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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

UNIFIED PATENTS, LLC,
Petitioner

v.

CORRIGENT CORPORATION,
Patent Owner

IPR2022-01514

**PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT 7,330,431**

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TABLE OF EXHIBITS

EX1001	U.S. Patent 7,330,431
EX1002	File History of U.S. Application 10/933,572
EX1003	Declaration of James T. Geier
EX1004	<i>Curriculum Vitae</i> of James T. Geier
EX1005	Declaration of Kevin Jakel
EX1006	U.S. Patent 6,069,894 to Holender et al. (“Holender”)
EX1007	U.S. Patent 7,292,542 to Wright (“Wright”)
EX1008	U.S. Publication 2004/0095946 to Baker (“Baker”)
EX1009	PCT International Publication WO 02/19616 to Lemieux (“Lemieux”)
EX1010	Complaint, <i>Corrigent Corporation v. Cisco Systems, Inc.</i> , 6:22-cv-00396 (W.D. Tex. 2022)
EX1011	Complaint, <i>Corrigent Corporation v. Dell Technologies Inc. et al</i> , 1:22-cv-00496 (D. Del. 2022)
EX1012	Complaint, <i>Corrigent Corporation v. Arista Networks, Inc.</i> , 1:22-cv-00497 (D. Del. 2022)
EX1013	Gopalan, K., “Efficient network resource allocation with QoS guarantees,” Technical Report TR-133, 2003 (“Gopalan”)

EX1014	PCT International Publication WO 03/85514 to Norrgard et al. (“Norrgard”)
EX1015	U.S. Patent 7,453,824 to Nucci et al. (“Nucci”)
EX1016	European Patent Application EP0635958 to Iwakawa et al. (“Iwakawa”)
EX1017	U.S. Patent 5,815,492 to Berthaud et al. (“Berthaud”)
EX1018	Moh, S. et al., “Mapping Strategies for Switch-Based Cluster Systems of Irregular Topology,” Proceedings, Eighth International Conference on Parallel and Distributed Systems. ICPADS 2001, IEEE, 2001 (“Moh”)
EX1019	U.S Patent 6,331,986 to Mitra et al. (“Mitra”)

I. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8

A. Real Party-in-Interest

Under 37 C.F.R. § 42.8(b)(1), Unified Patents, LLC (“Unified” or “Petitioner”) certifies that Unified is the real party-in-interest and certifies that no other party exercised control or could exercise control over Unified’s participation in this proceeding, filing this Petition, or conduct in any ensuing trial. In view of *Worlds Inc. v. Bungie, Inc.*, 903 F.3d 1237, 1242-44 (Fed. Cir. 2018), Unified has submitted voluntary discovery to support its certification. *See* EX1005 (Declaration of Kevin Jakel).

B. Related Matters

According to assignment records, U.S. Patent 7,330,431 (“the ’431 patent,” EX1001) is assigned to Corrigent Corporation (“Patent Owner”).

As of the filing date of this Petition, and to the best knowledge of the Petitioner, the ’431 patent is at issue in:

- *Corrigent Corporation v. Cisco Systems, Inc.*, 6:22-cv-00396 (W.D. Tex. 2022) (EX1010);
- *Corrigent Corporation v. Dell Technologies Inc. et al*, 1:22-cv-00496 (D. Del. 2022) (EX1011); and
- *Corrigent Corporation v. Arista Networks, Inc.*, 1:22-cv-00497 (D. Del. 2022) (EX1012).

As of the filing date of this Petition, and to the best knowledge of the Petitioner, the '431 patent has not been challenged in any AIA review proceeding or reexamination, and Petitioner is unaware of any other challenges involving the grounds and evidence discussed herein.

C. Lead and Back-up Counsel and Service Information

Lead Counsel	Backup Counsel
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Please address all correspondence to lead and back-up counsel. Petitioner consents to electronic service and asks Patent Owner to do the same.

II. OVERVIEW OF CHALLENGE

A. Challenged Claims

Petitioner respectfully requests review of claims 25-27 of the '431 patent and cancellation of these claims as unpatentable.¹

B. Statutory Ground of Challenge²

This Petition, supported by the declaration of Mr. James T. Geier (“Geier,” EX1003), requests cancellation of the challenged claims on the following grounds:

Ground 1: Claims 25 and 27 are unpatentable under 35 U.S.C. § 103 because they are rendered obvious by U.S. Patent 6,069,894 to Holender et al. (“Holender,” EX1006) in view of U.S. Patent 7,292,542 to Wright (“Wright,” EX1007) and the general knowledge of a person of ordinary skill in the art (“POSITA”).

Ground 2: Claims 25 and 26 are unpatentable under 35 U.S.C. § 103 because they are rendered obvious by U.S. Patent Publication 2004/0095946 to Baker (“Baker,” EX1008) in view of Wright, PCT International Publication WO 02/19616 to Lemieux (“Lemieux,” EX1009), and the general knowledge of a POSITA.

¹ An element-by-element claim listing is included in the Appendix to this Petition.

² Pre-America Invents Act (“pre-AIA”) provisions apply to this proceeding.

The earliest claimed priority date for the '431 patent is September 3, 2004, which corresponds to the filing date of application 10/933,572. *See* EX1001, 1.

Holender has a PCT filing date of June 12, 1995, a § 102(e) date of April 21, 1997, and issued as a patent on May 30, 2000; Lemieux claims priority to U.S. application 09/651,822 on August 30, 2000 and published as a PCT application on March 7, 2002; both are prior art under at least 35 U.S.C. §§ 102(b) and (e). Wright was filed on March 5, 2003 and issued on November 6, 2007; Baker was filed on November 18, 2002 and issued on May 20, 2004; both are prior art under at least 35 U.S.C. § 102(e).

This Petition, supported by Mr. James T. Geier's declaration (EX1003), demonstrates a reasonable likelihood Petitioner will prevail with respect to cancellation of at least one challenged claim. 35 U.S.C. § 314(a). Petitioner respectfully requests institution on all the challenged grounds. *SAS Institute Inc. v. Iancu*, 138 S. Ct. 1348 (2018).

III. LEVEL OF ORDINARY SKILL IN THE ART

A POSITA as of the earliest claimed priority date for the '431 patent (i.e., September 3, 2004) would have had at least a bachelor's degree in optical, electrical, computer, and/or network engineering (or an equivalent field) and at least two years

of relevant industry experience, or the equivalent thereof. More education can supplement practical experience and vice versa. Geier, ¶¶32-34.³

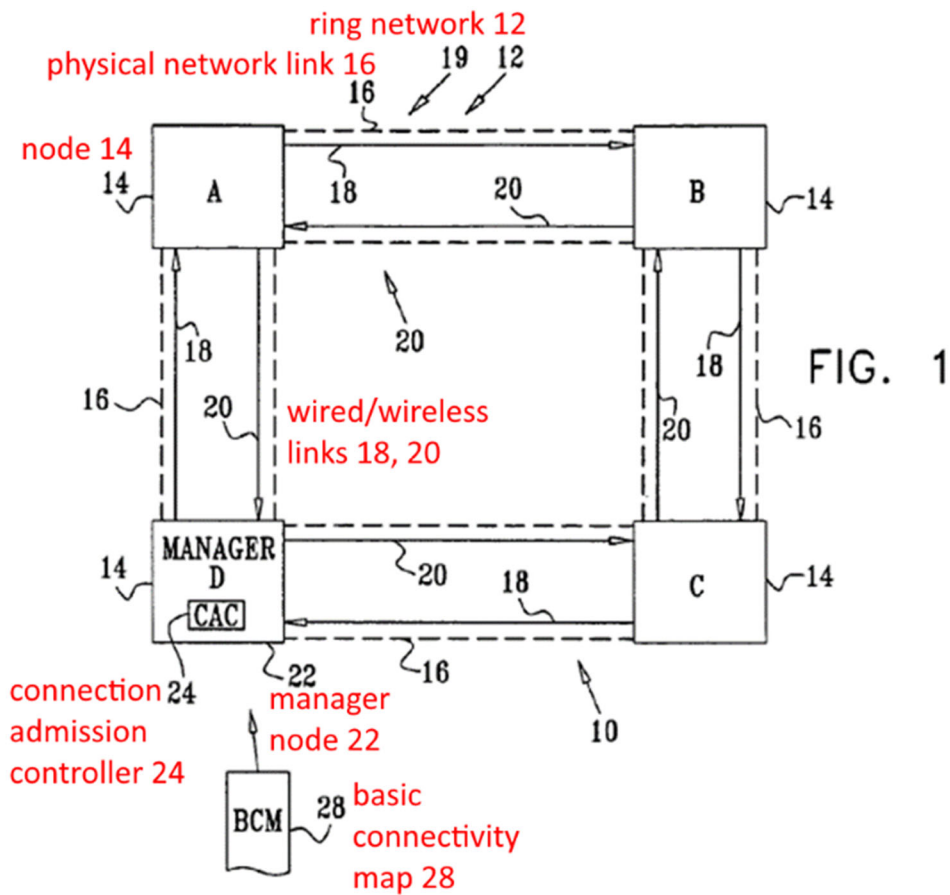
IV. U.S. PATENT 7,330,431

A. Summary

The '431 patent is directed to a “method for assigning bandwidth in a network including nodes coupled by links arranged in a physical topology.” EX1001, Abstract. The physical topology relates to the real-world arrangement of nodes (e.g., switches, routers, computers, etc.) of a networked system. Examples of network topology arrangements include ring, hub and spoke (or star), and full mesh topologies. The '431 patent further relates to “data communications within a network, and specifically to optimizing bandwidth allocation for the data in the network.” *Id.*, 1:7-9. Figure 1 below shows an example of a physical network in the '431 patent.⁴

³ Petitioner submits the declaration of Mr. James T. Geier (EX1003), an expert in the field of the '431 patent. Geier, ¶¶5-12; EX1004. Mr. Geier was a POSITA of the '431 patent as of its earliest claimed priority date. Geier, ¶¶18, 34.

⁴ Unless otherwise specified, all **bold** and *italics* emphases and color annotations below have been added. Text in *italics* is used to signify claim language and/or add emphasis.



EX1001, Fig. 1 (annotated)

Id., Fig. 1. Figure 1 includes a “high-speed ring network 12” containing nodes 14 (A, B, C, and D) that are connected over wired, fiberoptic, and/or wireless links 18 and 20 that are configured to carry data traffic in a clockwise and a counterclockwise network as part of the ring. *Id.*, 6:38-53. The example system also includes a connection admission controller (CAC) 24 as part of a manager node 22. *Id.*

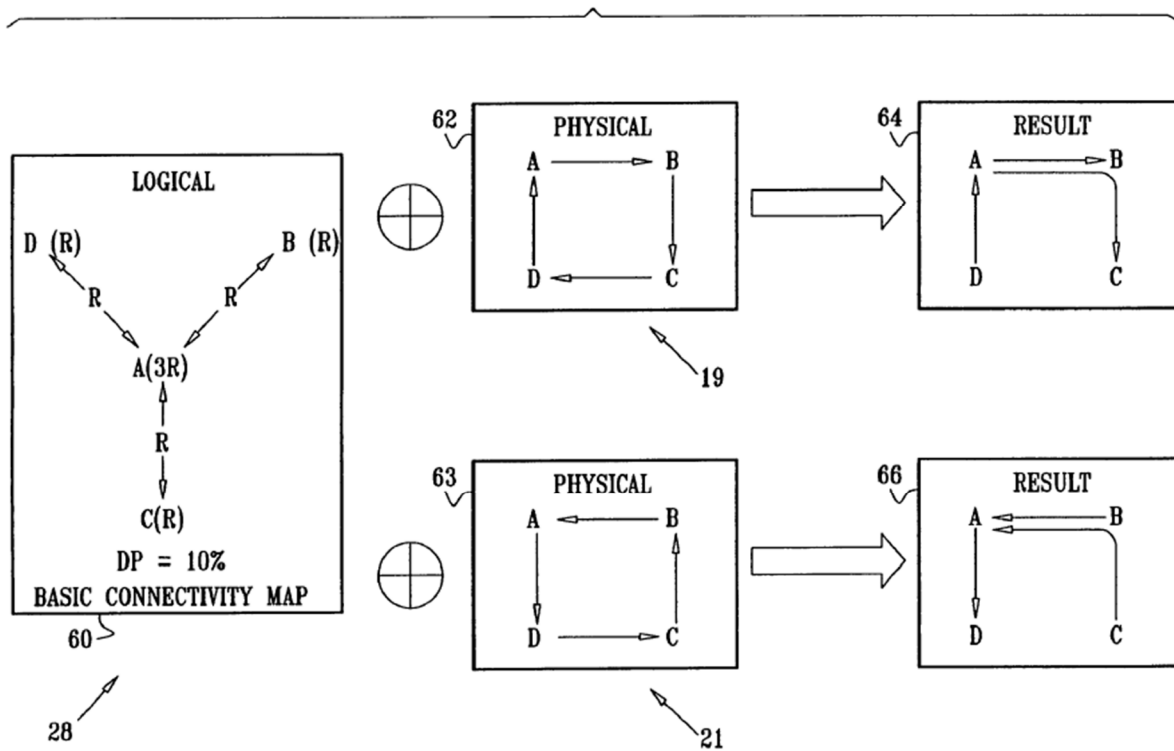
To achieve the bandwidth assignment described in the apparatus of claim 25, a controller performs four steps, each of which is discussed in turn below.

First, the controller *receives a definition of logical connections between the nodes*, where (a) the *logical connections* are associated with a data transmission service and (b) the *connection* (i.e., logical) *topology* is *different from the physical topology*. *Id.*, claim 25. Although the '431 patent never clearly defines what it means to *receive a definition of logical connections*, the context of the claim language and the specification suggests that the controller receives information (e.g., a “basic connectivity map”) from a source (e.g., input by an operator, or stored in memory) about the logical connections (e.g., the relationship and arrangement of nodes in the logical network topology) to be implemented on top of the physical network topology. *Id.*, 7:12-41. Regarding the portion of the claim that states the *logical connections* are associated with a data transmission service, the '431 patent explains that estimation of bandwidth allocation needs may be difficult to perform for different services; e.g., point-to-multipoint traffic (video on demand services) or multipoint-to-multipoint traffic (virtual private LAN services). *Id.*, 1:60-2:2. The patent notes that “the logical topology for each service is chosen from a number of different logical connection topologies . . . **depending on the nature of the service.**” *Id.*, 2:27-31. Accordingly, different arrangements of logical network connections may be better suited for different service applications.

Second, the controller *determines respective bandwidth requirements for the logical connections based on parameters of the service*. The *parameters* (i.e., the

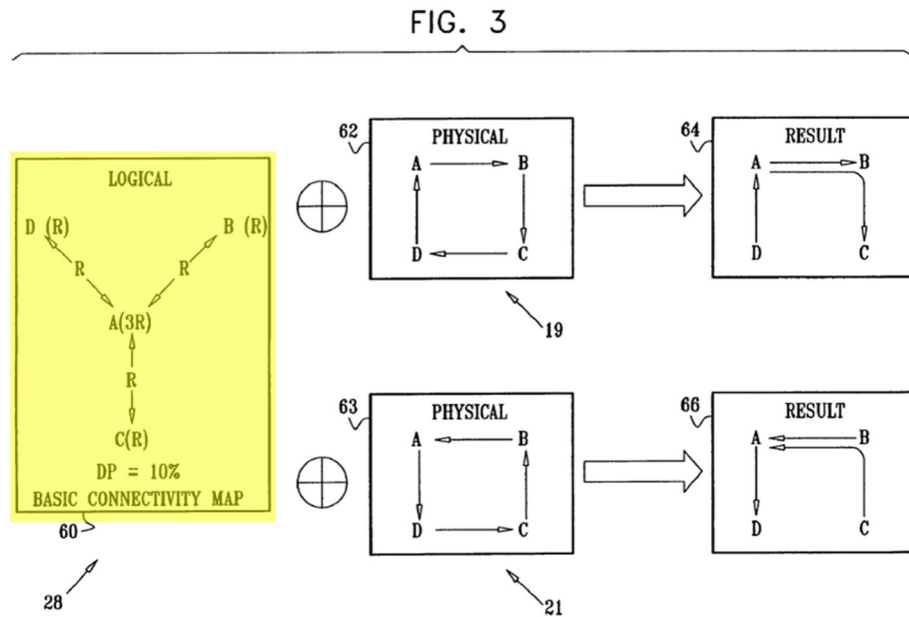
bandwidth requirement) *for a given service* (e.g., video on demand, voice/video conferencing, virtual private LAN, etc.) govern which logical topology is most suitable to be applied (i.e., mapped) to the physical network. *Id.*, 2:10-47. The '431 patent provides Figure 3 as one “example of process 50 for determining the actual bandwidth of each link.” *Id.*, 7:63-65. The patent explains that “for each of the links the bandwidth requirements are summed to **determine a mapping bandwidth.**” *Id.*, 7:42-44. This determination uses the logical connections to determine the amount of bandwidth that should be reserved. *Id.*, 8:21-34. The challenged claims do not recite any additional details as to how this determination is completed nor is it limited to any specific algorithm or determination procedure, although generalized examples are provided in the specification. *See id.*, claims 25-27, 7:63-12:44.

