 is unpatentable as obvious over Baker in view of Wright.

7. Claim 11

Claim 11 depends from claim 1 and further recites "wherein allocating the bandwidth comprises comparing a mapping bandwidth determined in response to the bandwidth requirements of the logical connections and to the mapping with a full bandwidth determined by assuming all possible logical connections in the network are provided for." Ex. 1001, 14:15–20.

Petitioner relies on its arguments for claim 1 and further identifies the recited "mapping bandwidth" with the bandwidth that Wright determines for the service, which is calculated by summing the bandwidths of the virtual paths sharing a link. Pet. 53 (citing Ex. 1001, 7:42–44, 8:67–9:2; Ex. 1003 ¶¶ 145–47); *see also supra* Section III.C.4(d).

Petitioner also identifies the recited "comparing" step in claim 11 with an alleged comparison Wright makes between the "full logical mesh" depicted in Figure 1 with the "logical connectivity mesh" depicted in Figure 2. Pet. 53–54 (citing Ex. 1006 ¶¶ 14, 16, 24, Fig. 5; Ex. 1003 ¶¶ 148–150); *see also* Pet. Reply 39. *See supra*, Section III.C.2.

Patent Owner responds that Wright's alleged comparison between a "full logical mesh" and a "logical connectivity mesh" is "in the context of explaining logical connectivity to the reader, and is not an actual step that Wright teaches should be performed as part of determining mapping

bandwidths. PO Resp. 36–38 (citing Ex. 1006 ¶¶ 16–17; Ex. 1001, 14:15–20, 15:31–43; Ex. 2008 ¶¶ 104–113); *see also* PO Sur-reply 32–35.

Petitioner replies that in claim 11, the "comparing" step is part of allocating the bandwidth, not part of mapping limitation 1.4. Pet. Reply 39.

We agree with Patent Owner that Wright's comparison between a "full logical mesh" and a "logical connectivity mesh" is explanatory for the reader. We do not find in Wright any teaching or suggestion that one should actually perform such a comparison as a step in the claimed method for assigning bandwidth, let alone during the bandwidth-allocation step of limitation 1.5.

Thus, we determine that Petitioner has not shown, based on the evidence and arguments of record in this proceeding, that the combination of Baker and Wright teaches all the limitations of claim 11, or that claim 11 is unpatentable as obvious over Baker in view of Wright and Holender '699.

8. Claims 25 and 26

Independent claim 25 is as follows:

[25.0] 25. Apparatus for assigning bandwidth in a network including nodes coupled by links arranged in a physical topology, the apparatus comprising:

[25.1] a controller which is adapted to:

[25.2] receive a definition of logical connections between the nodes, the logical connections being associated with a data transmission service to be provided over the network,

[25.3] the logical connections having a connection topology different from the physical topology,

[25.4] determine respective bandwidth requirements for the logical connections based on parameters of the service,

[25.5] map the connection topology to the physical topology, so that each of the logical connections is associated with one or more links of the physical topology, and

[25.6] allocate a bandwidth for the service on each of the links in response to the bandwidth requirements of the logical connections and to the mapping.

Ex. 1001, 16:15–31 (Petitioner's reference numbers added).

Claim 26 depends from claim 25 and further recites "wherein the controller is comprised in one of the nodes." Ex. 1001, 16:32–33.

Petitioner relies on its arguments for claim 1 and further argues that Baker discloses an apparatus to accomplish the method of claim 1 in which head node N0 (comprising the recited "controller" of limitation 25.1 and claim 26) is responsible for executing the Administer Ring routine. Pet. 54–55 (citing Ex. 1005 ¶¶ 44, 46–47, 51–52; Ex. 1006 ¶ 6; Ex. 1003 ¶¶ 151–158); *see also* Pet. 58 (citing Ex. 1005 ¶¶ 44, 49, 51, Fig. 2; Ex. 1003 ¶¶ 177–181) (making the same argument for claim 26).

Petitioner argues that the Baker–Wright combination meets limitation 25.2 because the controller in Baker's node N0 performs a star overlay procedure and thus must have received information about the virtual paths to be established, and likewise in Wright's Figure 5, step 504 of "receive logical connectivity requirements" includes the virtual information. Pet. 56–57 (citing Ex. 1005 ¶¶ 47, 51; Ex. 1006 ¶ 24, Fig. 5; Ex. 1010, 3:63–67; Ex. 1003 ¶¶ 159–166).

For limitations 25.3–25.6, Petitioner relies on the same arguments it made for limitations 1.2–1.5, in which the recited functions take place in the node N0 controller. Pet. 57 (citing Ex. 1005 ¶ 46; Ex. 1003 ¶¶ 167–176).

Apart from its general arguments which we discuss above in the context of claim 1, Patent Owner makes no particular arguments for claims

25 or 26, except that Patent Owner argued in its Sur-reply that "Petitioners have failed to show that Baker discloses or suggests 'a controller which is adapted to . . . map the connection topology to the physical topology' recited in Independent Claim 25." PO Sur-reply 19. Patent Owner provides no citations for this, and we disagree because Petitioner persuasively shows that Baker discloses a controller in head node N0 that maps the connection topology to the physical topology. For the reasons given above for claim 1 and the additional reasons articulated in the Petition for claims 25 and 26, Petitioner has shown by a preponderance of the evidence that claims 25 and 26 are unpatentable as obvious over Baker in view of Wright.

D. GROUND BASED ON BAKER AND WRIGHT, AND HOLENDER '699 (CLAIMS 12–16, 18–24, AND 27–30)

Petitioner's second ground challenges claims 12–16, 18–24, and 27–30 as obvious over Baker, Wright, Holender '699, and Holender '894. Pet. 4.

1. Overview of Holender '894

Holender '894 shares the same inventors as Holender '699 and includes much of the same subject matter. *Compare* Ex. 1007, *with* Ex. 1020; *see* Ex. 1021 ¶ 90.

2. Claim 12

Independent claim 12 is as follows:

12.0 12. A method for assigning bandwidth in a network including nodes coupled by links arranged in a physical topology, the method comprising:

12.1 defining between the nodes a first set of logical connections associated with a first data transmission service to be provided over the network, and a second set of logical

connections associated with a second data transmission service to be provided over the network, the first set of logical connections having a first connection topology, the second set of logical connections having a second connection topology,

12.2 the first and second connection topologies being different from the physical topology;

12.3 determining respective first bandwidth requirements for the first set of logical connections based on first parameters of the first data transmission service and respective second bandwidth requirements for the second set of logical connections based on second parameters of the second data transmission service;

12.4 generating a first mapping of the first connection topology to the physical topology, so that each of the first set of logical connections is associated with one or more links of the physical topology;

12.5 allocating a first bandwidth for the first data transmission service on each of the links in response to the first bandwidth requirements of the first set of logical connections and to the first mapping;

12.6 generating a second mapping of the second connection topology to the physical topology, so that each of the second set of logical connections is associated with one or more links of the physical topology;

12.7 allocating a second bandwidth for the second data transmission service on each of the links in response to the second bandwidth requirements of the second set of logical connections and to the second mapping; and

12.8 summing the first and the second bandwidths to determine a total allocation for each of the links.

Ex. 1001, 14:21–57.

In general, Petitioner relies on its arguments for claim 1, with additional arguments incorporating the additional teachings of Holender '894. *See* Pet. 58–66; Ex. 1021 ¶¶ 180–181.

We address each limitation of claim 12 below, although Patent Owner only specifically contests Petitioner's arguments relating to limitations 12.4–8.

(a) Preamble (12.0) and Limitations 12.1–12.3

In particular as to the preamble (12.0) and limitations 12.1–12.3, Petitioner relies on its arguments for the preamble of claim 1 (1.0) and limitations 1.1–1.3, and further argues that both Holender references describe establishing multiple (at least "first" and "second") different logical topologies comprising sets of logical connections. Pet. 58–63 (citing Ex. 1005 ¶¶ 13, 30, 38, 59, 80, Figs. 1, 2; Ex. 1006 ¶¶ 5, 6, 14, 24–25; Ex. 1007, 1:16–27, 2:50–53, 3:60–4:14, 4:23–30, 4:54–65, 5:1–11, Fig. 1; Ex. 1020, 1:13–24, 4:62–65, 5:49–64, 6:11–19, 6:43–54, 6:57–67, Fig. 1; Ex. 1003 ¶¶ 219, 222–235; Ex. 1021 ¶¶ 184–191, 192, 194).

According to Petitioner, Holender '894 also expressly teaches limitation 12.3 by "disclos[ing] optimizing a predefined objective function 'associated with resource partitioning' that involves 'calculating logical link capacities for corresponding logical networks.'" Pet. 62–63 (citing Ex. 1020, 7:37–41, 8:36–44, Fig. 4).

Patent Owner does not specifically contest these arguments. *See* PO Resp. Because Petitioner persuasively shows that Baker discloses a method for assigning bandwidth to resources of a physical ring network, we need not decide whether the preamble is limiting. *See, e.g.*, Ex. 1005 ¶ 62, Fig. 1. For the same reasons as the preamble of claim 1 and limitations 1.1–1.3, and the

additional reasons provided in the petition for claim 12, we determine that Baker, in view of Wright, Holender '699, and Holender '894, teaches the preamble of claim 12 and limitations 12.1–12.3.

(b) Limitations 12.4–12.7

For limitations 12.4–12.7, Petitioner relies on its arguments for limitations 1.4 and 1.5, and also argues as to "mapping" limitations 12.4 and 12.6 that "the Holender references further describe 'how to distribute or partition said physical network resources among the logical networks,'" which constitutes the act of generating (first and second) mappings. Pet. 63–68 (quoting Ex. 1007, 2:59–61; Ex. 1020, 2:26–27) (citing Ex. 1007, 1:53–57, 2:59–67, 4:54–65, 5:38–41; Ex. 1020, 1:51–53, 2:24–29, 4:4–6, 6:43–54; Ex. 1003 ¶¶ 236–246; Ex. 1021 ¶¶ 196–203).

Patent Owner relies on the arguments we address above in the context of claim 1, and also argues that Petitioner has failed to explain how the Holender references "relate to the Baker–Wright combination," and in particular "provide[s] no information on how the Holender references change or apply the teachings of Baker or Wright." PO Resp. 23–24 (citing Ex. 2008 ¶ 55); *see also id.* at 25–36 (discussing its arguments about the "allocating . . . in response to" limitations which include 12.5 and 12.7).