FIG. 3

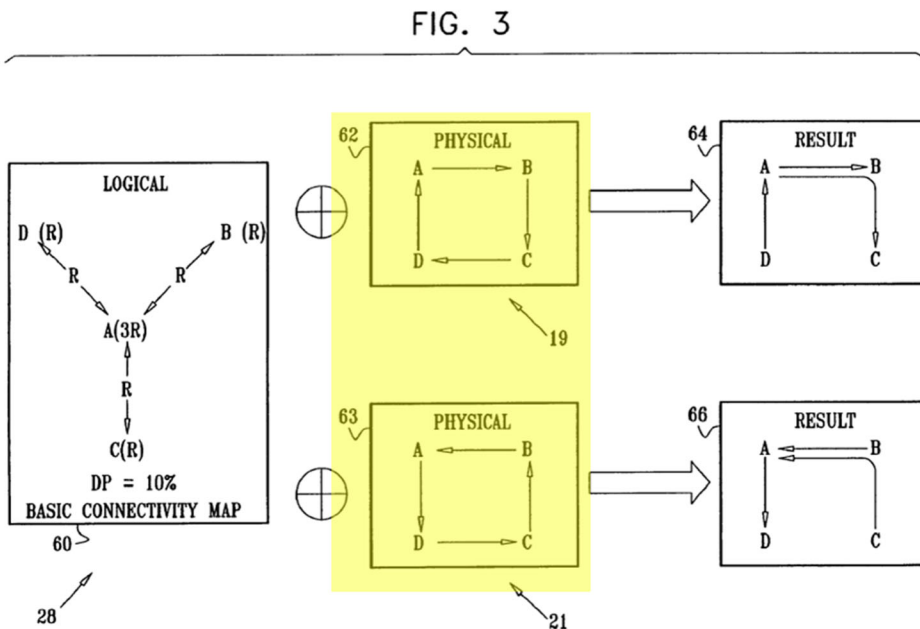


EX1001, Fig. 3

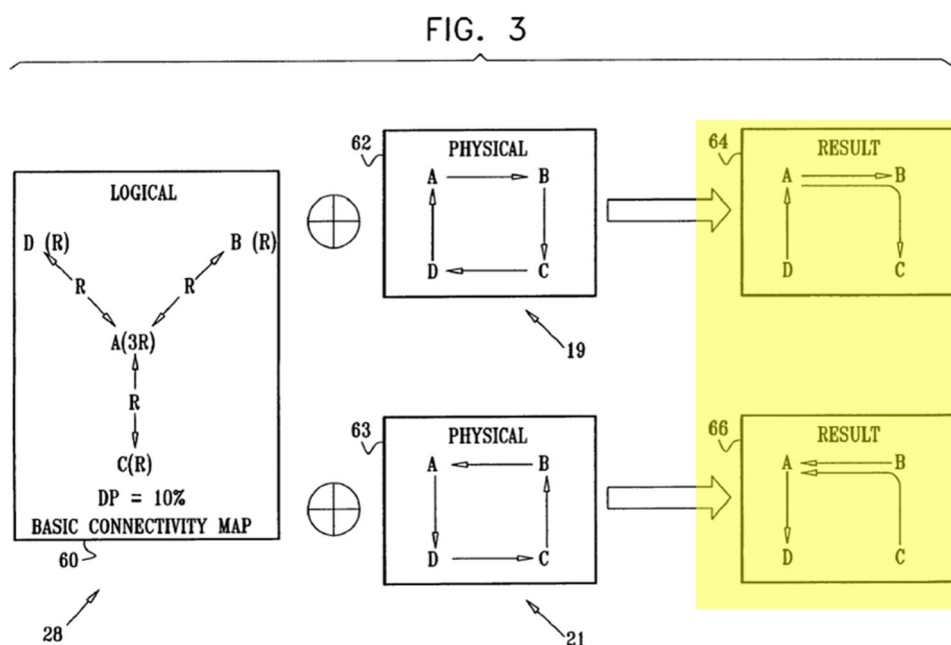
Third, the controller *maps the connection topology to the physical topology*, where the *logical connections* are associated with one or more links of the physical topology. This is illustrated in Figure 3. As shown in Figure 3, the logical topology desired in this example is a hub and spoke (or star) topology, where node A sits in the middle of nodes B, C, and D:



Next, diagrams 62 and 63 represent the physical links of the underlying ring network available to support the logical network:



Finally, based on the relationship between connections of the logical topology, diagrams 64 and 66 represent the physical links that are actually used to support the logical network:



Notably, here, neither physical link between nodes C and D is used, and accordingly, no bandwidth needs to be allocated on that physical link to support the logical network of Figure 3. *See id.*, 7:63-10:7.

Fourth, the controller *allocates bandwidth for the service on each of the links in response to the bandwidth requirements of the logical connections and to the mapping*. The patent notes that one method of allocating bandwidth would be to “allocate the full bandwidth required for all possible paths that packets may travel,” but that this comes “at the expense of large guaranteed bandwidth wastage.” *Id.*, 2:3-

10. Accordingly, the patent sought to provide “systems for bandwidth allocation that make more efficient use of the guaranteed bandwidth available.” *Id.* The patent explains that “[a]ssigning the actual bandwidths of the links in a physical network according to the logical connectivity of nodes in services carried by the network is a simple and effective way to allocate bandwidth correctly and efficiently, particularly guaranteed bandwidth.” *Id.*, 2:27-35.

Claim 25 is exemplary of the description above:

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

a controller which is adapted to:

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

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

[3] **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

[4] **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.

Id., claim 25 (bracketed numbers added).

B. Prosecution History

The '431 patent issued from U.S. Patent Application 10/933,572 (“the '572 application”), filed on September 3, 2004. EX1001, 1. The '572 application did not receive any rejections. *See* EX1002. A Notice of Allowance issued on October 4, 2007. *Id.*, 92-99. The allowance referred to U.S. Patent 5,854,903 to Morrison as disclosing certain elements of claim 25 but identified the final two limitations ([3] “map the connection . . .” and [4] “allocate a bandwidth . . .”) as not being sufficiently taught or suggested. *Id.*, 96. The Examiner identified two other references in the notice (U.S. Patent Publication 2002/0133756 to Jain, and U.S. Patent 6,580,693 to Chernyak et al.) and considered them pertinent to the applicant’s disclosure. *Id.*, 98-99.

None of the references used in the grounds of this Petition were cited in any IDS or otherwise used at all during prosecution. *See* EX1002. The combinations of references cited in this Petition disclose the exact limitations the Examiner identified as allowable subject matter. *See* §§ VI.A-B, *infra*.

V. CLAIM CONSTRUCTION

No terms of the '431 patent warrant construction beyond their ordinary and customary meaning, or alternatively, only require construction to the extent necessary to determine whether the prior art teaches the claims. *Geier*, ¶¶35-37; *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017). At least because a POSITA would have understood the claims to encompass the prior art, express constructions are not necessary. *Geier*, ¶36.

VI. THE CHALLENGED CLAIMS ARE UNPATENTABLE⁵

A. Ground 1 – Claims 25 and 27 are unpatentable by Holender in view of Wright and the general knowledge of a POSITA

1. Overview of Holender

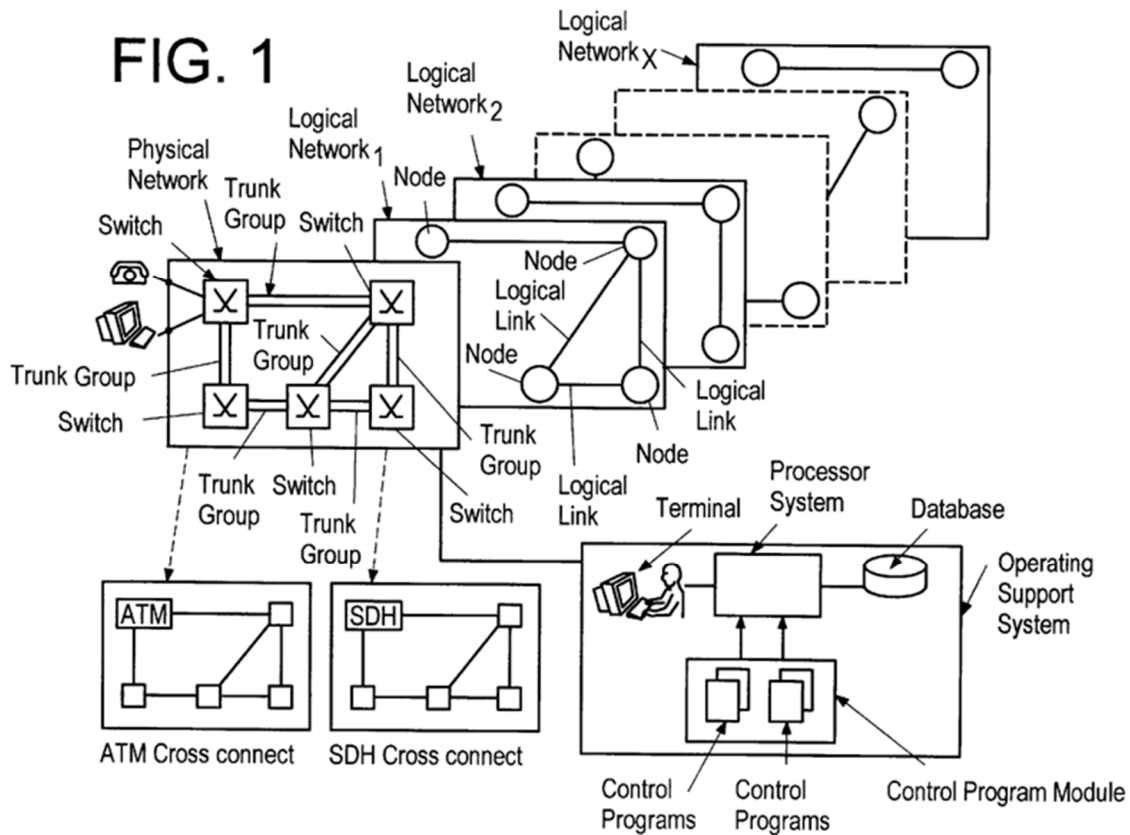
Holender discloses that a system where “[a] set of logical networks is established on top of a physical network.” EX1006, Abstract. Holender describes optimizing the operation of the network based on a set of decision variables, and that

⁵ All analysis in the Petition, unless otherwise stated, is made from the position of a POSITA as of the priority date of the '431 patent.

“[p]hysical transmission resources are partitioned among logical networks.” *Id.*

Like the controller in the '431 patent, Holender's system discloses an “operation and support system” (“OSS”) that comprises a “processor system PS, terminals T, and a control program module CPM with a number of control programs CP along with other auxiliary devices.” *Id.*, 6:20-63. Holender's OSS “contains e.g. functions for monitoring and controlling the physical network and the traffic.” *Id.*

Holender recognized that a “main characteristic of a modern telecommunication network is its ability to **provide different services,**” and “[o]ne **efficient way of providing said services is to logically separate the resources of a physical network,**” shown in Figure 1. *Id.*, 1:9-24.



EX1006, Fig. 1

First, like the '431 patent's receiving a definition of logical connections associated with a service, Holender discloses it was known that **“logical networks can be established by a network manager, a network operator or other organization.”** *Id.*, 1:36-44; *see also* Fig. 1 (depicting a network operator using a terminal). Holender notes “[t]he process of establishing logical networks means that the **topology of each one of the logical networks is defined,**” and, “[i]n other words, the **structure of the nodes and logical links in each logical network is determined.**” *Id.*, 6:43-54.

Second, like the '431 patent's determining bandwidth for the logical connections, Holender taught to “**calculate . . . the logical link capacities** for the corresponding logical networks so as to maximize the total carried traffic.” *Id.*, 8:36-43; *see also id.*, 2:24-29.

Third, like the '431 patent's mapping the connection topology to the physical topology, Holender discloses “[o]n top of a physical network PN there is established a number of logical networks LN, also referred to as logical or virtual subnetworks, each of which comprises nodes N and logical links LL interconnecting the nodes.” *Id.*, 1:9-24. As shown in Figure 1, “a first logical network LN1 comprises one view of parts of the physical network,” and the “logical links of the various logical networks share the capacities of physical links present in said physical network.” *Id.* Holender recognized the “topology of these logical or virtual networks **will in general differ** from the topology of the underlying physical network.” *Id.*, 6:17-19; *see also id.*, Fig. 2.

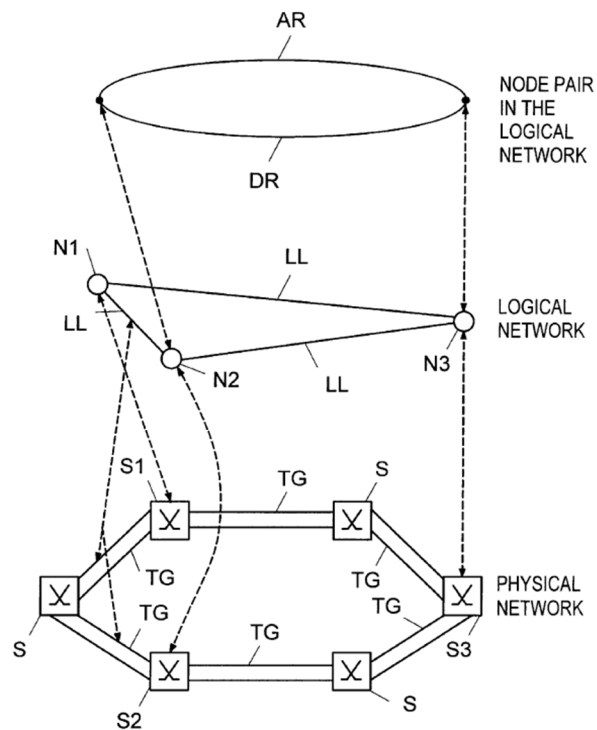


FIG. 2
PRIOR ART

EX1006, Fig. 2

Fourth, like the '431 patent's allocating bandwidth for the logical connections on the physical links of the physical network, Holender teaches the “**physical transmission resources, i.e. the transmission capacities of the physical links, have to be partitioned or distributed among the logical links** of said logical networks” *Id.*, 7:44-51. Holender further discloses the “**physical link capacities are then allocated among the logical links** of the various logical networks **in accordance with the finally calculated logical link capacities.**” *Id.*

Holender is analogous art to the '431 patent; it is from the same field of endeavor (e.g., data communications in a network utilizing a logical topology mapped on top of a physical topology) and is reasonably pertinent to the particular problem the '431 patent was trying to solve (e.g., how to optimize bandwidth allocations across the physical links in the network based on the service provided and the logical network). Geier, ¶¶41-42.

2. Overview of Wright

Wright discloses a “method for traffic engineering of connectionless virtual private network (VPN) services.” EX1007, Abstract. The method comprises “receiving **physical connectivity data** for a connectionless VPN including service nodes and links between the service nodes.” *Id.*

First, like the '431 patent's receiving a definition of logical connections associated with a service, Wright describes that “[l]**ogical connectivity data** for the edge nodes **is received.**” *Id.*, Abstract. Wright further discloses the use of a “**quality of service (QoS) metric, or guarantee**” for characterizing network services. *Id.*, 1:30-33. Wright also describes its bandwidth allocation is service specific for each restricted (i.e., logical) topology: “The **bandwidth guarantees of the restricted topology** may be designed to **ensure adequate bandwidth for the service.**” *Id.*, 3:44-46; *see also id.*, 5:4-9 (“The mechanism for providing bandwidth . . . **is**

implementation specific.”). Figure 5 of Wright further illustrates “a flow diagram of an exemplary process for performing traffic engineering.” *Id.*, 6:65-7:17.

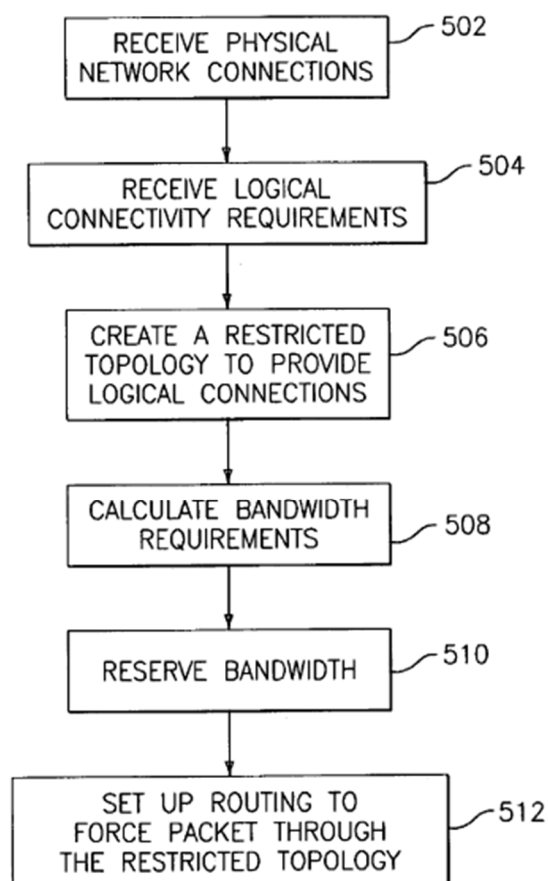


FIG. 5

EX1007, Fig. 5

At steps 502 and 504, Wright discloses receiving physical network connections and logical connectivity requirements. *Id.*, 6:65-7:17.

Second, like the '431 patent's determining bandwidth for the logical connections, in Wright, a “**bandwidth requirement** for each link in the restricted

topology **is calculated.**” *Id.*, Abstract, 6:65-7:17, 4:20-5:22, Fig. 5 (“calculate bandwidth requirements”).

Third, like the ’431 patent’s mapping the logical topology to the physical topology, Wright describes a “**restricted topology is created** in response to the physical connectivity data and to the **logical connectivity data.**” *Id.*, Abstract. For example, Figure 1 of Wright depicts a physical network, including “edge nodes 102, service nodes 104, a VPN 106 and internal transport links 108.” *Id.*, 3:54-4:19. As shown, “the physical links 108 in the VPN 106” represent “all the possibly physical routes for sending packets through the VPN 106.” *Id.*

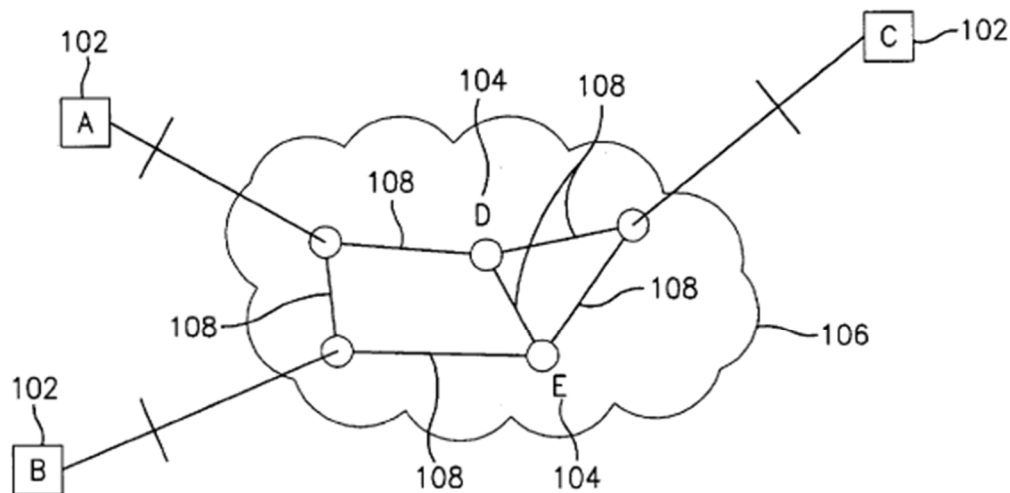


FIG. 1

EX1007, Fig. 1

Next, Figure 3 is “a block diagram of an alternative exemplary **logical connectivity mesh** that is constrained to a specific restricted topology (e.g., a virtual topology) **through the physical VPN 106 depicted in FIG. 1.**” *Id.*, 4:35-45.

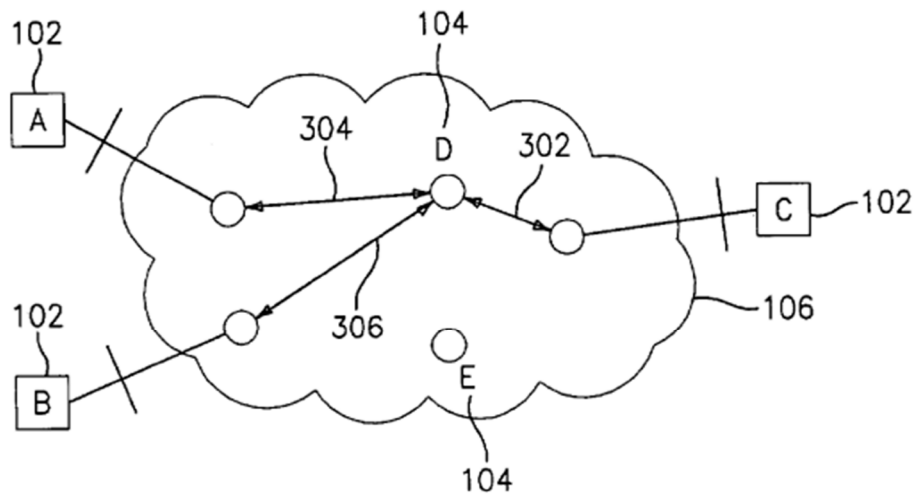


FIG. 3

EX1007, Fig. 3

Here, the virtual topology “**is implemented utilizing the underlying service nodes 104**, including the edge nodes 102, and links 108 depicted in FIG. 1.” *Id.*; *see also id.*, 6:65-7:17, Fig. 5.