Patent Owner also contends that the language in the Holender references describing "how to distribute or partition said physical network resources among the logical networks" is "introductory language about how generally in network systems it is necessary to decide how to allocate physical resources," and "does not actually describe 'how' to allocate physical resources." *Id.* at 24 (quoting Ex. 1007, 2:59–61) (citing Ex. 1007, 2:59–69, 5:38–41; Ex. 2008 ¶¶ 56–57). Patent Owner also argues that other

cited parts of the Holender references "relate to allocating resources, and not to links or any potential 'mapping,'" and still do not answer the question "how" to combine the references. *Id.* at 24–25 (citing Ex. 1007, 1:53–57; Ex. 2008 ¶¶ 57–59).

In reply, Petitioner argues that Baker alone sufficiently discloses "mapping," but "Holender '699 provides extensive details about how to perform resource allocation," including a detailed mathematical framework for doing so, which is commensurate in scope with the challenged claims. Pet. Reply 18–20 (citing Ex. 1001, 13:46–48, 14:41–43, 14:49–51; Ex. 1007, 1:53–57, 2:59–67, 4:54–58, 5:38–41, 6:49–8:58, 9:1–25; Ex. 1021 ¶¶ 120–123; Ex. 1003 ¶ 238; Ex. 1036 ¶¶ 35–37).

In its Sur-reply, Patent Owner contends that the Petition's citations to the Holender references "do not disclose a specific 'mapping' that is 'generated' or a mapping result such as the one shown in FIG. 3 of the '431 Patent." PO Sur-reply 20 (citing Ex. 2008 ¶ 57). Patent Owner characterizes the Holender references' disclosures as "more similar to defining logical connections and does not disclose the claimed mapping." *Id.* (citing Ex. 1003 ¶ 87).

Patent Owner also disputes that Holender '699 "allocate[s] a bandwidth on links of the physical topology using information from a mapping" because according to Patent Owner, Holender '699 optimizes logical link capacities based only on the capacities of the physical links and not the mapping of those links to logical connection topologies. PO Sur-reply 27–28 (citing Ex. 1007, 6:9–13, 6:50–7:3; Ex. 1020, 8:63–64, 8:45–9:08, 10:20–27; 12:54–67, 13:9–14).

We find Petitioner's arguments persuasive that Baker, in view of Wright, teaches mapping and allocating steps 12.4–12.7 for at least one mapping between a connection topology and a physical topology, for reasons we discuss above in the context of limitations 1.4 and 1.5. *See supra* Section III.C.4(c)–(d). We also agree with Petitioner, for the reasons presented in the Petition, that the Holender references teaches that there may be two or more logical topologies mapped to the same physical topology, and a person of ordinary skill in the art would have had reason to perform distinct mapping and allocating steps for each such logical topology.

We disagree with Patent Owner that the Holender references must teach precisely how to map topologies or allocate bandwidth, because Petitioner relies sufficiently on Baker and Wright for those teachings. We also disagree with Patent Owner that the Holender systems, themselves, necessarily needs to determine bandwidth in response to the mappings, as Petitioner relies on the Baker–Wright combination for this. Nevertheless, we disagree with Patent Owner that Holender '699's bandwidth allocations do not use any mapping information. Holender '699 teaches that "the physical transmission resources" such as physical links bandwidth "are allocated among the logical links of the logical networks according to the determined logical link capacities," and this requires knowledge, obtained in the mapping steps, of which logical links correspond to which physical links. Ex. 1007, 3:15–17; accord *id.* at 6:10–13, 9:22–25; *see also id.* at 6:50–7:3 (describing a matrix expressing "[t]he incidence of physical links and logical links").

For the above reasons, and the reasons discussed above in the context of claim 1, Petitioner has persuasively shown that the combination of Baker, Wright, Holender '699, and Holender '894 teaches limitations 12.4–12.7.

(c) Limitation 12.8

Petitioner argues that for "summing" limitation 12.8, "[t]he Holender references explain that the 'sum of logical link capacities on the same physical link cannot exceed the capacity of the physical link,'" the "logical link capacities" being the "'number of logically separate logical networks' established on top of the physical network." Pet. 65 (first quoting Ex. 1007, 6:64–65; and then quoting *id.* at 6:50–52) (citing Ex. 1007, 6:60–65; Ex. 1020, 8:45–47, 8:57–59). According to Petitioner, "It would have been obvious to sum allocated bandwidths for the first and second data transmission services to ensure that they do not exceed the available physical link capacity." *Id.* (citing Ex. 1005 ¶ 9; Ex. 1006 ¶¶ 4, 16; Ex. 1003 ¶¶ 247–250; Ex. 1021 ¶ 205).

As further support, Petitioner points to Wright's teaching that when two paths within a single logical topology share the same physical link, one way to calculate the required reserved bandwidth is to add the bandwidth for each of the two logical paths. Pet. 65–66 (citing Ex. 1006 ¶ 17). Petitioner argues that "[i]t would have been obvious to repeat Wright's summing for each logical topology, as demonstrated by the Holender references." *Id.* (citing Ex. 1003 ¶¶ 251–252; Ex. 1021 ¶ 206).

Patent Owner replies that Holender '699 "does not actually disclose summing capacities but is rather in the context of explaining a physical constraint." PO Resp. 34 (citing Ex. 1007, 6:60–67; Ex. 2008 ¶¶ 95–96). But to the extent that Holender '699 does disclose summing, Patent Owner

argues that this is "summing of logical link capacities on the same physical link" rather than "summing a first bandwidth allocated in response to the first mapping and a second bandwidth allocated in response to the second mapping" as recited in limitation 12.8. *Id.* at 34–35 (citing Ex. 2008 ¶ 97).

Likewise, Patent Owner argues that Wright's teaching of adding capacities "refers to logical link capacities on a same physical link," and "does not disclose summing a first bandwidth allocated in response to the first mapping and a second bandwidth allocated in response to the second mapping," which could only be arrived at through improper hindsight. PO Resp. 35 (citing Ex. 1006 ¶ 17; Ex. 2008 ¶¶ 98–99)

Petitioner acknowledges that "Wright teaches summing logical link bandwidth requirements x, y over the same physical link to determine how much bandwidth to actually allocate," but disagrees that this distinguishes Wright's teachings from the recited "summing" limitation 12.8. Pet. Reply 30–31 (citing Ex. 1006 ¶¶ 17, 24, Fig. 3; Ex. 1003 ¶ 251; Ex. 1036 ¶¶ 62–63). Petitioner argues that it relies, independently of Wright, on Holender '699's teaching that "the sum of logical link capacities on the same physical link cannot exceed the capacity of the physical link," where the logical link capacities are derived from separate logical networks overlayed over the same physical links. *Id.* at 32 (quoting Ex. 1007, 6:63–65) (citing Ex. 1007, 6:50–52, 6:60–65, Fig. 1). Petitioner contends that, in combination with Baker–Wright, it would have been obvious in view of Holender '699 to sum the allocated bandwidths from each logical network "to ensure the sum does not exceed available physical link capacity." *Id.* at 32–33 (citing Ex. 1003 ¶ 250).

Petitioner disagrees with Patent Owner that Holender '699's sum merely describes a physical constraint. Pet. Reply 33 (citing Ex. 1003 ¶¶ 249–250). Petitioner points to Equation 8 in Holender '699 for calculating the normalized capacities $\hat{C}_{ki}$ for logical links $i = 1, \ldots, n$ of the various overlapping logical networks associated with physical link k, each physical link with capacity C_k^{phys}:

$$\hat{C}_{ki} = \frac{C_{ki}}{\sum_{l=1}^{n} C_{kl}} C_k^{phys}, i = 1, \ldots, n$$

Id. (citing Ex. 1007, 8:38–50; Ex. 1036 ¶¶ 59–61).

In its Sur-reply, Patent Owner argues that, "[t]o the extent Holender '699 . . . discloses summing, it discloses summing *logical link capacities*—not bandwidths determined in the "allocating" steps 12.5 and 12.7. PO Sur-reply 31–32 (citing Ex. 1007, 6:60–67).

For reasons explained in the Petition and Petitioner's Reply, we agree with Petitioner that the Baker–Wright–Holender '699 combination teaches summing the two bandwidths determined in "allocating" steps 12.5 and 12.7 to determine a total allocation for each of the physical links—motivated by the known need to ensure that bandwidths do not exceed the available physical link capacity.

We disagree with Patent Owner that Holender '699's discussion of summing is merely describing a physical constraint. Holender '699 teaches normalizing the logical link capacities, which requires summing the logical link capacities. *See* Ex. 1007, 8:38–51. We credit Dr. Houh's testimony that this "confirms that [Holender '699's] teachings about summing are not simply 'explaining a physical constraint,' but actually performed." Ex. 1036 ¶ 61. Holender '699 refers to capacities C_j as "logical link capacities for each

logical link j over all logical networks. Ex. 1007, 6:52–55. But when mapped to physical links, Holender '699 denotes capacities C_{kl} as "capacities of the logical links [l] that need capacity on the k:th physical link." Ex. 1007, 8:38–43. In other words, they are the capacities, or bandwidths, allocated to each physical link k for implementing associated logical link l. *See also id.* at 6:60–67 (describing a matrix designed to indicate "if logical link j needs capacity on the k:th physical link.").

Thus, for the reasons above and the reasons provided by Petitioner, we determine that Petitioner has shown that the Baker–Wright–Holender '699–Holender '894 combination teaches limitation 12.8.

(d) Conclusion as to Claim 12

For all the above reasons, we find Petitioner's arguments persuasive that the combination of Baker, Wright, Holender '699, and Holender ''894 teach all the limitations of claim 12 and that a person of ordinary skill in the art would have had reason to combine the references as Petitioner proposes, with a reasonable expectation of success. Thus, by a preponderance of the evidence, we determine that claim 12 is unpatentable under § 103(a) as obvious over the combination of Baker, Wright, Holender '699, and Holender '894.

3. Claims 13–16

Claim 13 depends from claim 12 and further recites "wherein the network comprises a ring network, and wherein the physical topology comprises a ring topology." Ex. 1001, 14:58–60.

Claim 14 depends from claim 12 and further recites "wherein the first connection topology comprises a hub-and-spoke topology and the second connection topology comprises a full mesh topology." Ex. 1001, 14:61–64.

Claim 15 depends from claim 12 and further recites "wherein at least one of the first and second data transmission services comprises a guaranteed bandwidth service." Ex. 1001, 14:65–67.

Claim 16 depends from claim 12 and, similar to claim 5, further recites "wherein at least one of the first and second data transmission services comprises a class of service defined by a protocol under which the network operates." Ex. 1001, 15:1–4.

Patent Owner makes no particular arguments for claims 13–16. *See* PO Resp. For the reasons articulated in the Petition, Petitioner has shown by a preponderance of the evidence that claims 13–16 are unpatentable as obvious over Baker in view of Wright, Holender '699, and Holender '894.