Fourth, like the ’431 patent’s allocating bandwidth for the logical connections on the physical links of the physical network, in Wright, the “**bandwidth requirement is reserved** on each link in the restricted topology.” *Id.*, Abstract. “The basic technique for providing QoS guarantees is the **allocation of network**

resources along the path of the service instance.” *Id.*, 1:34-44. Wright describes that “the **network resource allocation is summarized as the bandwidth allocation** for that service on a link, or path.” *Id.* With reference to Figure 3 above, Wright explains “[a]ll packets within the VPN 106 from edge nodes 102 ‘A’, ‘B’ and ‘C’ travel along a subset of the links 302, 304 and 306. **Bandwidth is reserved along this subset of links to support a bandwidth QoS.**” *Id.*, 4:35-45; *see also id.*, 6:65-7:17, Fig. 5.

Accordingly, like the ’431 patent’s goal of reducing bandwidth reserved on the physical links of the network, Wright discloses that the “exemplary virtual topology, or restricted topology, depicted in FIG. 3 is selected to **minimize the amount of bandwidth reserved on the links 108 to provide a bandwidth QoS.**” *Id.*, 4:46-49. Wright describes example of reserving bandwidth where “**only the bandwidth actually required** is reserved on the links 108.” *Id.*, 4:50-5:3.

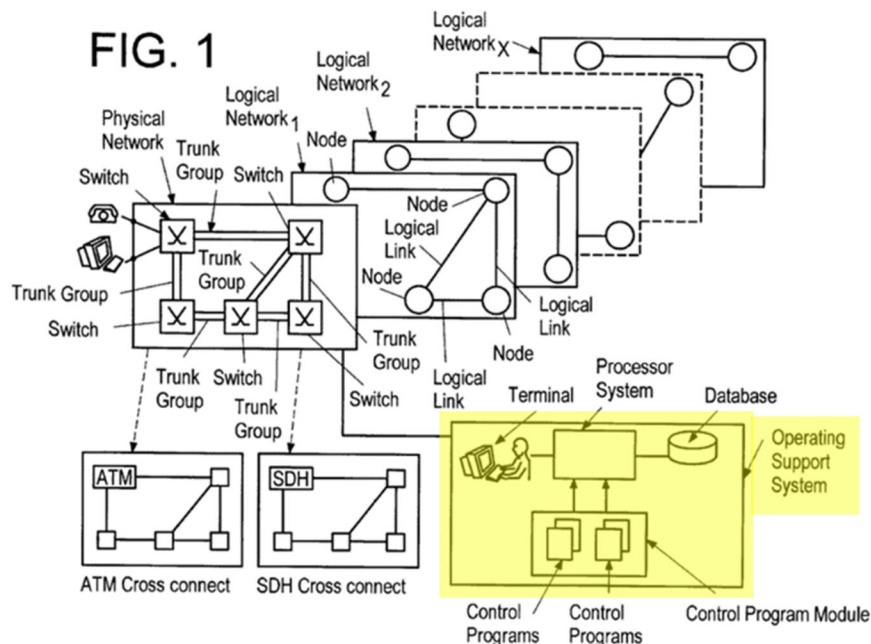
Wright is analogous art to the ’431 patent; it is from the same field of endeavor (e.g., data communications in a network utilizing a logical topology mapped on top of a physical topology) and is reasonably pertinent to the particular problem the ’431 patent was trying to solve (e.g., determining and allocating bandwidth across the physical links in the network based on the service provided and the logical network). Geier, ¶¶43-44.

3. Claim 25

a) [25-preamble] “*Apparatus for assigning bandwidth in a network including nodes coupled by links arranged in a physical topology, the apparatus comprising:*”

To the extent that the preamble is limiting (see *Pacing Techs., LLC v. Garmin Intern., Inc.*, 778 F. 3d 1021, 1023–1024 (Fed. Cir. 2015) (finding preambles are not normally limiting)), Holender in view of Wright and the general knowledge of a POSITA discloses or renders obvious this limitation.

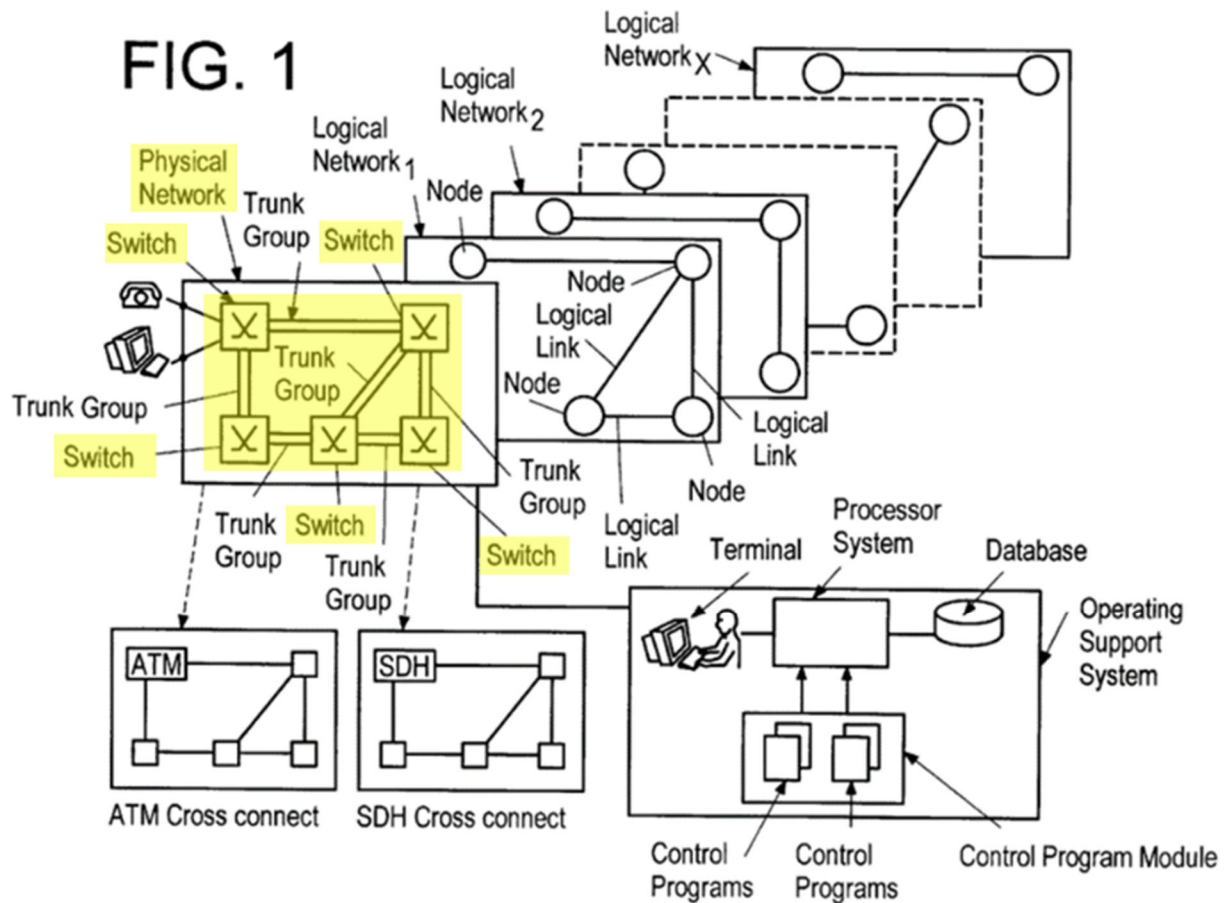
Holender discloses an *apparatus for assigning bandwidth in a network* through its “operation and support system OSS,” which “contains e.g. functions for monitoring and controlling the physical network and the traffic.” EX1006, 6:20-63, Fig. 1. Holender’s OSS (*apparatus*) is illustrated in Figure 1:



EX1006, Fig. 1 (annotated)

Holender’s OSS is responsible for *assigning bandwidth in a network* because Holender recognized that an “efficient way of providing said services is to **logically separate the resources of a physical network**” using logical networks applied on top of a physical network. *Id.*, 1:9-25; *see also id.*, 2:24-29, 2:34-37, 5:49-64. A POSITA would have understood that the “resources of a physical network” referred to in Holender, which are also described as the “transmission **capacities of the physical links**” are simply another way of referring to the *bandwidth* of the physical links. Geier, ¶47. Holender itself is explicitly directed to solving the problem of providing logical networks that address bandwidth demands for specific services. *See* EX1006, 5:49-64 (“it is not at all easy to **integrate services with very different demands to e.g. bandwidth, grade of service**”), 6:55-64 (“Conveniently, traffic classes are arranged into groups in such a way that those with **similar demands to bandwidth** are handled together in a separate logical network”). Accordingly, Holender’s OSS (including its processor system, control program module, and control programs) and teaching that “**physical link capacities are then allocated** among the logical links of the various logical networks” disclose an *apparatus for assigning bandwidth in a network*. *Id.*, 16:61-17:37, 13:1-14.

Further, Holender discloses that its network *includ[es] nodes coupled by links arranged in a physical topology*, as shown in Figure 1:



EX1006, Fig. 1 (annotated)

As shown, a “physical network comprises switches S (physical **nodes**) or equivalents, **physical links interconnecting said switches**, and various auxiliary devices.” *Id.*, 1:9-44. While the ’431 patent uses the term *node* to refer to both physical and logical nodes, Holender generally refers to the physical devices as switches, and the logical equivalents as nodes. *See id.*; Geier, ¶48. Holender also identifies the physical network layout as a *topology*, e.g., “the topology of these logical or virtual networks will in general differ from the **topology of the**

underlying physical network.” EX1006, 6:17-19, 6:43-54, 7:25-43. Accordingly, the switches (i.e., “physical nodes”) of Holender, which include “physical links” connecting the switches, disclose *including nodes coupled by links arranged in a physical topology*.

b) [25a] “a controller which is adapted to:”

Holender, in view of Wright and the general knowledge of a POSITA, discloses or renders obvious this limitation.

Regarding the term *controller*, the ’431 patent describes a “Connection Admission Controller (CAC) in the network allocates bandwidth according to the received requests,” and “performs functions” described by the specification related to claim 25. EX1001, 1:37-40, 6:49-53. This comports with what a POSITA’s understanding of the term *controller* would have been, i.e., a processor (or component) in a system that receives, interprets, and executes instructions. Geier, ¶¶49-52 (citing EX1016, EX1017, and EX1019).

Holender discloses a *controller* because its OSS “comprises a **processor system PS**, terminals T and a **control program module CPM** with a number of control programs CP along with other auxiliary devices.” EX1006, 6:20-63, 5:49-64. In Holender, the “architecture of the processor system is usually that of a multiprocessor system with several processors working in parallel.” *Id.*, 6:20-63. The OSS “contains e.g. functions for monitoring and **controlling** the physical

network and the traffic.” *Id.* Holender further explains its method “is preferably performed by one or more control programs CP of the control program module of the operation and support system OSS,” and that these “**control programs**, in turn, are **executed by one or more of the processors** in the processor system PS described above.” *Id.*, 14:13-25. One such control program executed by the processor serves to “control[] the network switches through the data links so as to partition the physical link capacities among the logical links of the logical networks.” *Id.* Accordingly, Holender discloses *a controller which is adapted to perform the remaining limitations of claim 25, explained below.*

c) [25b] “*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,*”

Holender, in view of Wright and the general knowledge of a POSITA, discloses or renders obvious this limitation.

The ’431 patent does not use the language or otherwise define *receive a definition of logical connections between the nodes* outside of the claim language; it does, however, describe the process for network setup, e.g., “on setup of network 12, an operator of the network inputs a basic connectivity map (BCM) 28 to manager node 22.” EX1001, 7:12-16. The patent also notes the “applied BCM is one of a number of different connectivity maps, each having a different logical topology and

bandwidth relations, that the operator may input to node 22. Alternatively or additionally, more than one of the basic connectivity maps are stored in node 22, and the operator chooses one of the stored maps as the applied BCM.” *Id.*, 7:16-22. Accordingly, a POSITA would have understood the language of *a controller which is adapted to: receive a definition of logical connections* simply means that the controller receives information sufficient to define the logical connections between nodes of the logical network. Geier, ¶54. Later in the claim (i.e., limitation 25e), this information is used to “map[] the logical topology . . . to the existing physical topology of network 12.” EX1001, 7:32-41.

Holender discloses *receive a definition of logical connections between the nodes* because, just like the ’431 patent’s disclosure of a network operator inputting a connectivity map, Holender discloses it was known that **“logical networks can be established by a network manager, a network operator or other organization.”** EX1006, 1:9-44, Fig. 1 (depicting a network operator using a terminal), 6:20-63. Holender further discloses that it was known for logical networks to include information about *connections between the nodes* because it discloses “[o]n top of a physical network PN **there is established a number of logical networks LN**, also referred to as logical or virtual subnetworks, **each of which comprises nodes N and logical links LL interconnecting the nodes.**” *Id.*, 1:9-24. This information is used in Holender such that “the **network manager establishes a number of logical**

networks on top of the physical network by associating different parts of the traffic with different parts of the transmission and switching resources of the physical network.” *Id.*, 6:43-54. Holender explains that “[t]he process of establishing logical networks means that the **topology of each one of the logical networks is defined,**” and, “[i]n other words, **the structure of the nodes and logical links in each logical network is determined.**” *Id.* In view of this disclosure, Holender discloses *receive a definition of logical connections between the nodes*, or at minimum, a POSITA would have found it obvious that Holender’s controller would receive such a definition, given its logical networks comprise information about the nodes and the logical links interconnecting the nodes. Geier, ¶¶55-56 (citing EX1016, EX1018); EX1006, 1:9-24.

Holender discloses *the logical connections being associated with a data transmission service to be provided over the network* because a primary purpose of Holender is to provide logical networks that are tailored to specific services with different demands. Holender explains “[i]t has gradually been recognized in the last couple of years that it is not at all easy to **integrate services with very different demands** to e.g. **bandwidth, grade of service** or congestion control functions.” EX1006, 5:49-64. Holender further discloses “[i]n some cases it turn[s] out to be better to **support different services** by offering separate logical networks,” and that “[n]etwork management can be simplified if **service classes are arranged into**

groups.” *Id.* For example, “all traffic types requiring more than a given amount of bandwidth can be integrated in one logical network, and those traffic types that require less bandwidth than this given amount can be integrated in another logical network.” *Id.*, 6:20-63. In view of this, a POSITA would have understood Holender discloses that “services with very different demands . . . e.g. bandwidth” would be on “separate logical networks.” *Id.*, 5:49-64; Geier, ¶57. Accordingly, when Holender receives information (*definition*) about a logical network to be established on its physical network, a POSITA would have understood the *logical connections* of Holender’s logical network are *associated with a data transmission service to be provided over the network* because Holender explicitly discloses using different logical network structures for services with different demands. Geier, ¶57.

To the extent not explicitly disclosed in Holender, a POSITA would have found it obvious to look to the teachings of Wright for the reasons discussed in § VI.A.5, *infra*. For example, Figure 5 of Wright depicts a flow diagram for performing Wright’s process:

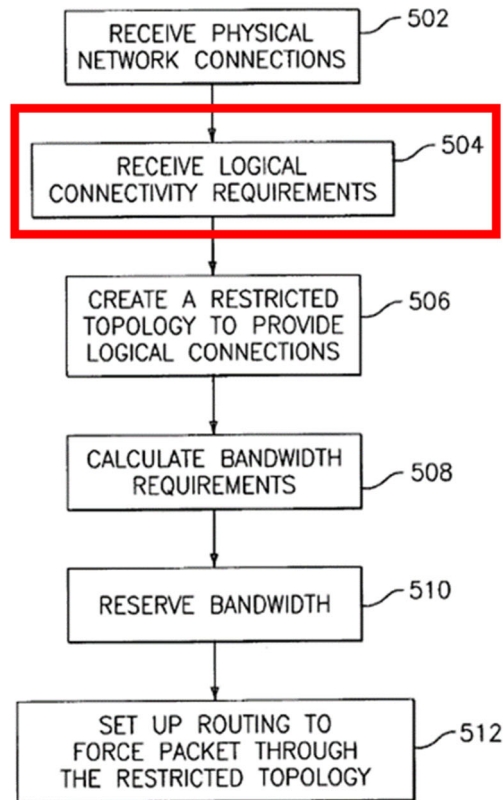


FIG. 5

EX1007, Fig. 5 (annotated)

In step 502, “the physical network connections, such as those depicted in FIG. 1, are received. The physical network connections **may include data such as nodes and links** included in the VPN.” EX1007, 6:65-7:17. Next, Wright teaches at step 504 “the **logical connectivity requirements are received**,” which include “the **logical connectivity requirements []** in terms of edge nodes and communication requirements between edge nodes.” *Id.* Accordingly, Wright demonstrates it was known to *receive a definition of logical connections between the nodes* when setting up a logical network.

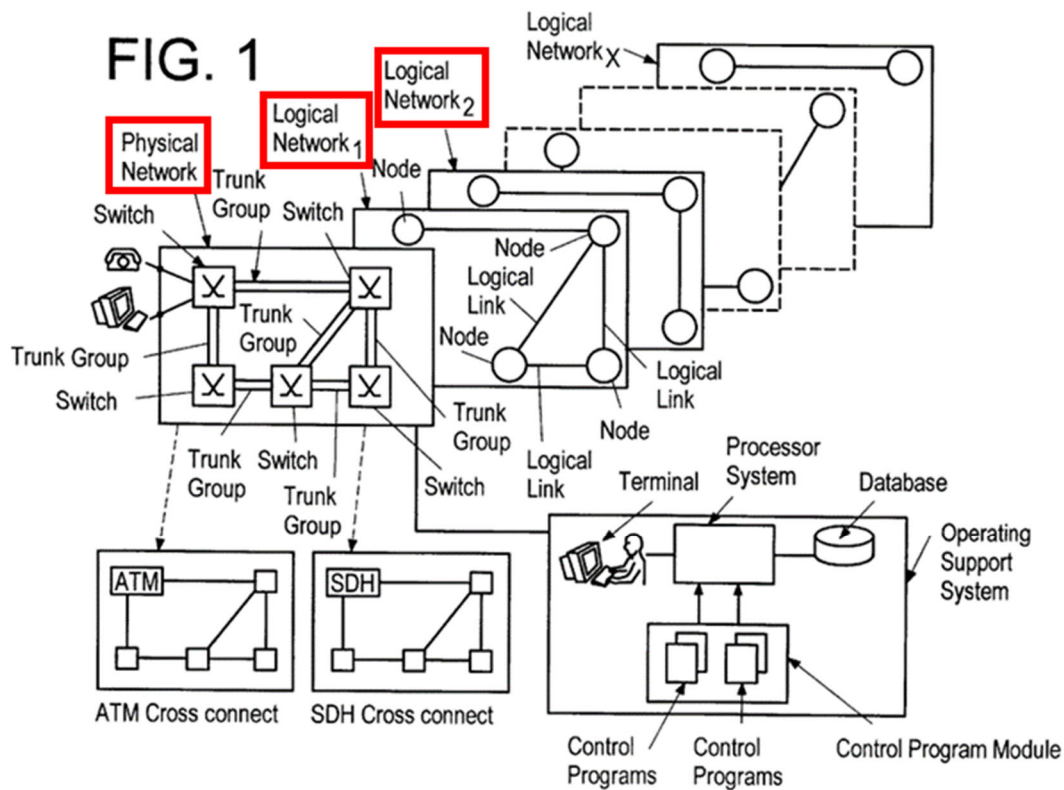
Wright also provides several examples of *the logical connections being associated with a data transmission service to be provided over the network*. First, Wright discloses “the **restricted [i.e., logical] topology may be chosen** to identify the required bandwidth and to **provide guarantees for that bandwidth in the service architecture.**” *Id.*, 5:4-9. Wright also states that the “bandwidth **guarantees of the restricted [i.e., logical] topology may be designed** to ensure adequate bandwidth **for the service.**” *Id.*, 3:44-46. Second, and more generally, Wright is directed to providing **quality of service (QoS)** guarantees in the context of logical connections mapped to a physical topology; which, axiomatically, a POSITA would have understood to mean that the QoS guarantees applied to the connections of the logical topology are associated with a specific *data transmission service to be provided over the network*. *Id.*, 1:30-46, 3:31-53, 5:4-9, 7:18-41; Geier, ¶58. Accordingly, by Wright providing bandwidth guarantees for specific service using the design of the logical network, Wright teaches *logical connections being associated with a data transmission service to be provided over the network*.

d) [25c] “*the logical connections having a connection topology different from the physical topology,*”

Holender, in view of Wright and the general knowledge of a POSITA, discloses or renders obvious this limitation.