4. Claim 18

Claim 18 depends from claim 12 and further recites "wherein generating the first mapping comprises generating a first bandwidth requirement for each of the links, and wherein generating the second mapping comprises generating a second bandwidth requirement for each of the links." Ex. 1001, 15:8–12.

Petitioner relies on its arguments for claim 12 as well as its arguments for claim 7, which includes a similar limitation although depending from claim 1. Pet. 67 (citing Ex. 1003 ¶¶ 255–257). In addition, Petitioner argues that "[b]ased on the Holender references' multiple logical topologies, it would have been obvious to perform 'generating a . . . bandwidth requirement' for physical links used by each logical topology." *Id.* (citing

Ex. 1007, 4:54–65; Ex. 1020, 6:43–54; Ex. 1003 ¶¶ 268–270; Ex. 1021 ¶ 219).

Patent Owner makes no particular arguments for claim 18. *See* PO Resp. 36. As we discuss above, we do not find persuasive Petitioner's argument for claim 7 based solely on the combination of Baker and Wright. *See supra* Section III.C.8. However, we do find persuasive Petitioner's arguments based on the combination of Baker, Wright, and the Holender references, and we credit the testimony of Dr. Houh that "[i]t would have been obvious to repeat the teachings of Baker and Wright for the generating the bandwidth requirement for each of the links of a mapping for another logical topology based on Holender '699's teachings." Ex. 1003 ¶ 269. This would have simply involved duplication of Baker's mapping step on other logical topologies, without any new or unexpected result. *See In re Harza*, 274 F.2d 669, 774 (CCPA 1960) (mere duplication of known elements "has no patentable significance unless a new and unexpected result is produced"); *cf. KSR*, 550 U.S. 398, 416 ("The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.").

For the reasons given above for claim 12 and the additional reasons articulated in the Petition for claim 18, Petitioner has shown by a preponderance of the evidence that claim 18 is unpatentable as obvious over Baker in view of Wright and Holender '699, and Holender '894.

5. Claims 19–22

Claim 19 depends from claim 12 and further recites "wherein the first parameters of the first service comprise respective first node-bandwidths required by each of the nodes to provide the first service, and wherein the

second parameters of the second service comprise respective second node-bandwidths required by each of the nodes to provide the second service." Ex. 1001, 15:13–18.

Claim 20 depends from claim 12 and further recites "and comprising monitoring traffic generated in the network by the first and second data transmission services, and adjusting the total allocation in response to the traffic." Ex. 1001, 15:19–22.

Claim 21 depends from claim 12 and, similar to claim 10, further recites "wherein the first data transmission service comprises a plurality of subclasses of traffic, and wherein allocating the first bandwidth comprises allocating a reserved bandwidth to one of the subclasses." Ex. 1001, 15:23–27.

Claim 22 depends from claim 12 and further recites "wherein the first connection topology is different from the second connection topology." Ex. 1001, 15:28–30.

Patent Owner makes no particular arguments for claims 19–22. For the reasons articulated in the Petition, Petitioner has shown by a preponderance of the evidence that claims 19–22 are unpatentable as obvious over Baker in view of Wright, Holender '699, and Holender '894.

6. Claim 23

Claim 23 depends from claim 12 and further recites the following:

23.0 wherein summing the first and the second bandwidths to determine a total allocation for each of the links comprises:

23.1 determining a first mapping bandwidth in response to the first bandwidth requirements of the first set of logical connections and to the first mapping;

> 23.2 determining a second mapping bandwidth in response to the second bandwidth requirements of the second set of logical connections and to the second mapping; and
>
> 23.3 comparing the first mapping bandwidth and the second mapping bandwidth with a full bandwidth determined by assuming all possible logical connections in the network are provided for.

Ex. 1001, 15:31–43.

Petitioner relies on its arguments for claim 12 as well as its arguments for claim 11, which includes a limitation similar to 23.3 although claim 11 depends from claim 1. Pet. 69–71. In particular, for limitations 23.1 and 23.2, Petitioner identifies the recited first and second "mapping bandwidths" with bandwidths that Wright determines for the service, which is calculated by summing the bandwidths of the virtual paths sharing a link. Pet. 69 (citing Ex. 1003 ¶¶ 284–289). Petitioner contends that, "[b]ased on the Holender references' multiple logical topologies providing multiple services, it would have been obvious to '*determin[e] a second mapping bandwidth*' for a '*second set of logical connections*.'" Pet. 70 (alteration in original) (citing Ex. 1007, 4:54–65; Ex. 1020, 6:43–54; Ex. 1003 ¶¶ 290–294; Ex. 1021 ¶ 236).

For limitation 23.3, Petitioner relies on its arguments for claim 11, and further that, "[b]ased on the Holender references' multiple logical topologies providing multiple services, it would have been obvious to '*compar[e]*' each '*mapping bandwidth*' with a '*full bandwidth*.'" Pet. 71 (alteration in original) (citing Ex. 1007, 4:54–65; Ex. 1020, 6:43–54; Ex. 1003 ¶¶ 295–297).

Alternatively, Petitioner argues that "it would have been obvious to 'compare'" the first and second "mapping bandwidths" with a "full bandwidth" because "Wright and the Holender references each teach

summing bandwidth requirements of all logical connections over the same physical link, to avoid using more bandwidth than is available for that link." Pet. 70–71 (citing Ex. 1006 ¶¶ 16–17; Ex. 1007, 6:63–65; Ex. 1008, 5:16–25; Ex. 1020, 8:57–59; Ex. 1003 ¶¶ 297–99; Ex. 1021 ¶¶ 238–239).