Holender discloses “[t]he **topology of these logical or virtual networks will in general differ from the topology of the underlying physical network.**”

EX1006, 6:17-19. This is illustrated in Holender’s Figures 1 and 2:



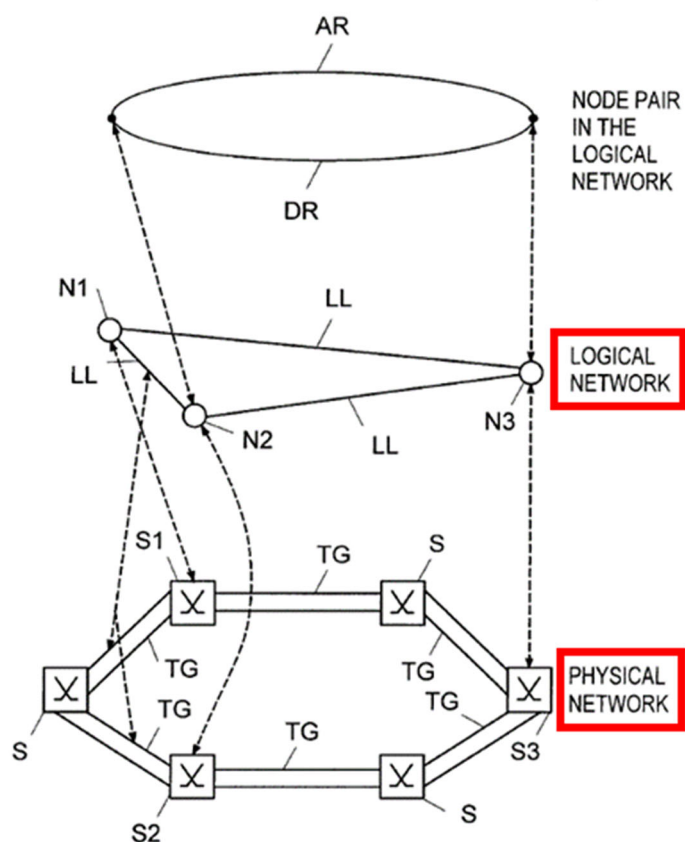
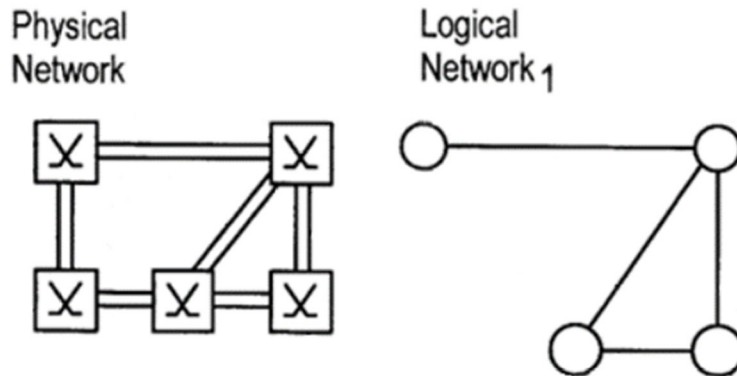


FIG. 2
PRIOR ART

EX1006, Figs. 1 & 2⁶ (annotated)

⁶ Figure 2 of Holender is a “schematic drawing explaining the relationship between physical links and switches, logical links and nodes, and also routes.” EX1006, 5:9-11; *see also* 1:36-65. Although labeled as “prior art” (because Holender discloses that these teachings were already known in the art), nothing in the specification of Holender contradicts or modifies Figure 2 in any way.

As shown in Figure 1 of Holender, the physical network and logical network 1 are different (i.e., logical network 1 does not include the bottom-left switch and related connections from the physical network):



Excerpt of diagrams in EX1006, Fig. 1

To the extent not explicitly disclosed in Holender, a POSITA would have found it obvious to look to the teachings of Wright for the reasons discussed in § VI.A.5, *infra*. Wright similarly discloses that a logical topology would be different from the physical topology, illustrated in Figures 1 (physical topology) and 3 (logical topology):

Accordingly, a POSITA would have understood the architecture of Holender's system to operate in the same way as Figure 2. Geier, ¶60.

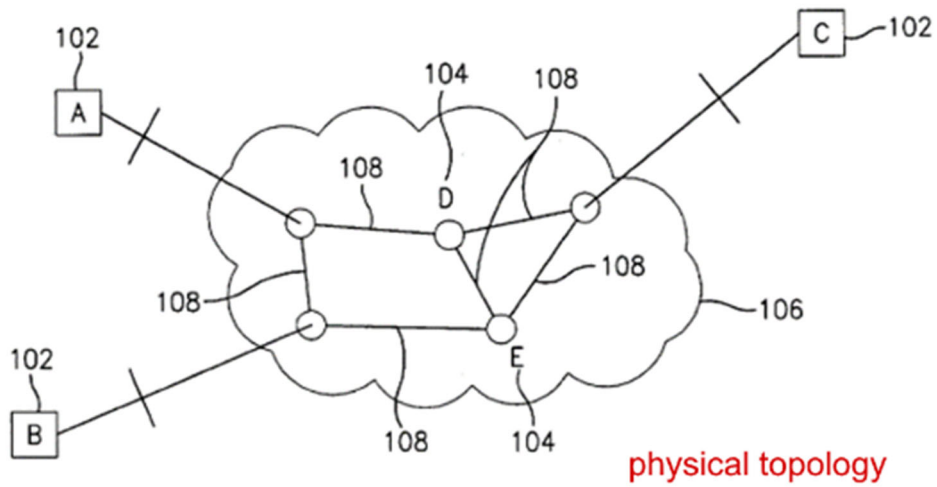


FIG. 1

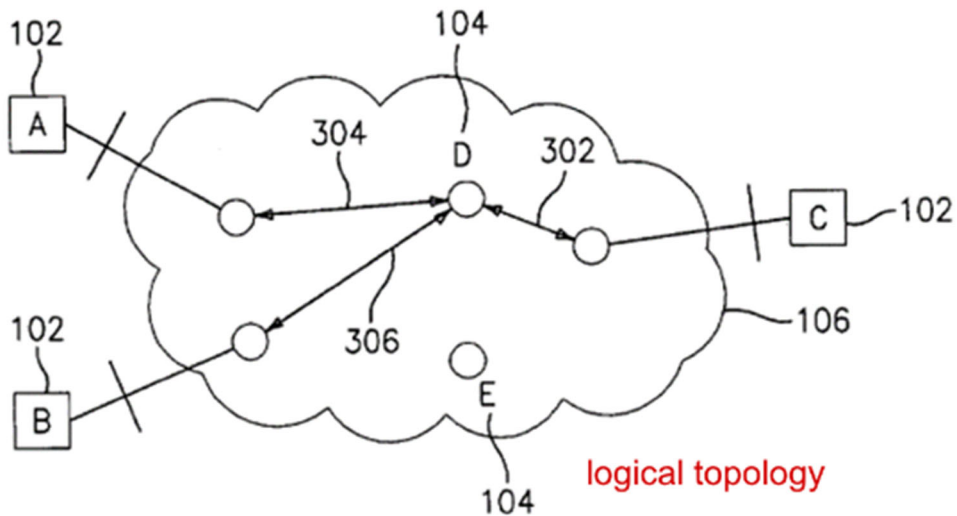


FIG. 3

EX1007, Figs. 1 & 3 (annotated)

Id., 3:54-5:22.

e) [25d] “*determine respective bandwidth requirements for the logical connections based on parameters of the service,*”

Holender, in view of Wright and the general knowledge of a POSITA, discloses or renders obvious this limitation.

Regarding *determine respective bandwidth requirements for the logical connections*, Figure 3 of the '431 patent illustrates an “**example** of process 50 for **determining the actual bandwidth** of each link.” EX1001, 7:63-65. The patent explains that “for each of the links the **bandwidth requirements are summed** to determine a mapping bandwidth.” *Id.*, 7:42-44. This determination uses the logical connections to determine the amount of bandwidth that should be reserved. *Id.*, 8:21-34. In this example provided by the '431 patent, bandwidth is conserved because any logical connections that do not require a corresponding physical link to function do not need to have any bandwidth reserved across that unused physical link. For example, in the example embodiment of Figure 3, the physical link between nodes C and D does not require any mapping bandwidth reservation, because those nodes are not connected in the logical topology (i.e., instead, nodes C and D communicate through central node A as shown in the logical topology). *Id.*, 7:32-10:7. Beyond this example, however, the '431 patent does not describe or require any specific algorithm or method for determining bandwidth requirements. *See* EX1001. Indeed, a POSITA would have recognized this at least because the '431 patent repeatedly

describes the bandwidth determinations of Figures 3 and 4 as “examples,” uses open-ended language, and is consistent with the plain language of the claim. *Id.*, 7:35-37, 7:63-8:1, 10:9-11, 11:51-65, 13:25-33; Geier, ¶62. As explained below, a POSITA would have recognized many ways to accomplish bandwidth determinations.

Regarding *based on parameters of the service*, the ’431 patent does not clearly define *parameters* and uses the term rarely outside of the claim language. The most relevant disclosure is that “[t]ypically, **parameters of the service** include respective node-bandwidths required by each of the nodes to provide the service.” EX1001, 3:15-17. Accordingly, a POSITA would have understood that *parameters of a service* include the node bandwidth requirements to support a given service. Geier, ¶63.

Holender discloses *determine respective bandwidth requirements for the logical connections* because it performs an “optimization associated with resource partitioning [] to **calculate** [i.e., *determine*], given a description of the physical network, the topology of the logical networks, the traffic types, the routes in each of the logical networks and also the offered traffic to each route or to each node pair in each logical network, **the logical link capacities for the corresponding logical networks so as to maximize the total carried traffic or the network revenue.**” EX1006, 8:36-43. Holender also discloses that “**logical link capacities** and route offered traffic values **are iteratively calculated** . . . to find an optimal point.” *Id.*,

16:61-17:37, 13:1-14; *see also id.*, 2:24-37, 5:49-64, 14:13-25. The result of these detailed calculations in Holender is that “**the logical link capacities for the various logical networks** and the route offered traffic values in each logical network which maximizes the revenue function **are known.**” *Id.*, 16:61-17:37. Accordingly, Holender’s calculations of the capacities for each link (i.e., *connections*) in the logical network topology, teaches this limitation.

Holender further discloses that its calculation is *based on parameters of the service* because, as discussed above in limitation 25b, a primary purpose of Holender is to provide logical networks that are tailored to specific services with different bandwidth demands. *See* § VI.A.3.c, *supra*; *see also* EX1006, 5:49-64. Holender explains that “[i]n some cases it turn[s] out to be better to **support different services** by offering separate logical networks,” and that “[n]etwork management can be simplified if **service classes are arranged into groups.**” *Id.*, 5:49-64. Holender further explains that, for example, “all traffic types **requiring more than a given amount of bandwidth** can be integrated in **one logical network**, and those **traffic types that require less bandwidth** than this given amount **can be integrated in another logical network.**” *Id.*, 6:55-63; *see also id.*, 1:9-53, 2:24-37, 7:44-51. Accordingly, because Holender itself teaches using different logical networks to support different bandwidth requirements based on the bandwidth demands of a service, it follows that Holender *determine[s] respective bandwidth requirements*

for the logical connections based on parameters of the service. Geier, ¶64. To the extent Holender is deemed not explicit on this point, the concept of designing logical networks and determining bandwidth based on a service to be provided over the logical network was well known to a POSITA at the time. Geier, ¶65 (citing EX1009, EX1013).

To the extent not explicitly disclosed in Holender, a POSITA would have found it obvious to look to the teachings of Wright for the reasons discussed in § VI.A.5, *infra*. As to *determine respective bandwidth requirements for the logical connections based on parameters of the service*, Wright discloses in Figure 5 that, after its system has “create[d] a restricted topology to provide logical connections” in step 506, its system then “calculate[s] bandwidth requirements” in step 508:

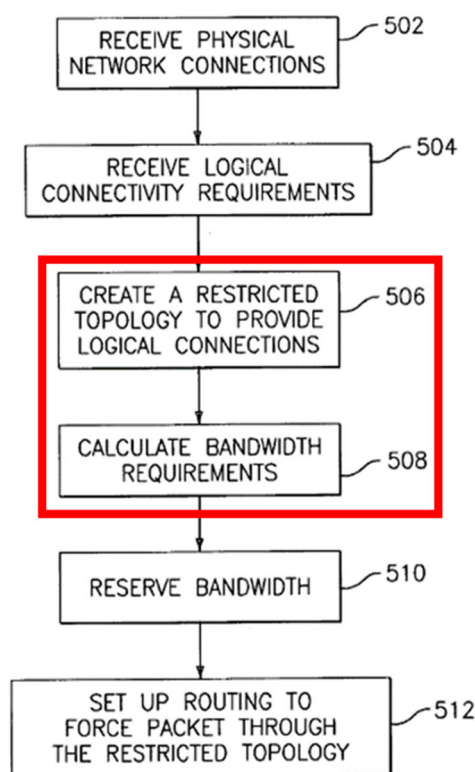


FIG. 5

EX1007, Fig. 5 (annotated)

Wright discloses that a “**bandwidth requirement for each link** in the restricted topology is **calculated**.” EX1007, Abstract, 2:23-48, 4:20-5:9. Wright also describes it was known that “**network services . . .** may be characterized by a **quality of service (QoS)** metric, or guarantee,” and that “**bandwidth allocation** is a fundamental requirement for a variety of QoS guarantees.” *Id.*, 1:30-44. Wright is generally directed to providing virtual private network services, but also identifies that a similar approach may be used for a “virtual private LAN service[s]” and

“video-on-demand,” two service applications explicitly identified by the ’431 patent.
Id., 1:54-56, 7:37-41.

Wright explains how bandwidth is calculated with reference to Figure 3, which depicts a “restricted topology . . . implemented utilizing the underlying service nodes 104, including edge nodes 102, and links 108 depicted in FIG. 1.” *Id.*, 4:20-45.

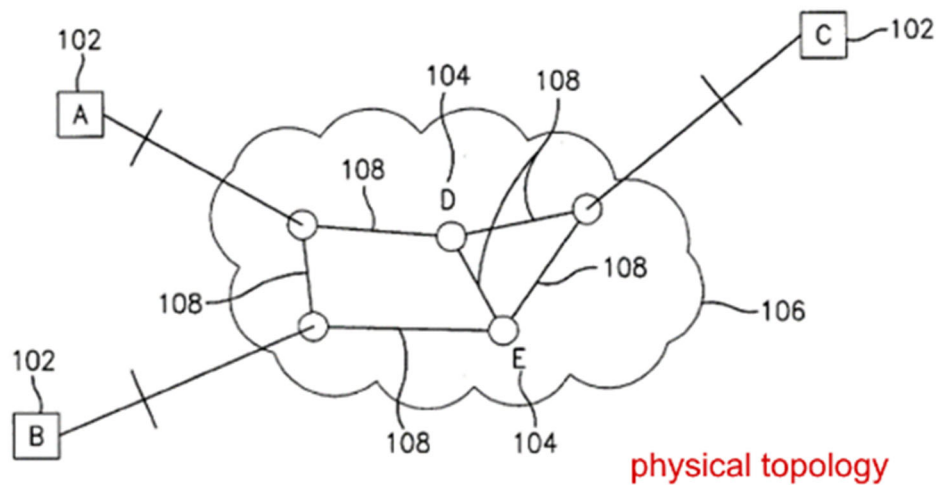


FIG. 1

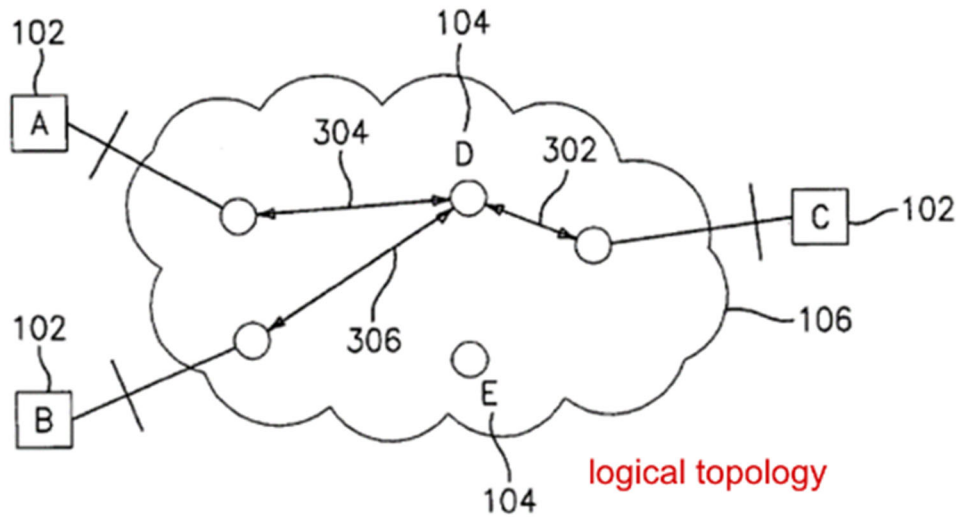


FIG. 3

EX1007, Figs. 1 & 3 (annotated)

Wright explains that in FIG. 3:

The exemplary virtual topology, or restricted topology, depicted in FIG. 3 is selected to minimize the amount of bandwidth reserved on the links 108 to provide a bandwidth QoS. For example, the logical connectivity from edge node 102 “A” to edge node 102 “B” and from edge node 102 “A” to edge node 102 “C” share the same link 304 from edge node 102 “A” to service node 104 “D”. Consider that the bandwidth requirement from edge node 102 “A” to edge node 102 “B” is “x” Mb/s and from edge node 102 “A” to edge node 102 “C” is “y” Mb/s. One way to calculate the required reserved bandwidth from the edge node 102 “A” to service node 104 “D” is to reserve “x+y” Mb/s. **In contrast, an exemplary embodiment of the present invention calculates the required reserved bandwidth as the maximum of “x” and “y” because it**

recognizes that there is maximum bandwidth that can be generated from edge node 102 “A” traversing the link 304 to service node 104 “D”. . . . Therefore, the reserved bandwidth is calculated to be the maximum of the required bandwidths from edge node 102 “B” to edge nodes 102 “A” and “C”. In this manner, only the bandwidth actually required is reserved on the links 108.

Id., 4:46-5:3; *see also id.*, 7:18-41. Wright’s method of using the edge nodes to calculate bandwidth requirements is similar to that of the ’431 patent itself, which in making its bandwidth determination, notes that “[i]n determining the entries in Table II [used to calculate the mapping bandwidth], it is assumed that **only nodes at the ends of paths are effective in determining bandwidth.**” EX1001, 8:57-59. Accordingly, because Wright’s discussion of calculating bandwidth in Figure 3 relates to a logical network and logical connections 302, 304, and 306, it discloses *determin[ing] respective bandwidth requirements for the logical connections.*

Finally, Wright provides further teaching that its calculations are *based on parameters of the service*, because it discloses that “**bandwidth guarantees of the restricted topology may be designed to ensure adequate bandwidth for the service.**” EX1007, 3:44-46. Wright further notes that the “mechanism for providing bandwidth guarantees on the links 108 between the service nodes 104 (including the edge nodes 102) **is implementation specific.**” *Id.*, 5:4-9; *see also id.*, 7:18-41 (mentioning various services that may be supported by the logical network,

including voice over IP, video-on-demand, and video conferencing). In the combined system discussed in greater detail below in § VI.A.5, Wright’s teachings outlined here would be applied in the same way to Holender’s system. Geier, ¶¶75-81.

f) [25e] “*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*”

Holender, in view of Wright and the general knowledge of a POSITA, discloses or renders obvious this limitation.

Holender teaches *map[ping] 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* because it discloses “[o]n of a **physical network PN** there is **established a number of logical networks LN**, also referred to as **logical or virtual subnetworks**, each of which comprises **nodes N** and **logical links LL** **interconnecting the nodes.**” EX1006, 1:9-24. Specifically, Holender discloses:

From this operation and support system OSS the network manager **establishes a number of logical networks on top of the physical network by associating different parts of the traffic with different parts of the transmission and switching resources of the physical network.** This can e.g. be realized by controlling the port assignment of the switches and cross connect devices of the physical network, ... **In other words, the structure of the nodes and logical links in each logical network is determined.**

Id., 6:43-54. In view of this disclosure, a POSITA would understand Holender establishes logical networks (comprising nodes and logical links interconnecting the nodes) on top of a physical network (*map the connection topology to the physical topology*). Geier, ¶67. Holender further describes this process is accomplished “by associating different parts of the traffic with **different parts of the transmission and switching resources of the physical network**” (*each of the logical connections is associated with one or more links of the physical topology*), and a POSITA would have understood Holender’s “transmission and switching resources of the physical network” to be the same as the links of Holender’s physical topology. *Id.*

This limitation is further illustrated by Holender’s Figure 2, which is “a simple schematic drawing explaining the **relationship between physical links, logical links and also routes.**” EX1006, 1:36-44. In Figure 2, a “simple underlying **physical network** with physical switches S and trunk groups TG, i.e. **physical links**, interconnecting the switches is illustrated.” *Id.*

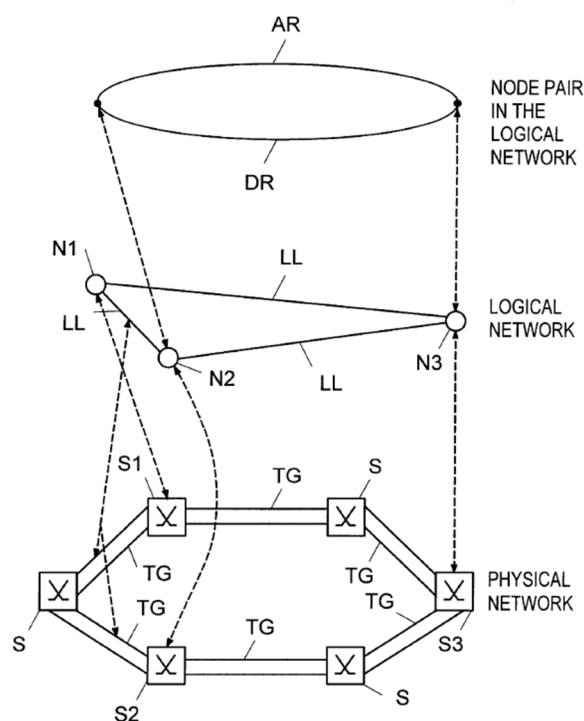


FIG. 2
PRIOR ART

EX1006, Fig. 2

For example, switches S1 and S2 in the physical network correspond to nodes N1 and N2 of the logical network, respectively, indicated by the dotted line arrows. *Id.*, Fig. 2. Similarly, logical link LL that connects nodes N1 and N2 of the logical network is shown as being mapped to the physical links between switches S, S1, and S2; i.e., when data is transferred between nodes N1 and N2 in the logical network, that data will flow between switches S1, S, and S2, as shown in the annotated figure below.

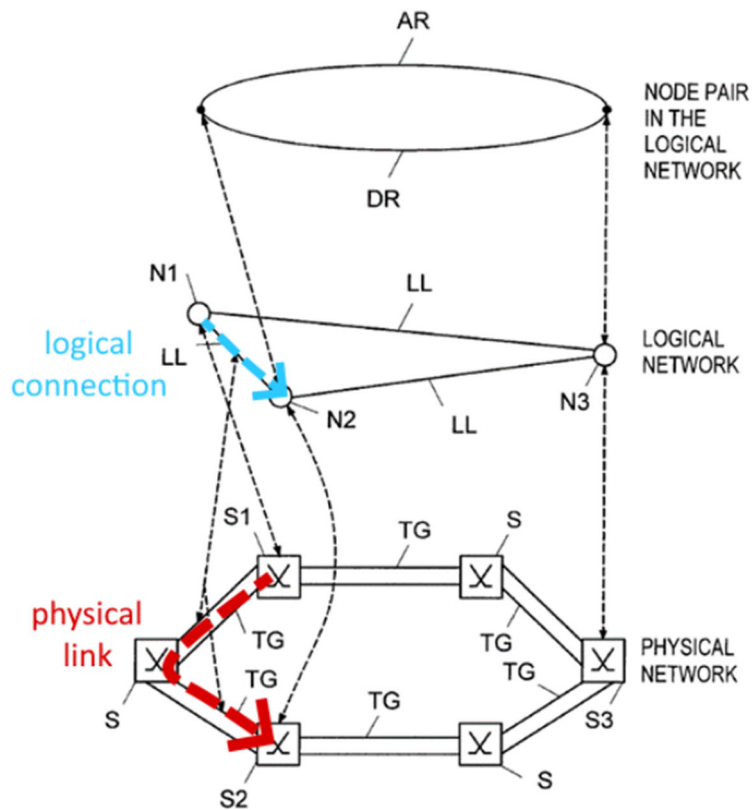


FIG. 2
PRIOR ART

EX1006, Fig. 2 (annotated)

This further demonstrates that the logical topology of Holender is mapped *so that each of the logical connections is associated with one or more links of the physical topology*. *Id.*; see also *id.*, 1:9-53, 2:24-29, 6:43-63, 7:25-43, 14:13-25.

Furthermore, the concept of mapping logical topologies to physical topologies would have been exceedingly well known to a POSITA at the time because, as early as 1995, references described mapping logical topologies on top of an underlying physical network, where the logical connections were associated with

the physical links of the network. Geier, ¶¶68-69 (citing EX1014, EX1016, EX1018).

g) [25f] “*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.*”

Holender, in view of Wright and the general knowledge of a POSITA, discloses or renders obvious this limitation.

The '431 patent describes that in the allocation step, the controller “allocates actual bandwidths to each of the links based on the comparison.” *Id.*, 7:55-62. Like the bandwidth determination of limitation 25d, this limitation is not limited to any specific method for allocating bandwidth. *See* § VI.A.3.e, *supra*.

Holender discloses *allocat[ing] a bandwidth for the service on each of the links* because it discloses that, after the logical link capacities are calculated and known, “[t]he **physical link capacities are then allocated** among the logical links of the various logical networks in accordance with the finally calculated logical link capacities.” EX1006, 16:61-17:37; *see also id.*, claim 42 (“**allocating the physical transmission resources among the logical links**”), 1:9-53, 2:24-37, 5:49-64, 6:55-63, 7:44-51, 14:13-25. This disclosure further makes clear that Holender’s allocation is *in response to the bandwidth requirements of the logical connections and to the mapping*, because it does so “**according to the capacity values of said logical links** after the optimization.” *Id.*, 16:61-17:37. Holender discloses *allocating for the*

service because, as discussed throughout, Holender explicitly describes different services with different demands (e.g., bandwidth) being on “separate logical networks.” *Id.*, 5:49-64. Accordingly, since each logical network in Holender is associated with at least one service, any bandwidth allocation that occurs in relation to that logical network is bandwidth allocated *for the service* being provided by the logical network. Geier, ¶71. In addition, given Holender’s disclosure that “logical links of the various logical networks share the capacities of physical links present in said physical network,” a POSITA would have recognized that when Holender discusses allocating “physical link capacities” or “physical transmission resources” across the logical links of a logical network, that it is doing so *in response to the bandwidth requirements of the logical connections and to the mapping* because the links of Holender’s logical networks include “capacity values of said logical links” (*requirements of the logical connections*) and have a *mapping* related to the service being provided by that specific logical network. EX1006, 16:61-17:37; Geier, ¶72. Furthermore, references long before the ’431 patent demonstrate that it was known to a POSITA to allocate bandwidth for services in the way described by this limitation. Geier, ¶73 (citing EX1017, EX1019).

To the extent not explicitly disclosed in Holender, a POSITA would have found it obvious to look to the teachings of Wright for the reasons discussed in § VI.A.5, *infra*. Wright discloses that once its system calculates a bandwidth

requirement for the connections in a logical network (i.e., as performed in limitation 25d), “[t]he **bandwidth requirement is reserved on each link** in the restricted [i.e., logical] topology.”

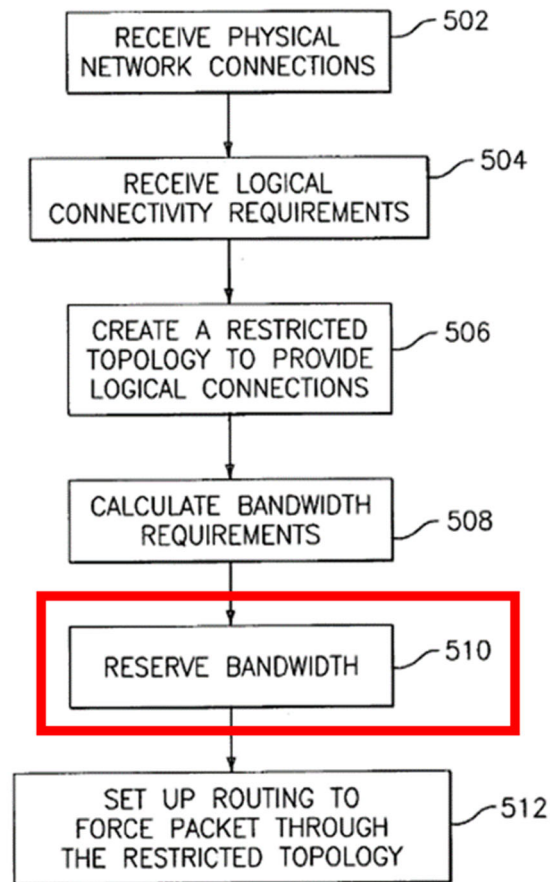


FIG. 5

EX1007, Fig. 5 (annotated)

EX1007, Fig. 5, Abstract.

As discussed throughout, Wright explains that “network services . . . may be characterized by a quality of service (QoS) metric, or **guarantee.**” *Id.*, 1:30-44. And

one “basic technique for providing QoS guarantees is the **allocation of network resources along the path of the service instance**” (*allocate a bandwidth for the service on each of the links*). *Id.* Wright acknowledged that “[t]ypically, the **network resource allocation** is summarized as the **bandwidth allocation** for that service on a link, or path,” and further that “[b]andwidth allocation is a fundamental requirement for a variety of QoS guarantees.” *Id.* Wright gives an example that “guarantees on bandwidth, latency, loss and jitter all require, at a minimum, **that bandwidth can be guaranteed.**” *Id.*; *see also id.*, 3:31-46, 5:4-9.

Accordingly, after the calculation of the bandwidth required for the logical network as described in limitation 25d above is performed, Wright discloses that “[i]n this manner, **only the bandwidth actually required is reserved on the links 108.**” *Id.*, 4:46-5:3. Wright further notes that “[i]n general, the restricted topology may be chosen to **identify the required bandwidth** and to **provide guarantees for that bandwidth in the service architecture,**” and that “[t]he mechanism for providing **bandwidth guarantees on the links 108** between the service nodes 104 (including the edge nodes 102) is **implementation specific**” (*in response to the bandwidth requirements of the logical connections and to the mapping*). *Id.*, 5:4-9. Notably, these disclosures make clear that Wright is reserving bandwidth on the links 108, which refer to the underlying physical network depicted in Wright’s Figure 1, in the same way that the ’431 patent describes allocating bandwidth on the

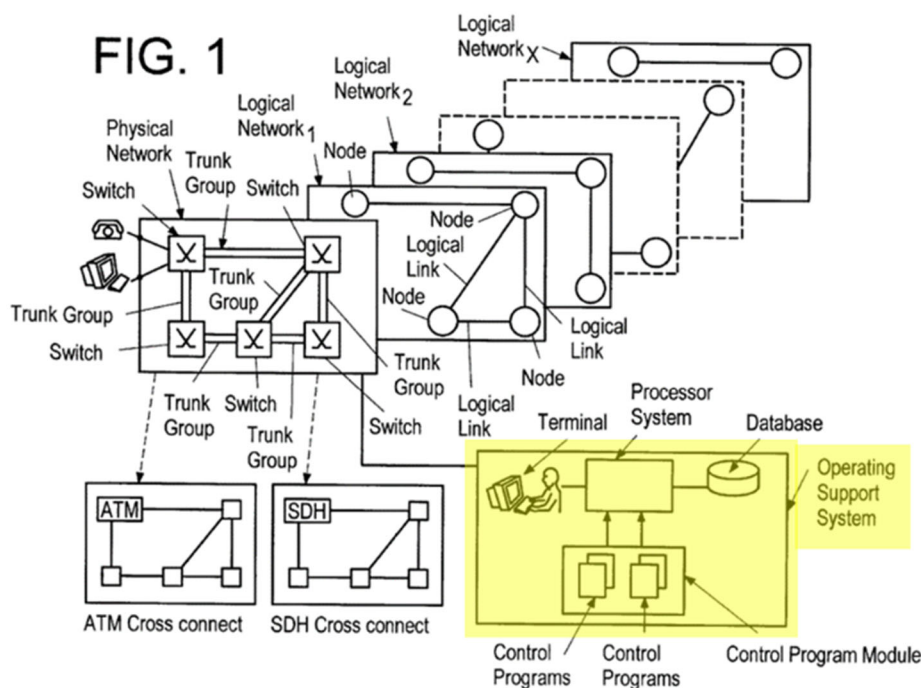
physical network links as part of this limitation. *See* EX1001, 7:32-62, Fig. 2. In the combined system discussed in greater detail below in § VI.A.5, Wright’s teachings outlined here would be applied in the same way to Holender’s system.

4. **Claim 27**

a) [27a] “*Apparatus according to claim 25, wherein the controller is external to the network.*”

Holender in view of Wright and the knowledge of a POSITA discloses a *controller* as shown above in § VI.A.3.b for limitation 25a, *supra*.

Regarding *wherein the controller is external to the network*, Holender’s system is generally shown as having its controller *external to the network*, e.g., as shown in Figure 1:



EX1006, Fig. 1 (annotated)

For example, the OSS, which includes the processor system, control program module, and control programs, is illustrated as being external to the physical network. EX1006, Fig. 1. Further, Holender explains that “[a]n operation and support system OSS usually comprises a processor system PS The architecture of the processor system is usually that of a multiprocessor system with several processors working in parallel.” *Id.*, 6:20-63. Holender also notes that “[a]lternatively, the processor system may consist of a single processor, often a large capacity processor.” *Id.*

5. Motivation to combine Wright’s teachings with Holender

A POSITA would have been motivated to incorporate the teachings of Wright related to quality of service (QoS), bandwidth calculation, and bandwidth allocation into Holender’s system such that Holender’s system is enhanced to explicitly calculate and allocate bandwidth for services as taught by Wright; the combination would have resulted in a system that explicitly calculates the bandwidth required by a logical network applied on top of a physical network, and then allocates that bandwidth on the physical links of the physical network to support the logical network. Geier, ¶75. A POSITA would have recognized Holender as providing a base system and framework for applying a variety of logical networks on top of physical networks, ready for improvement with Wright’s teachings. *Id.*; EX1006, Abstract, Fig. 1, 1:9-24, 6:20-63, 7:25-43. Implementing Wright’s teachings would

have enhanced Holender’s system, e.g., by providing functionality to quickly and efficiently calculate the bandwidth required in a single logical network that is applied on top of a physical network topology. Geier, ¶76.

First, Holender discloses a system where “[a] set of logical networks is established on top of a physical network.” EX1006, Abstract. Holender also discloses an operation and support system (OSS) with processing systems and generally containing “functions for monitoring and controlling the physical network and the traffic.” *Id.*, 6:20-63. Holender also considers the importance of bandwidth considerations, explaining that “it is not at all easy to integrate services with very different demands to e.g. bandwidth, grade of service or congestion control functions.” *Id.*, 5:49-64. Holender states that the “physical transmission resources, i.e. the transmission capacities of the physical links, have to be partitioned or distributed among the logical links of said logical networks in some way. In this context, a natural objective is to partition the physical transmission resources so as to optimize the operation of the complete physical network, viewed as the set of logical networks, according to a given predefined objective function.” *Id.*, 7:44-51. Holender further discusses general ideas for optimizing bandwidth calculations and allocation across several logical networks. *Id.*, 16:61-17:37.

Motivated by Holender’s general teachings, a POSITA would have looked to Wright for specific implementation details on different ways to efficiently determine

and allocate bandwidth between edge nodes and service nodes in a single logical topology, as well as Wright’s general teachings for implementing such a system. EX1007, Figures 2-3, 2:23-38 4:20-5:9. Wright discloses that a “bandwidth requirement for each link in the restricted topology is calculated.” *Id.*, Abstract, 2:23-48. Wright also describes it was known that “**network services** . . . may be characterized by a **quality of service (QoS)** metric, or guarantee,” and that “**bandwidth allocation** is a fundamental requirement for a variety of QoS guarantees.” *Id.*, 1:30-44. “The basic technique for providing QoS guarantees is the allocation of network resources along the path of the service instance.” *Id.*, 1:34-44. As explained above in § VI.A.3.e for limitation 25d, Wright provides a detailed explanation of how to calculate the bandwidth required in a system with a logical topology and several edge nodes. *See* EX1007, 4:20-5:3; *see also id.*, 7:18-41. Similarly, as explained above in § VI.A.3.g for limitation 25f, Wright provides explicit instructions for allocating bandwidth on the physical links of the underlying physical network to support the logical network. EX1007, 1:30-44, 4:46-5:9. Geier, ¶77.