Patent Owner responds that Holender '699's disclosure of multiple logical topologies and summing does not disclose the recited "full bandwidth." PO Resp. 38 (citing Ex. 2008 ¶¶ 114–115); *see also* PO Sur-reply 32–35.

In reply, Petitioner argues that "Holender '699 demonstrates the well-known concept of repeating the mapping bandwidth determinations for multiple logical topologies, and the obviousness of considering all logical networks on a given physical link when comparing." Pet. Reply 39–40.

In its Sur-reply, Patent Owner argues that, as illustrated in the '431 patent, the recited "full bandwidth determined by assuming all possible logical connections in the network are provided for" does not necessarily simply mirror the physical network. PO Sur-reply 33–34 (citing Ex. 1001, 11:46–50).

For the reasons we discuss above in the context of claim 11, we do not find Petitioner's arguments based on Wright persuasive. *See supra* Section III.C.11.

We likewise do not find persuasive Petitioner's reliance on the Holender references for claim 23. The Holender references describe a set of calculations enacting the constraint that "the sum of logical link capacities on the same physical link cannot exceed the capacity of the physical link," which the Holender references express as $SC \leq C_{phys}$, where SC is a vector containing, for each physical link, the sums of associated logical link

capacities for every logical network, and C_{phys} is a vector containing the physical capacities of each link. Ex. 1007, 6:60–7:3, 8:38–40; Ex. 1020, 8:54–65, 10:20–23. However, Petitioner has not shown that the Holender references teach making this comparison directly. Rather, Holender '699, for example, ensures that this constraint is satisfied by normalizing the logical link capacities according to Equation 8. *See* Ex. 1007, 8:38–58, 9:19–21 ("Th[e] first set of logical link capacities is normalized (expression (8)) such that the physical capacity constraints are satisfied."). In other words, although Holender '699 expresses a constraint, which can be understood in terms of a comparison, Petitioner has not shown that either Holender reference teaches actually making that comparison as part of summing first and second bandwidths (e.g., by calculating the sum in Holender '699's Equation 8).

Even if the Holender references taught a person of ordinary skill in the art to actually perform the $SC \leq C_{phys}$ comparison as part of the summing step, Petitioner has not shown that this comparison, or any other comparison in Holender '699 or Holender '894, involves a "full bandwidth determined by assuming all possible logical connections in the network are provided for." The comparison $SC \leq C_{phys}$ involves the logical link capacities for every overlapping logical network, but Petitioner has not shown that the overlapping logical networks necessarily include "all *possible* logical connections in the network"—just the ones of interest for the Holender references' service classes.

Thus, we determine that Petitioner has not shown, based on the evidence and arguments of record in this proceeding, that the combination of Baker, Wright, Holender '699, and Holender '894 teaches all the limitations

of claim 23, or that claim 23 is unpatentable as obvious over Baker in view of Wright, Holender '699, and Holender '894.

7. Claim 24

Independent claim 24 is as follows:

24.0 24. A method for assigning bandwidth in a ring network including nodes coupled by links, the method comprising:

24.1 defining between the nodes a first set of logical connections associated with a first data transmission service to be provided over the network, and a second set of logical connections associated with a second data transmission service to be provided over the network,

24.2 the first set of logical connections having a hub-and-spokes connection topology, the second set of logical connections having a full mesh connection topology;

24.3 determining respective first bandwidth requirements for the first set of logical connections based on first parameters of the first data transmission service and respective second bandwidth requirements for the second set of logical connections based on second parameters of the second data transmission service;

24.4 generating a first mapping of the first connection topology to the ring network, so that each of the first set of logical connections is associated with one or more links of the ring network;

24.5 determining a first bandwidth for the first data transmission service on each of the links in response to the first bandwidth requirements of the first set of logical connections and to the first mapping;

24.6 generating a second mapping of the second connection topology to the ring topology, so that each of the second set of logical connections is associated with one or more links of the ring network;

> 24.7 determining a second bandwidth for the second data transmission service on each of the links in response to the second bandwidth requirements of the second set of logical connections and to the second mapping;
>
> 24.8 summing the first and the second bandwidths to determine a total bandwidth for each of the links; and
>
> 24.9 allocating one of the first bandwidth, the second bandwidth, and the total bandwidth to each of the links in response to respectively providing the first service, the second service, and both services, over the network.

Ex. 1001, 15:44–16:14.

Petitioner relies on its arguments for claims 1, 2, and 12, as well as "mapping" limitations 23.1 and 23.2 of claim 23. Pet. 71–72 (citing Ex. 1003 ¶¶ 300–311). In addition, for limitation 24.9, Petitioner argues that Wright and the Holender references teach that "the allocated bandwidth should not exceed the available link capacity," so "it would have been obvious to provide less than all services (the first service or second service) when the link capacity would not be sufficient to provide both services." Pet. 72 (citing Ex. 1006 ¶ 25; Ex. 1007, 6:60–65; Ex. 1020, 8:57–59; Ex. 1003 ¶¶ 311–315; Ex. 1021 ¶¶ 250–251).

Apart from its general arguments which we discuss above in the context of claims 1 and 12, Patent Owner makes no particular arguments for claim 24. *See* PO Resp. For the reasons given above, Petitioner has shown by a preponderance of the evidence that claim 24 is unpatentable as obvious over Baker in view of Wright, Holender '699, and Holender '894.