A POSITA would have understood the benefits of incorporating these teachings from Wright into the base system of Holender, as this would allow Holender’s system to calculate a bandwidth requirement quickly and efficiently for a single logical network, and allocate the bandwidth associated with that logical

network on the physical links of the underlying physical network. Geier, ¶78. For example, a POSITA would have recognized that—although Holender does disclose both the ideas of calculating bandwidth for a logical network, and allocating that bandwidth—Holender’s primary focus is on the optimization of bandwidth allocation across multiple logical networks, using detailed formulas and optimization methods. Geier, ¶78; *see* EX1006, 2:24-42, 9:49-17:37. By contrast, Wright discloses a simple (yet efficient) method for bandwidth calculation in a single logical network using the edge nodes. Geier, ¶78; *see* EX1007, 4:46-5:3; *see also id.*, 7:18-41, Fig. 5.

A POSITA would have understood that Wright’s teaching would be useful in the system of Holender for several reasons. First, in the instance where Holender’s system is implementing only a single logical network, the teachings of Wright provide a simple method for determining and allocating bandwidth across that logical network. Geier, ¶79. Second, even if Holender’s system is used to implement multiple logical networks supported by an underlying physical network, a POSITA would have recognized that Wright’s teachings would provide a quick and useful starting point for bandwidth calculation and allocation for a single logical network, that can later be optimized using Holender’s optimization formulas after actual bandwidth usage is observed, or when more logical networks are added. Geier, ¶79. For example, whenever a new logical network is added in Holender, a POSITA

would have recognized and used Wright’s formulas to generate a baseline bandwidth requirement for that logical network. Geier, ¶79. The combination therefore would have resulted in a system (like Holender’s) that explicitly makes efficient bandwidth determinations and allocations for a logical network based on a calculation of the maximum bandwidth required between the edge nodes of a system (as taught by Wright).

Moreover, in the combination, both Holender and Wright would be performing the same functions they previously disclosed—but Holender’s system would now include explicit functionality for quickly calculating bandwidth for a logical network and allocating that bandwidth on an underlying physical network. A POSITA would have understood that including Wright’s teachings would require no unusual modification to Holender—as noted above in § VI.A.1 (overview of Holender) and § VI.A.2 (overview of Wright), both references contemplate the application of logical networks on top of physical networks, and both references disclose the concepts and ability to calculate and allocate bandwidth for logical networks applied on top of physical networks. Geier, ¶80; *see* §§ VI.A.1-2, *supra*.

In view of the foregoing, several rationales support obviousness:

- i. Combining prior art elements (Wright’s teachings on calculating and allocating bandwidth with Holender’s system for applying logical networks on top of physical networks) according to known methods

(implementing the teachings of Wright to enhance the capabilities of Holender’s system) to yield predictable results (Holender’s system having additional functionality related to quick calculation and allocation of bandwidth); and

- ii. Use of known technique (Wright’s teachings on calculating and allocating bandwidth) to improve similar devices (Holender’s system for applying logical networks on top of physical networks is similar to Wright’s disclosure of the same) in the same way (Holender’s system now having the ability to perform Wright’s calculations for a logical network).

KSR Int’l Co. v. Teleflex Inc., 550 U.S. 398, 415-22 (2007).

A POSITA would have had a reasonable expectation of success in combining Holender and Wright because they both relate to the application of a logical network topology on top of a physical network topology. *See* §§ VI.A.1-2, *supra*. Both references also explicitly consider various calculations of bandwidth in the context of a logical network and allocating that bandwidth across the physical links of the underlying physical network. *See* §§ VI.A.3.e & VI.A.3.g, *supra*. This would have required minimal modifications to Holender’s system (merely implementing Wright’s additional teachings on bandwidth calculation and allocation), and the combination would have led to a predictable result (Holender’s system with the

added functionality to perform the bandwidth calculation and allocation methods described in Wright). Geier, ¶81; *see Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1364 (Fed. Cir. 2007).

B. Ground 2 – Claims 25 and 26 are unpatentable by Baker in view of Wright, Lemieux, and the knowledge of a POSITA

1. Overview of Baker

Baker discloses a “logical star architecture imposed on an underlying non-star network, for example a Virtual Path Ring (VPR).” EX1008, Abstract. For example, Figure 1 of Baker “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** according to one embodiment of this invention.” *Id.*, [0031].

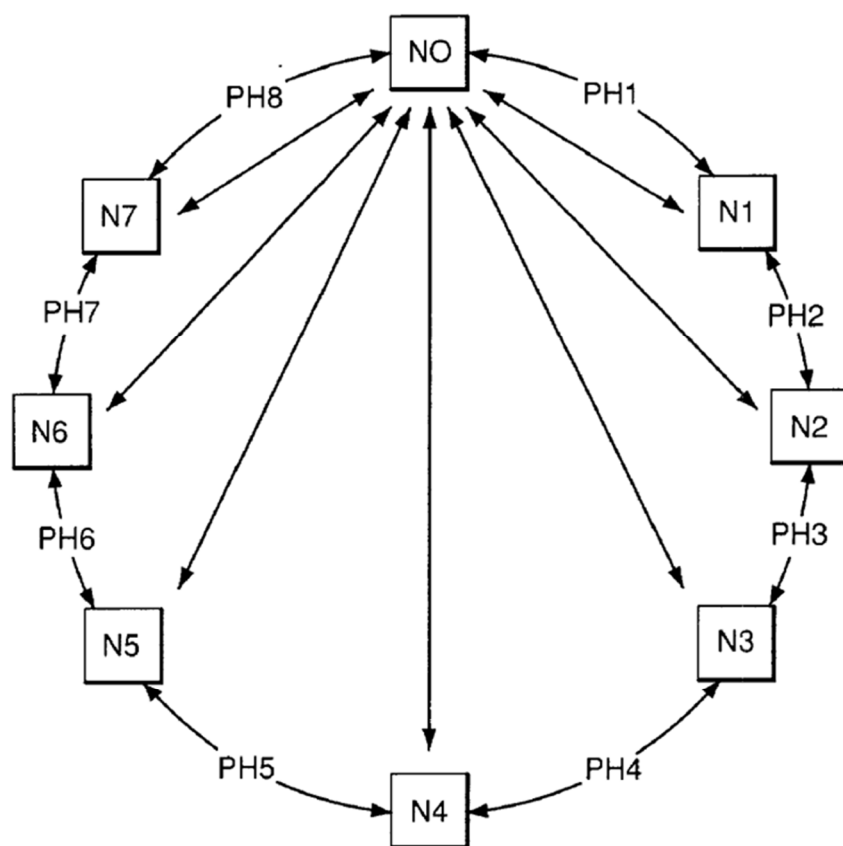


FIG. 1

EX1008, Fig. 1

Regarding bandwidth, Baker acknowledges that the logical star architecture “provides distinct advantages over the underlying ring” in several areas, including “**bandwidth management.**” *Id.*, [0059]. For example, “imposition of the logical star architecture on a VPR **reduces node-to-node switching costs** (e.g., delay, as well as memory and **processing costs**) since all nodes in a logical star topology are at most two logical hops away.” *Id.*, Abstract. Baker sought to implement the

advantages associated with a star network where “traffic can be transmitted between any two nodes in the network with at most two ‘hops,’ where a hop is defined as transmission between two directly connected nodes,” while avoiding the **disadvantages** of a star network, i.e., “that the central node corresponds to a potential single point of failure for the entire network.” *Id.*, [0005]-[0007]. Accordingly, by implementing the star logical topology, “[t]he problems in the prior art are addressed in accordance with the principles of the invention by overlaying a logical star topology on a non-star network, such as a ring network, such that signals are transmitted through the underlying non-star network in accordance with the overlaid logical star topology.” *Id.*, [0012].

As to bandwidth savings, like the ’431 patent, Baker recognized that the “**cost of communication can be reduced** in networks . . . **through the use of a ‘virtual path.’**” *Id.*, [0076]. In this way, “[i]ntermediate nodes on the route effectively ignore communication packets associated with a virtual path that they do not terminate,” and “[a] communication packet associated with a virtual path is thus not subject to the full overhead or routing cost at each intermediate node along the journey to its destination.” *Id.*

Like the ’431 patent’s mapping the logical topology to the physical topology, Baker describes that a “head node” (i.e., N0) “is designated that will **execute a set of special ‘star overlay’ procedures.**” *Id.*, [0047]. The head node is responsible for

flooding information about the physical and logical topologies across the nodes of the network. *Id.*, [0047]-[0054].

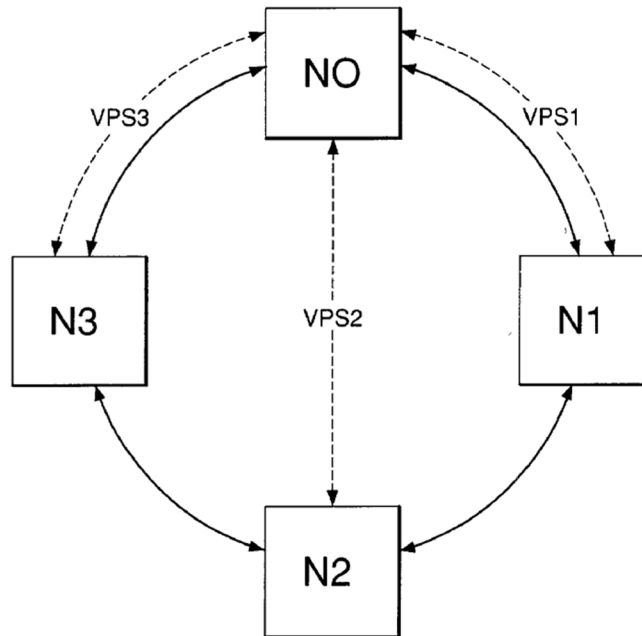


FIG. 4

EX1008, Fig. 4

Baker is analogous art to the '431 patent; it is from the same field of endeavor (e.g., data communications in a network utilizing a logical topology mapped on top of a physical topology) and is reasonably pertinent to the particular problem the '431 patent was trying to solve (e.g., saving bandwidth across the physical links in the network using a logical network). Geier, ¶¶84-85.

2. Overview of Lemieux

Lemieux is directed to an “aggregation network including a plurality of interconnected access routers is configured in accordance with a certain **physical network topology**.” EX1009, 2:5-13. Similar to Wright, Lemieux manages the logical configuration of its network “in view of **quality of service (QoS)**, resource availability and cost concerns.” *Id.*, 5:6-9.

Like the ’431 patent’s disclosure of logical connections being associated with a service, Lemieux similarly discloses configuring logical networks in response to service requests: “[r]esponsive to **individual subscriber requests for a bursty traffic service**, a resource handler functionality **determines which one of a plurality of logical network topologies** is best suited to support the provision of communications **for that bursty traffic service**.” *Id.*, 2:5-13. Like the ’431 patent’s disclosure of video on demand service, disclosed examples of Lemieux’s bursty traffic services that can be provided over logical networks include multimedia, video conferencing, file transfer (FTP), video-on-demand, and games-on-demand services. *Id.*, 4:15-26, 9:3-28, 11:21-13:12.

Like the ’431 patent’s disclosure of physical and logical topologies being different, Lemieux’s Figure 2 illustrates “the physical interconnection of an aggregation network in a partially meshed network topology; and FIGURES 3A-3C are schematic diagrams illustrating the implementation of different logical network

topologies using the partially meshed physical network topology for the aggregation network of FIGURE 2.” *Id.*, 2:23-27.

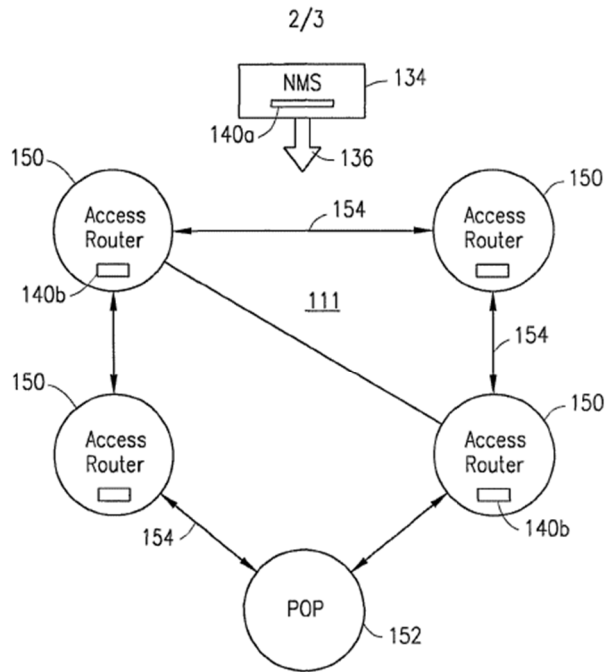
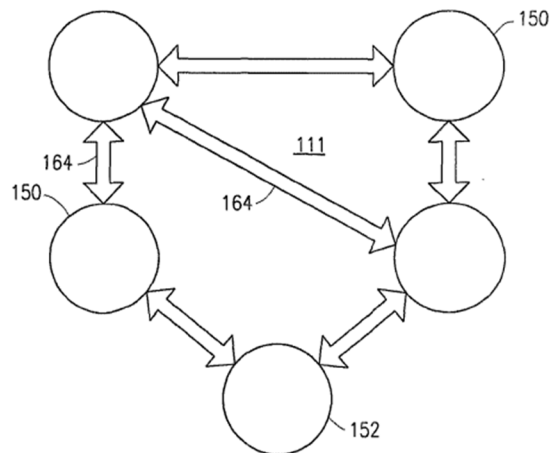
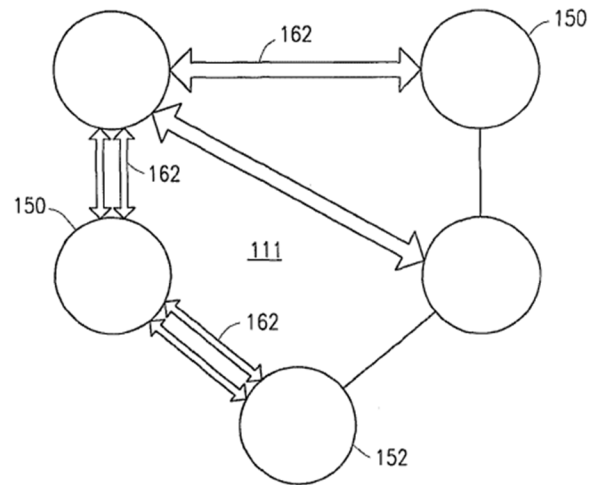
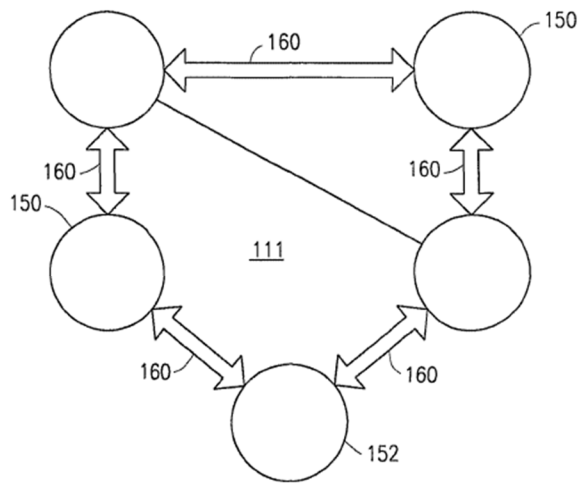


FIG. 2

EX1009, Fig. 2



EX1009, Figs. 3A-3C

As shown in Figure 2, Lemieux’s network 111 “further includes a network management system 134 that is connected to the access router(s) 150 via a communications link 136. The network management system 134 operates . . . to tailor the partially meshed physical topology of the network 111 to implement certain logical network topologies for subscriber bursty communications service.”

Id., 7:20-8:5. Once established, the network 111 “is informed, through its connection admission control (CAC) functionality, to open a connectionless connection oriented flow arrangement to support admission of the flow of bursty video conference traffic to the network 111 using the established logical network topology.” *Id.*, 9:25-28.

Lemieux is analogous art to the ’431 patent; it is from the same field of endeavor (e.g., data communications in a network utilizing a logical topology mapped on top of a physical topology) and is reasonably pertinent to the particular problem the ’431 patent was trying to solve (e.g., providing and optimizing a logical topology based on the service provided on the network). Geier, ¶¶86-87.

3. Claim 25

a) [25-preamble] “*Apparatus for assigning bandwidth in a network including nodes coupled by links arranged in a physical topology, the apparatus comprising:*”

To the extent that the preamble is limiting, Baker in view of Wright, Lemieux, and the knowledge of a POSITA discloses or renders obvious this limitation.

Baker discloses an *apparatus for assigning bandwidth in a network* because, in the combined system in view of Wright’s teachings (*see* § VI.B.5, *infra*), Baker’s system would perform bandwidth assignment based on Wright’s teachings on how to calculate bandwidth (EX1007, 4:46-5:3, 7:18-41) and allocate it (*id.*, 1:30-44, 4:46-5:9), as discussed above in Ground 1. *See* §§ VI.A.3.e & VI.A.3.g, *supra*. Baker itself acknowledges its structure “provides distinct advantages” over a traditional

ring network, including “bandwidth management.” EX1008, [0059]. Furthermore, in the combined system, Baker’s “head node” (i.e., N0), and Lemieux’s teaching of using a “connection admission control (CAC)” to establish logical networks, disclose an *apparatus for assigning bandwidth* when modified with Wright’s teachings for the reasons discussed below in § VI.B.5, *infra*.

Baker’s system *include[es]* nodes coupled by links arranged in a physical topology, illustrated by Figure 1:

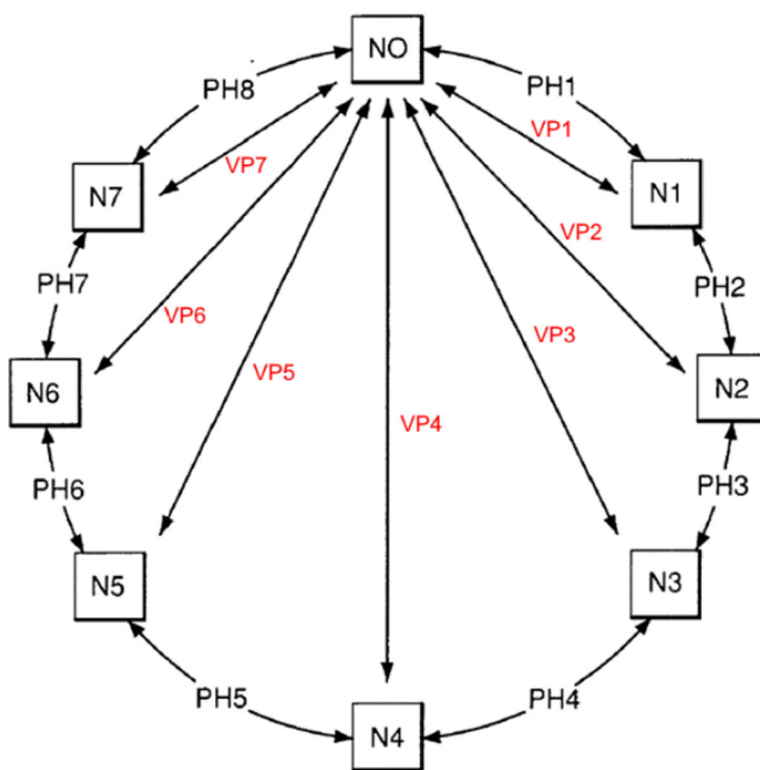


FIG. 1

EX1008, Fig. 1 (annotated)

As shown, Baker’s system includes *nodes* (i.e., N0 through N7) *coupled by links* (i.e., physical links PH1 through PH8) *arranged in a physical topology* (i.e., the ring network comprising nodes N0 through N7, connected by links PH1 to PH8). EX1008, Fig. 1, Abstract, [0005]-[0012], [0031], [0059].

b) [25a] “a controller which is adapted to:”

Baker in view of Wright, Lemieux, and the knowledge of a POSITA discloses or renders obvious this limitation.

Baker describes that a “head node” (i.e., N0 of Figure 1) “is designated that will execute a set of special ‘star overlay’ procedures.” *Id.*, [0047].

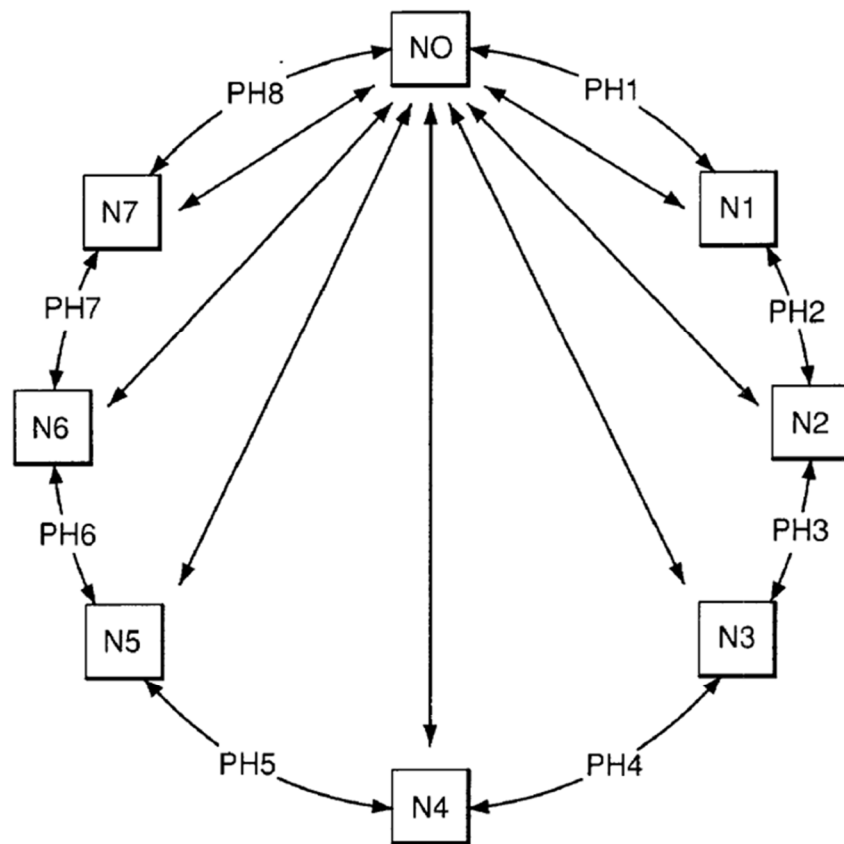


FIG. 1

EX1008, Fig. 1

Baker explains that this head node (also referred to as the “peer group leader” or “PGL”) can be associated with additional resources, i.e., **processing power**, memory, or redundant hardware. *Id.* The head node is responsible for flooding information about the physical and logical topologies across the nodes of the network. *Id.*, [0047]-[0054]. Accordingly, Baker discloses a *controller* (e.g., a processor) within a peer group leader node in its system.

To the extent any additional disclosure is required, Wright also discloses that it was known to use a processor to perform bandwidth allocation in a network, e.g., disclosing “a computer program product for traffic engineering of connectionless VPN services comprises a **storage medium readable by a processing circuit and storing instructions for execution by the processing circuit for performing a method.**” EX1007, 2:39-43. Lemieux also discloses a “connection admission control (CAC),” e.g., disclosing “[o]nce established, the network 111 is informed, **through its connection admission control (CAC) functionality**, to open a connectionless connection oriented flow arrangement to support admission of the flow of bursty video conference traffic to the network 111 using the established logical network topology.” EX1009, 9:25-28. Similar to Lemieux, the ’431 patent also discloses the use of a “connection admission controller (CAC) 24 which performs the functions” of the patent. EX1001, 6:47-53.

Accordingly, the combination of Baker in view of Wright, Lemieux, and the knowledge of a POSITA (Geier, ¶92) discloses *a controller which is adapted to perform the remaining limitations of claim 25, as explained below.*

c) [25b] “*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,*”

Baker in view of Wright, Lemieux, and the knowledge of a POSITA discloses or renders obvious this limitation.

In the combined system with Baker and Lemieux (*see* § VI.B.5, *infra*), Wright discloses this limitation for the same reasons discussed above in § VI.A.3.c for Ground 1, *supra*.

To the extent any further disclosure is required, Lemieux discloses *the logical connections being associated with a data transmission service to be provided over the network*, because it describes that “the **physical topology** of the aggregation network 111 may be configured to provide multiple logical topologies at the same time to handle the needs of different subscriber bursty communications service requests.” EX1009, 8:12-9:2. For example, once a logical topology in Lemieux has been established, Lemieux notes that “[o]nce established, **the network 111 is informed, through its connection admission control (CAC) functionality**, to open a connectionless connection oriented flow arrangement to support admission of the flow of bursty **video conference traffic to the network 111 using the established logical network topology.**” *Id.*, 9:25-28. Lemieux also explains that other services can be provided via established logical networks, including file

transfer (FTP) and video-on-demand (VOD) services. *Id.*, 4:15-26, 9:3-28, 11:21-13:12. Accordingly, Lemieux demonstrates a POSITA would have known that logical connections would be *associated with a data transmission service to be provided over the network*. See also Geier, ¶94.

d) [25c] “*the logical connections having a connection topology different from the physical topology,*”

Baker in view of Wright, Lemieux, and the knowledge of a POSITA discloses or renders obvious this limitation.

Baker describes that in its system, “[t]he problems in the prior art are addressed in accordance with the principles of the invention **by overlaying a logical star topology on a non-star network, such as a ring network**, such that signals are transmitted through the underlying non-star network in accordance with the overlaid logical star topology.” EX1008, [0012].

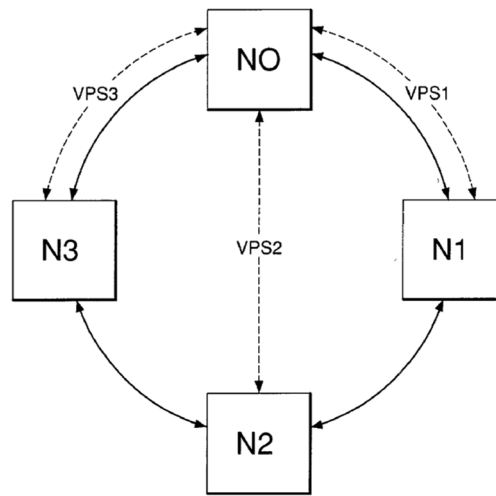
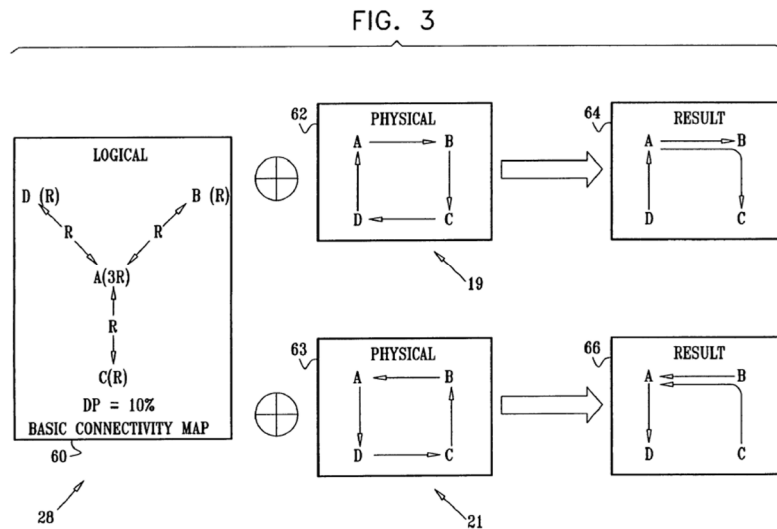


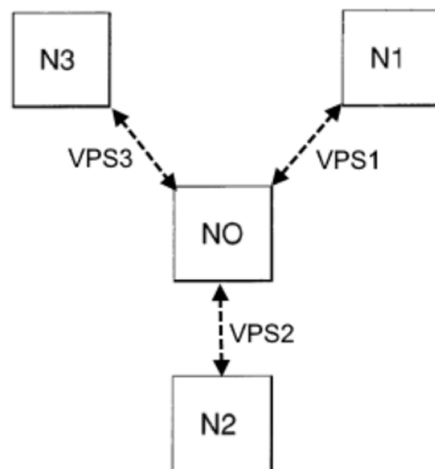
FIG. 4

EX1008, Fig. 4

Notably, Baker’s Figure 4 illustration of a four-node network, where the physical topology is a ring network, and the logical topology is a star network, is nearly identical to Figure 3 of the ’431 patent. *Id.*, Fig. 4; EX1001, Fig. 3.



EX1001, Fig. 3



**Alternative presentation of Baker (EX1008)'s Fig. 4
(representing a star logical network similar to the '431 patent's Fig. 3)**

For example, node N0 from Baker is equivalent to node A of the '431 patent, and nodes N1, N2, and N3 from Baker are equivalent to nodes B, C, and D of the '431 patent. Accordingly, like the '431 patent, Baker's Figure 4 represents *logical connections having a connection topology different from the physical topology*.

Wright also discloses *logical connections having a connection topology different from the physical topology*, e.g., in Figures 1 and 3:

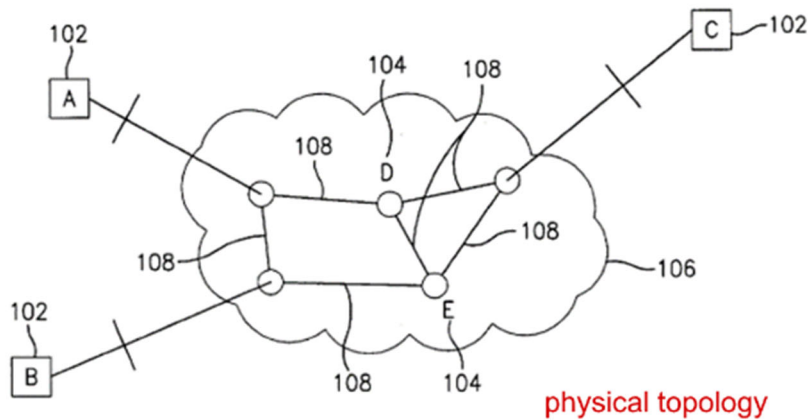


FIG. 1

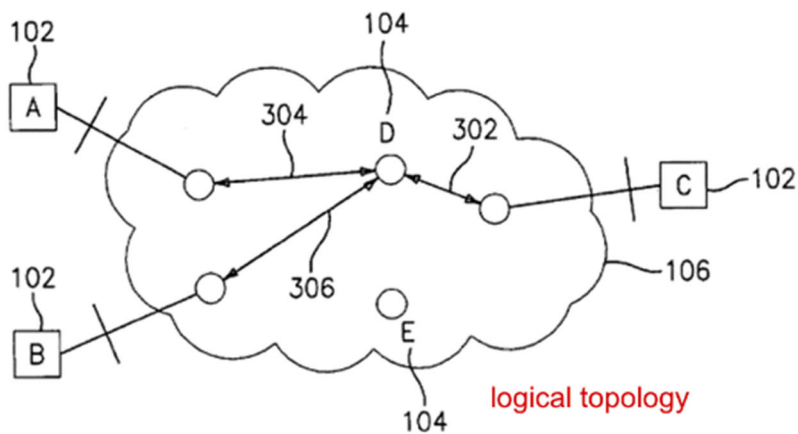


FIG. 3

EX1007, Figs. 1 & 3 (annotated)

EX1007, 3:54-5:22, Figs. 1, 3.

Finally, Lemieux explains that “**FIGURE 2 is a schematic diagram illustrating the physical interconnection** of an aggregation network in a partially meshed network topology; and **FIGURES 3A-3C are schematic diagrams illustrating the implementation of different logical network topologies** using the partially meshed physical network topology for the aggregation network of FIGURE 2.” EX1009, 2:23-27.

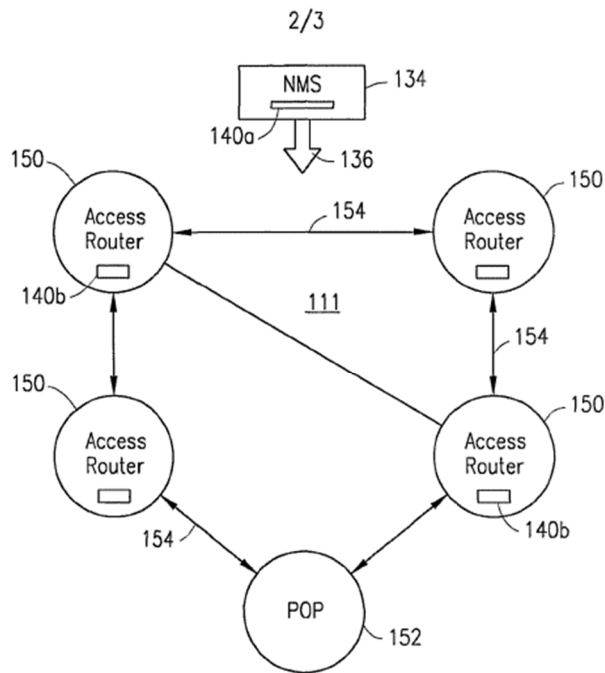


FIG. 2

EX1009, Fig. 2

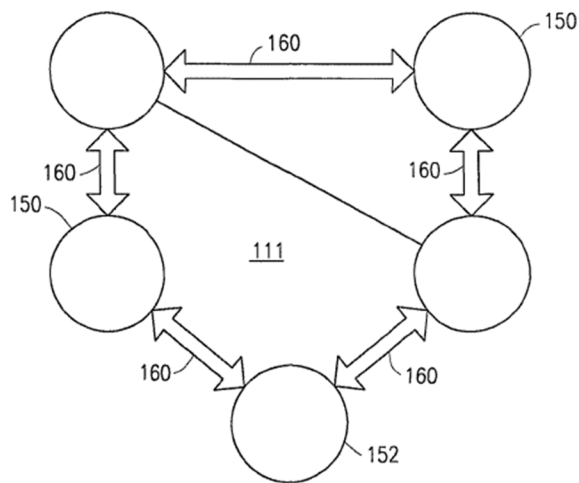


FIG. 3A

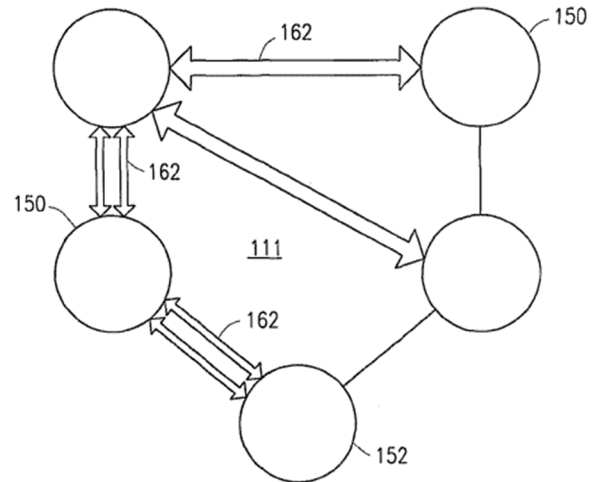


FIG. 3B

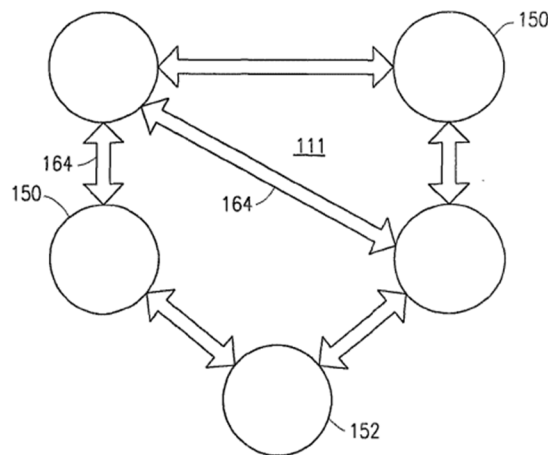


FIG. 3C

EX1009, Figs. 3A-3C

Accordingly, in the combined system of Baker, Wright, and Lemieux described below in § VI.B.5, the teachings of any reference in the combination are sufficient to disclose this limitation.

e) [25d] “**determine respective bandwidth requirements for the logical connections based on parameters of the service,**”

Baker in view of Wright, Lemieux, and the knowledge of a POSITA discloses or renders obvious this limitation.

Baker considers bandwidth requirements as part of its disclosure. For example, Baker notes that, when a logical topology is applied, “[t]he resulting logical star architecture depicted in FIG. 5 provides distinct advantages over the underlying ring depicted in FIG. 2 in such areas as control channel processing, protection switching, dynamic administration, **bandwidth management**, automatic provisioning, and Switched Virtual Circuit (SVC) signaling.” EX1008, [0059]. Baker also explains that its head node can “effectively manage the network feeder utilization,” and “[b]y centralizing this function, resources such as bandwidth can be more effectively managed.” *Id.*, [0062]. Like the ’431 patent, Baker also acknowledges that there is a lower cost in a logical network due to the reduced number of hops and processing power, e.g., “[i]t is important to remember that **the cost of traversing each physical node in a multiple physical node traversal has been significantly decreased by virtue of the virtual path assignments imposed on the network.**” *Id.*, [0086].

In view of these teachings, and for the reasons described in § VI.B.5, *infra*, a POSITA would have considered Wright’s teaching to supplement the bandwidth

management considered by Baker. Accordingly, in the combined system with Baker and Lemieux, Wright discloses limitation 25d for the same reasons discussed above in § VI.A.3.e for Ground 1, *supra*.