8. Claim 27

Claim 27 depends from claim 25 and further recites "wherein the controller is external to the network." Ex. 1001, 16:34–35.

Petitioner relies on its arguments for claim 25, and further argues that Holender '699 describes an operation and support system ("OSS") with a controller responsible for mapping logical networks to the physical network, and the OSS is external to the physical network. Pet. 72–74 (citing Ex. 1007, 4:31–32, 4:48–65, Fig. 1; Ex. 1020, 6:20–25, 6:37–54; Ex. 1003 ¶¶ 316–319). Petitioner argues that "the location of various processors and functions is largely a design choice," and it would have been such a simple design choice to centralize the function of Baker's head node N0 external to the network, "because there were a limited number of predictable solutions as demonstrated by both Baker (internal to the network) and the Holender references (partially or completely external to the network)." Pet. 74 (citing Ex. 1007, 4:32–53; Ex. 1020, 6:20–42; Ex. 1003 ¶¶ 320–322; Ex. 1021 ¶¶ 255–256).

Patent Owner makes no particular arguments for claim 27. *See* PO Resp. For the reasons given above, Petitioner has shown by a preponderance of the evidence that claim 25 is unpatentable as obvious over Baker in view of Wright, Holender '699, and Holender '894.

9. Claim 28

Independent claim 28 is as follows:

28.0 28. Apparatus for assigning bandwidth in a network including nodes coupled by links arranged in a physical topology, the apparatus comprising:

28.1 a controller which is adapted to:

28.2 receive a definition of a first set of logical connections, between the nodes, associated with a first data transmission service to be provided over the network, and a second set of logical connections, between the nodes, associated with a second data transmission service to be

provided over the network, the first set of logical connections having a first connection topology, the second set of logical connections having a second connection topology,

28.3 the first and second connection topologies being different from the physical topology,

28.4 determine respective first bandwidth requirements for the first set of logical connections based on first parameters of the first data transmission service and respective second bandwidth requirements for the second set of logical connections based on second parameters of the second data transmission service,

28.5 generate a first mapping of the first connection topology to the physical topology, so that each of the first set of logical connections is associated with one or more links of the physical topology,

28.6 allocate a first bandwidth for the first data transmission service on each of the links in response to the first bandwidth requirements of the first set of logical connections and to the first mapping,

28.7 generate a second mapping of the second connection topology to the physical topology, so that each of the second set of logical connections is associated with one or more links of the physical topology,

28.8 allocate a second bandwidth for the second data transmission service on each of the links in response to the second bandwidth requirements of the second set of logical connections and to the second mapping, and

28.9 sum the first and the second bandwidths to determine a total allocation for each of the links.

Ex. 1001, 16:36–17:6.

Petitioner relies on its arguments for claims 1, 12, and 25. Pet. 74–77 (citing Ex. 1003 ¶¶ 323–324, 329–331, 334–337). In particular, Petitioner contends that it would have been obvious, "[b]ased on the Holender

references' multiple logical topologies providing multiple services," to "receive" sets of logical connections (limitation 28.2), to "determine" multiple bandwidth requirements (limitation 28.4), to "generate a mapping" for each connection topology to the physical topology (limitation 28.7), and to "allocate a bandwidth" (limitations 28.6 and 28.8) for each data transmission service. *Id.* (citing Ex. 1007, 4:54–65; Ex. 1003 ¶¶ 325–328, 332–333, 338–345; Ex. 1020, 6:43–54; Ex. 1021 ¶¶ 259–260, 263, 267). For limitation 28.9, Petitioner also argues that it would have been obvious for Baker's node N0 controller to perform the summing function as part of its duty to perform topology and routing control, and to ensure that physical link capacities are not exceeded. Pet. 77 (citing Ex. 1005 ¶ 46; Ex. 1006 ¶ 17; Ex. 1003 ¶¶ 346–350).

Apart from its general arguments which we discuss above in the context of claims 1 and 12, Patent Owner makes no particular arguments for claim 28 in its Response. *See* PO Resp. In its Sur-reply, Patent Owner argues that, if we interpret either Holender reference to disclose mapping, it does not disclose that a "controller" performs the mapping as claim 28 requires. PO Sur-reply 20 (citing Ex. 1003 ¶ 87). We disagree with Patent Owner that the Holender references must specifically teach that the mapping steps take place in a controller, because Petitioner relies sufficiently on Baker for that teaching. *See, e.g.*, Ex. 1005 ¶ 51; *see also supra* Sections III.C.4(c)(2), III.C.12.

For the reasons given above, Petitioner has shown by a preponderance of the evidence that claim 28 is unpatentable as obvious over Baker in view of Wright, Holender '699, and Holender '894.

10. Claims 29 and 30

Claim 29 depends from claim 28 and further recites "wherein the controller is comprised in one of the nodes." Ex. 1001, 18:1–2.

Claim 30 depends from claim 28 and further recites "wherein the controller is external to the network." Ex. 1001, 18:3–4.

Patent Owner makes no particular arguments for claims 30 or 31. For the reasons articulated in the Petition, Petitioner has shown by a preponderance of the evidence that claims 30 and 31 are unpatentable as obvious over Baker in view of Wright, Holender '699, and Holender '894.

E. GROUND BASED ON BAKER, WRIGHT, HOLENDER '699, AND ZHENG (CLAIM 6)

Petitioner challenges claim 6 as obvious over Baker, Wright, and Zheng. Pet. 4.