Finally, to the extent any additional disclosure is required, it was known to determine bandwidth requirements for logical connections *based on parameters of the service*, because Lemieux discloses “a resource handler functionality (140) **determines which one of a plurality of logical network topologies** (ring (160), duplicated tree (162) or partially meshed (164)) **is best suited to support the provision of communications** for that requested bursty **traffic service**.” EX1009, Abstract. Like the ’431 patent’s disclosure of video on demand service, disclosed examples of bursty traffic services that can be provided over logical networks in Lemieux include multimedia, video conferencing, file transfer (FTP), video-on-demand, and games-on-demand services. *Id.*, 4:15-26, 9:3-28, 11:21-13:12. In view of this disclosure, a POSITA would have understood that Lemieux’s teaching of determining which logical topology “is best suited to support the provision of communications for that requested bursty traffic service” is a determination *based on parameters of the service*. Geier, ¶97.

Accordingly, in the combined system of Baker, Wright, and Lemieux described below in § VI.B.5, Wright and Lemieux’s teachings disclose or render obvious this limitation. *See also* Geier, ¶98.

f) [25e] “*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*”

Baker in view of Wright, Lemieux, and the knowledge of a POSITA discloses or renders obvious this limitation.

Baker discloses *map the connection topology to the physical topology*, because it discloses that “a ‘head’ node is designated that will execute a set of special ‘star overlay’ procedures,” including execution of an “Administer Ring routine.” EX1008, [0047], [0052]. The routine is described in detail in Baker’s paragraphs 53, 55, and 56, but more importantly, “[t]he result of the Administer Ring routine **is the assignment of one or more virtual paths from the head node to each of the other nodes in the ring.**” *Id.*, [0054]. Baker explains the “logical architecture equates to a star topology that is overlaid on the underlying ring network, as depicted in FIG. 4, where VPG1, VPG2, and VPG3 represent sets of virtual path addresses where each of [VPS1], [VPS2] and [VPS3] represent a set of one or more virtual paths” *Id.*

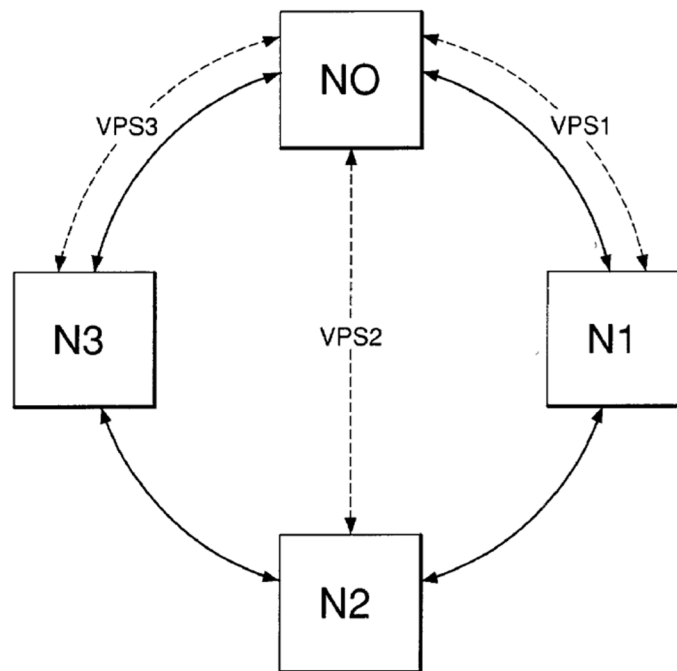


FIG. 4

EX1008, Fig. 4

Furthermore, in Baker, *each of the logical connections is associated with one or more links of the physical topology*. For example, Figure 1 “illustrates a bidirectional physical communications ring where 0 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 according to one embodiment of this invention.” *Id.*, [0031].

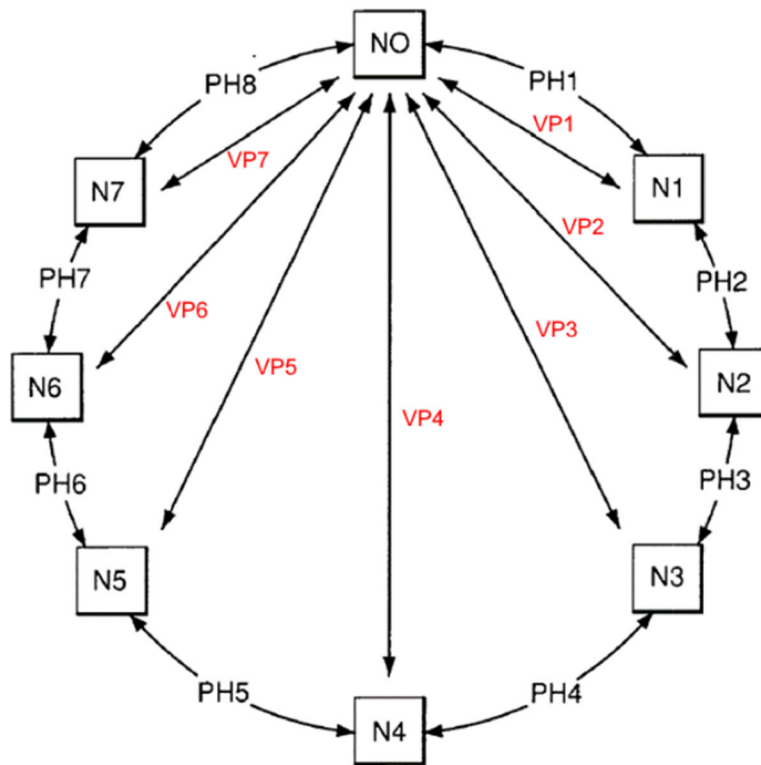


FIG. 1

EX1008, Fig. 1 (annotated)

Baker continues:

Here PH1 links N0 to N1, PH2 links N1 to N2, PH3 links N2 to N3 The physical links between the nodes result in a **physical ring topology**. The virtual paths, however, represent a **logical star topology** overlaid on the physical ring, where node N0 is the central node of the logical star topology. In particular, VP1 links N0 to N1, VP2 links N0 to N2 As used in this specification, the terms “virtual” and “logical” are used interchangeably.

Id., [0032]. Next, Baker explains how the system would operate absent its invention, e.g., “communication from N2 to N6 would involve a minimum of four hops, e.g., a first hop from N2 to N3 via physical path PH3, a second hop from N3 to N4 via physical path PH4, a third hop from N4 to N5 via physical path PH5, and a fourth hop from N5 to N6 via physical path PH6.” *Id.*, [0034]. But, using the virtual topology, network resources associated with overhead processing are reduced:

Although the total number of physical hops in the two topologies is the same (i.e., four), the total amount of overhead processing for the two communications is different. In particular, **the communication absent the invention involves “full-overhead” processing at nodes N2, N3, N4, and N5, while the communication in the overlaid logical star topology of the invention involves full-overhead processing at nodes N2 and N0 (i.e., the start nodes of the two logical hops), but only “reduced-overhead” processing at nodes N1 and N7 (i.e., the intermediate nodes of the two logical hops). As a result, the total overhead processing for the communication of the invention is less than that for the communication absent the Invention.**

Id., [0035]. This disclosure demonstrates that the *logical connection* from N2 to N6 (i.e., through N0) involves travel along the physical links (*associated with one or more links of the physical topology*) connecting N2, N1, N0, N7, and N6 (in that order), but only requires “full-overhead” processing at N2 and N0, as shown in the annotated diagram of Figure 1 below.

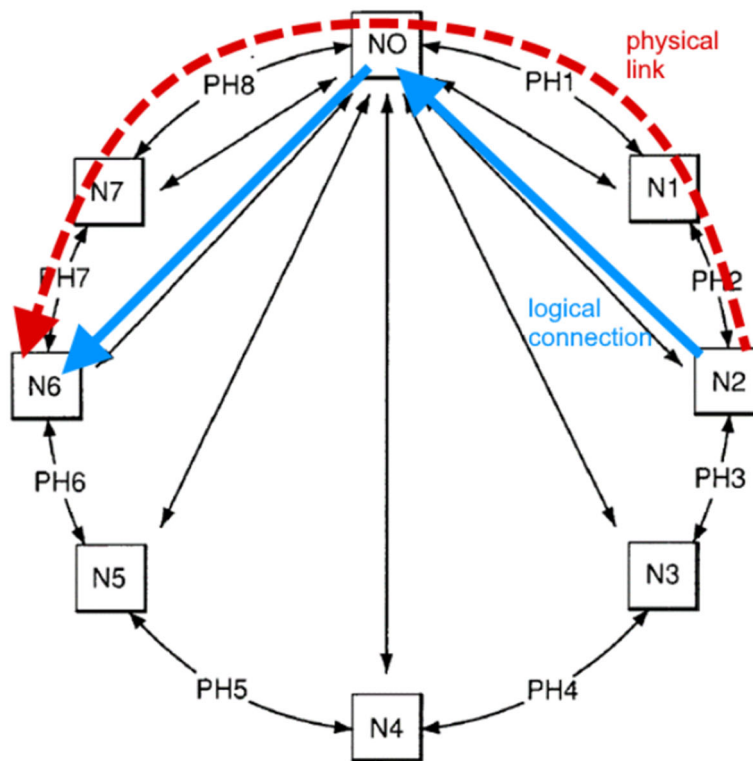


FIG. 1

EX1008, Fig. 1

See also Geier, ¶100.

g) [25f] “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.”

Baker in view of Wright, Lemieux, and the knowledge of a POSITA discloses or renders obvious this limitation.

In the combined system, as explained below (*see* § VI.B.5, *infra*), and for the reasons discussed above in limitation 25d, a POSITA would have looked to Wright

and Lemieux for disclosures related to calculating bandwidth in the combination. *See* § VI.B.3.e, *supra*. For this limitation, Wright discloses limitation 25f for the same reasons discussed above in § VI.A.3.g for Ground 1, *supra*. Accordingly, in the combined system of Baker, Wright, and Lemieux described below in § VI.B.5, Wright’s teachings disclose or render obvious this limitation. *See also* Geier, ¶102.

4. Claim 26

a) [26a] “Apparatus according to claim 25, wherein the controller is comprised in one of the nodes.”

Baker in view of Wright, Lemieux, and the knowledge of a POSITA discloses a *controller* as shown above in § VI.B.3.b for limitation 25a, *supra*.

Furthermore, the combined system discloses a *controller is comprised in one of the nodes* as shown above in § VI.B.3.b for limitation 25a. Baker explicitly describes a “peer group leader” node (or head node) in the system that is responsible for performing the functions of claim 25. EX1008, [0046]-[0054]; *see* § VI.B.3.b, *supra*. Baker describes that, referring to Figure 2, “N0 is configured to be the head node.” *Id.*, [0048].

5. Motivation to combine Wright and Lemieux’s teachings with Baker

A POSITA would have been motivated to incorporate the teachings of Wright related to quality of service (QoS), bandwidth calculation, and bandwidth allocation into Baker’s system such that Baker’s system is enhanced to explicitly calculate and

allocate bandwidth as taught by Wright; the combination would have resulted in a system that explicitly calculates the bandwidth required by a logical network applied on top of a physical network, and then allocates that bandwidth on the physical links of the physical network to support the logical network. Geier, ¶104.

A POSITA would have recognized that Baker considers bandwidth requirements as part of its disclosure but lacks specific implementation details on calculation and allocation. For example, Baker notes that, when a logical topology is applied, “[t]he resulting logical star architecture depicted in FIG. 5 provides distinct advantages over the underlying ring depicted in FIG. 2 in such areas as . . . **bandwidth management**.” EX1008, [0059]. Baker also explains that its head node can “effectively manage the network feeder utilization,” and “[b]y centralizing this function, **resources such as bandwidth can be more effectively managed**.” *Id.*, [0062]. Baker also acknowledges that there is a lower cost in a logical network due to the reduced number of hops and processing power, e.g., “[i]t is important to remember that the cost of traversing each physical node in a multiple physical node traversal has been significantly decreased by virtue of the virtual path assignments imposed on the network.” *Id.*, [0086].

A POSITA would have therefore recognized Baker as providing a base system and framework for applying a variety of logical networks on top of physical networks, ready for improvement with Wright’s teachings. Geier, ¶105.

Implementing Wright’s teachings would have enhanced Baker’s system, e.g., by providing functionality to calculate the bandwidth required in a logical network that is applied on top of a physical network topology. Geier, ¶105. Motivated by Baker’s general teachings as to bandwidth, a POSITA would have looked to Wright for specific implementation details on how to efficiently determine and allocate bandwidth between edge nodes and service nodes in a single logical topology. EX1007, Figs. 2-3, 4:20-5:9. Wright discloses that a “bandwidth requirement for each link in the restricted topology is calculated.” *Id.*, Abstract, 2:23-48. Wright also describes it was known that “**network services** . . . may be characterized by a **quality of service (QoS)** metric, or guarantee,” and that “**bandwidth allocation** is a fundamental requirement for a variety of QoS guarantees.” *Id.*, 1:30-44. “The basic technique for providing QoS guarantees is the allocation of network resources along the path of the service instance.” *Id.*, 1:34-44.

A POSITA would have understood the benefits of incorporating these teachings from Wright into the base system of Baker, as this would allow Baker’s system to calculate a bandwidth requirement for its logical network, and allocate the bandwidth associated with that logical network on the physical links of the underlying physical network, given Baker’s lack of disclosure on these details. Geier, ¶107. Accordingly, a POSITA would have understood that Wright’s teachings would be useful in the system of Baker primarily because Baker does not otherwise

disclose how bandwidth can be calculated and allocated. *Id.* However, given the overlap in subject matter between the two references, a POSITA would have immediately recognized the benefit and applicability of Wright’s teachings to Baker’s system. *Id.*

The teachings of Lemieux related to service-specific logical topologies, as well as providing multiple logical topologies, would have further enhanced Baker’s system. For instance, while Baker itself is primarily focused on applying a logical star (or hub and spoke) topology on top of a physical ring topology (EX1008, Abstract, [0005]-[0012], [0031], [0047]-[0054], Figs. 1, 4), Lemieux discloses that a “physical topology . . . may be configured to provide multiple logical topologies at the same time to handle the needs of different subscriber bursty communications service requests.” EX1009, 8:12-9:2; *see* § VI.B.2, *supra*. Lemieux further explains that other services can be established via various logical networks, and that certain logical networks may be better suited for certain service applications to be provided on the network (e.g., video conferencing, file transfer, and video-on-demand services may be better suited to different logical network topologies). *Id.* A POSITA would have readily understood the benefits of applying Lemieux’s teachings of applying multiple and different logical topologies to Baker’s system to provide logical topologies best suited for a given service on the network. Geier, ¶108.

This discussion demonstrates that several rationales support obviousness:

- i. Combining prior art elements (Wright’s teachings of calculating bandwidth and Lemieux’s service-based logical networks with Baker’s system for applying logical networks on top of physical networks) according to known methods (implementing the teachings of Wright and Lemieux to enhance the capabilities of Baker’s system) to yield predictable results (Baker’s system have additional functionality related to bandwidth determination and allocation, and different logical network structures for specific services); and
- ii. Applying a known technique (Wright’s teachings on calculating and allocating bandwidth and Lemieux’s teachings of service-based logical networks) to a known device (Baker’s system) ready for improvement to yield predictable results (a more efficient system for calculating and allocating bandwidth in a variety of service-based logical networks applied on top of a physical network).

KSR, 550 U.S. at 415-22.

A POSITA would have had a reasonable expectation of success in combining Baker, Wright, and Lemieux because they all relate to the application of a logical network topology on top of a physical network topology. *See* §§ VI.A.2, VI.B.1-2, *supra*. Both Baker and Wright consider the importance of bandwidth in the context of a logical network. *Id*; *see also* §§ VI.B.3.e & VI.B.3.g, *supra*. This would have

required minimal modifications to Baker’s system (merely implementing Wright’s teachings of additional teachings on bandwidth calculation and allocation and Lemieux’s teachings on multiple/different logical topologies for specific services), and the combination would have led to a predictable result (Baker’s system with the added functionality to perform the bandwidth calculation and allocation methods described in Wright, and apply multiple and/or different logical topologies as described in Lemieux). Geier, ¶109; *see Pfizer*, 480 F.3d at 1364.

VII. DISCRETIONARY INSTITUTION – 35 U.S.C. § 314(a)

The factors considered in *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB March 20, 2020) and *NHK Spring Co. v. Intrix-Plex Techs., Inc.*, IPR2018-00752, Paper 8 (PTAB Sept. 12, 2018) (precedential) do not weigh in favor of denial. Unified is not a defendant in a related court case. To the extent the Board is considering applying the factors beyond the holdings in those cases, the factors weigh against exercising discretion to deny. The pending district court cases involving the ’431 patent are still at early stages; in two cases (1:22-cv-00496 and -00497), no answer has yet been filed, and in the other (6:22-cv-00396), claim construction has not yet begun, and a Motion to Change Venue is currently pending. Further, due to their early stages, there appears to have been little investment in the district court cases by the court and parties, and there appears to be little overlap between the issues raised in this Petition and in the court cases.

Moreover, this Petition presents a “compelling unpatentability challenge” because it shows the Challenged Claims are obvious under two different grounds that consider various potential interpretations of the claims. *See* § VI, *supra*. This alone demonstrates that the Board should not discretionarily deny institution. USPTO Interim Procedure For Discretionary Denials In AIA Post-Grant Proceedings With Parallel District Court Litigation, June 21, 2022, 4-5.

VIII. CERTIFICATION OF GROUNDS FOR STANDING

Petitioner certifies pursuant to Rule 42.104(a) that the patent for which review is sought is available for *inter partes* review and Petitioner is not barred or estopped from requesting an *inter partes* review challenging the patent claims on the ground identified in this petition.

IX. CONCLUSION

For the foregoing reasons, Petitioner respectfully requests *inter partes* review of claims 25-27 of the '431 patent.

Dated: September 29, 2022

Respectfully Submitted,

/David C. Seastrunk/

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APPENDIX: CLAIM LISTING FOR U.S. PATENT 7,330,431

Claim 25

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

[25a] a controller which is adapted to:

[25b] 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,

[25c] the logical connections having a connection topology different from the physical topology,

[25d] determine respective bandwidth requirements for the logical connections based on parameters of the service,

[25e] 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

[25f] 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.

Claim 26

[26a] Apparatus according to claim 25, wherein the controller is comprised in one of the nodes.

Claim 27

[27a] Apparatus according to claim 25, wherein the controller is external to the network.

CERTIFICATION UNDER 37 CFR § 42.24(d)

Under the provisions of 37 CFR §42.24(d), the undersigned hereby certifies that the word count (using the word counting function of this Word processor, Microsoft Word for Windows, Version 2208, Build 15601.20148) for the foregoing Petition for *Inter Partes* Review—excluding the Table of Contents, List of Exhibits, Mandatory Notices, Appendix, Certification Under § 42.24(d), and Certificate of Service—totals 13,903 words, which is less than the 14,000 allowed under 37 CFR §42.24(a)(i).

Dated: September 29, 2022

Respectfully Submitted,

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CERTIFICATE OF SERVICE

I hereby certify that on September 29, 2022, I caused a true and correct copy of the foregoing materials:

- Petition for *Inter Partes* Review of U.S. Patent No. 7,330,431
- Exhibit List
- Exhibits for Petition for *Inter Partes* Review of U.S. Patent No. 7,330,431 (EX1001 – EX1019)
- Power of Attorney
- Word Count Certification under 37 C.F.R. § 42.24(d)

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