1. Overview of Zheng

Zheng describes "[a] method for controlling virtual connections between endpoints over a unidirectional ring network." Ex. 1008, code (57). "The method identifies the segments of the ring network that would be affected by the addition of [a new] connection between [two] endpoints," and determines whether adding the requested connection "would exceed the capacity for the segment." *Id.*

In one embodiment, the system "considers 'over-allocated' bandwidth in assessing whether to allow a connection to be established," which is "bandwidth that is allocated to a virtual connection that exceeds the required or subscribed bandwidth for a service on the virtual connection." Ex. 1008, 5:29–34.

2. Claim 6

Claim 6 depends from claim 1 and further recites "and comprising multiplying the bandwidth by a correction factor to determine an actual bandwidth." Ex. 1001, 13:65–67.

Petitioner relies on its arguments for claim 1 and further argues that Zheng teaches dividing a sum of bandwidth requirements B_j by a factor G, and then multiplying the ceiling value of this product by G, according to the following Equation 3:

$$DB = \left\lceil \frac{\sum_j B_j}{G} \right\rceil \times G$$

Pet. 81 (citing Ex. 1008, 5:36–37, 6:1–18, 6:47–7:7; Ex. 1003 ¶¶ 364–368; Ex. 1021 ¶ 288). Petitioner contends that a person of ordinary skill in the art would have looked to Zheng because it contains more details than Baker on how to manage physical resources like bandwidth, and Zheng provides ways to best manage highly variable traffic flows, including traffic from sources that may briefly exceed their peak rate. Pet. 78–80 (citing Ex. 1005 ¶¶ 16, 30, 37, 47; Ex. 1006 ¶¶ 5, 15, 62; Ex. 1007, 1:8–10, 4:56–5:14; Ex. 1008, 1:36–40, 1:52–54, 5:16–46, 6:21–23, 5:29–35, 6:30–34; Ex. 1003 ¶¶ 358–363).

According to Petitioner, a person of ordinary skill in the art "would have known that dividing by G is mathematically equivalent to multiplying by $\frac{1}{G}$, either of which is a '*correction factor*.'" Pet. 81 (citing Ex. 1003 ¶¶ 369–370; Ex. 1021 ¶¶ 289–290). Thus, Petitioner argues that it would have been obvious for Baker's controller to multiply the bandwidth requirements of the Baker–Wright combination by a granularity value to

determine an over-allocated bandwidth, "to provide extra bandwidth should a traffic source exceed an allowed peak rate." *Id.* (citing Ex. 1003 ¶¶ 371–372; Ex. 1021 ¶ 291).

Patent Owner makes no particular arguments for claim 6. For the reasons given above for claims 1 and the additional reasons presented in the Petition for claim 6, Petitioner has shown by a preponderance of the evidence that claim 6 is unpatentable as obvious over Baker in view of Wright and Zheng.

F. GROUND BASED ON BAKER, WRIGHT, HOLENDER '699, HOLENDER '894, AND ZHENG (CLAIM 17)

1. Claim 17

Claim 17 depends from claim 12 and further recites "and comprising multiplying at least one of the first and second bandwidths by a correction factor to determine a corrected bandwidth." Ex. 1001, 15:5–7.

Petitioner relies on its arguments for claims 6 and 12. Pet. 82 (citing Ex. 1003 ¶¶ 373–376; Ex. 1021 ¶¶ 292–299). In addition, Petitioner argues that "[b]ased on Holender '699 and Holender '894's multiple logical topologies providing multiple services with corresponding bandwidths, it would have been obvious to '*multiply[]*' multiple '*bandwidths*' by a correction factor." Pet. 82–83 (emphasis in original) (citing Ex. 1007, 4:54–65; Ex. 1020, 6:43–54; Ex. 1003 ¶¶ 377–378; Ex. 1021 ¶ 303).

Patent Owner makes no particular arguments for claim 17. For the reasons given above for claims 6, 12, and 17, Petitioner has shown by a preponderance of the evidence that claim 17 is unpatentable as obvious over Baker in view of Wright, Holender '699, Holender '894, and Zheng.

IV. CONCLUSION[12]

For the reasons above, Petitioner has shown by a preponderance of the evidence that claims 1–10, 12–22, and 24–30 of the '431 patent are unpatentable under § 103(a), but has not shown that claims 11 or 23 are unpatentable.

In summary:

Claim(s)	35 U.S.C. §	Reference(s)/ Basis	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
1–5, 7–10, 11, 25, 26	103(a)	Baker, Wright, Holender '699	1–5, 7–10, 25, 26	11
12–16, 18–24, 27–30	103(a)	Baker, Wright, Holender '699, Holender '894	12–16, 18–22, 24, 27–30	23
6	103(a)	Baker, Wright, Holender '699, Zheng	6	
17	103(a)	Baker, Wright, Holender '699, Holender '894, Zheng	17	
Overall Outcome			1–10, 12–22, 24–30	11, 23

[12] Should Patent Owner wish to pursue amendment of claims in a reissue or reexamination proceeding after this decision, we draw 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).

V. ORDER

In consideration of the foregoing, it is

ORDERED that claims 1–10, 12–22, and 24–30 of the '431 patent are unpatentable;

FURTHER ORDERED that claims 11 and 23 are not shown to be unpatentable based on the arguments and evidence presented in this proceeding;

FURTHER ORDERED that 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.

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