

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CISCO SYSTEMS INC., DELL TECHNOLOGIES INC., AND DELL INC.,
Petitioners

IPR2023-00169
U.S. Patent No. 7,330,431

**DECLARATION OF HENRY HOUE, PH.D.,
UNDER 37 C.F.R. § 1.68 IN SUPPORT OF PETITION
FOR *INTER PARTES* REVIEW**

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I, Henry Houh, Ph.D., do hereby declare as follows:

I. INTRODUCTION

1. I am making this declaration at the request of Cisco Systems, Inc., Dell Technologies, Inc., and Dell Inc. (“Petitioners”) in the matter of the *Inter Partes* Review of U.S. Patent No. 7,330,431 (“the ’431 patent”) to Rao et al.

2. I am being compensated for my work in this matter at my standard hourly rate. I am also being reimbursed for reasonable and customary expenses associated with my work and testimony in this proceeding. My compensation is not contingent on the outcome of this matter or the specifics of my testimony.

3. I have been asked to provide my opinions regarding whether the subject matter of claims 1-26 (“the Challenged Claims”) of the ’431 patent would have been obvious to a person having ordinary skill in the art (“POSITA”) at the time of the alleged invention, in light of the prior art. It is my opinion that the Challenged Claims would have been obvious to a POSITA.

4. In the preparation of this declaration, I have studied:

- a. the ’431 patent, Ex. 1001;
- b. the prosecution history of the ’431 patent (“’431 File History”), Ex. 1002;
- c. U.S. Patent Pub. No. 2004/0095946 to Baker et al. (“Baker”), Ex. 1005;

d. U.S. Patent Pub. No. 2004/0174884 to Wright (“Wright”), Ex. 1006;

e. U.S. Patent No. 6,104,699 to Holender et al. (“Holender”), Ex. 1007; and

f. U.S. Patent No. 6,757,247 to Zheng et al. (“Zheng”), Ex. 1008.

5. In forming the opinions expressed below, I have considered: the documents listed above; the relevant legal standards, including the standard for obviousness; and my own knowledge and experience based upon my work in the field of network communications and security as described below, as well as portions of the following additional materials:

a. U.S. Patent Pub. No. 2003/0147400 to Devi (“Devi”), Ex. 1009;

b. U.S. Patent No. 6,430,150 to Azuma et al. (“Azuma”), Ex. 1010;

c. U.S. Patent Pub. No. 2007/0038753 to Jorgensen (“Jorgensen”), Ex. 1011;

d. U.S. Patent No. 7,675,926 to Olsen et al. (“Olsen”), Ex. 1012;

e. U.S. Patent No. 7,953,888 to Ricciulli (“Ricciulli”), Ex. 1013;

f. U.S. Patent No. 7,450,598 to Chen et al. (“Chen”), Ex.1014;

g. Houh, Henry H., “Designing Networks for Tomorrow’s Traffic,”

Thesis for the degree of Doctor of Philosophy at the Massachusetts Institute of Technology, February 1998 (“Houh”), Ex.1015; and

h. U.S. Patent Pub. No. 2004/0223497 to Sanderson et al.
 (“Sanderson”), Ex.1018.

6. Unless otherwise noted, all **emphasis** in any quoted material has been added. Claim terms are *italicized*.

II. QUALIFICATIONS AND PROFESSIONAL EXPERIENCE

7. My complete qualifications and professional experience are described in my *Curriculum Vitae*, a copy of which can be found in Exhibit 1004. The following is a brief summary of my relevant qualifications and professional experience.

8. I received a Ph.D. in Electrical Engineering and Computer Science from the Massachusetts Institute of Technology (“MIT”) in 1998. I also received a Master of Science degree in Electrical Engineering and Computer Science in 1991, a Bachelor of Science degree in Electrical Engineering and Computer Science in 1989, and a Bachelor of Science Degree in Physics in 1990, all from MIT.

9. I am currently self-employed as an independent technical consultant. I am also founder and until October 2022 was president of a company that provides supplemental science, technology, engineering, and mathematics (“STEM”) education to children of all ages.

10. I first worked in the area of telecommunications in 1987 when I worked as a summer intern at AT&T Bell Laboratories as part of a five-year dual degree

program at MIT. I continued to work at AT&T Bell Laboratories as part of this MIT program. Later, as part of my doctoral research at MIT from 1991-1998, I was a research assistant in the Telemedia Network Systems (“TNS”) group at the Laboratory for Computer Science. The TNS group built a high-speed gigabit network and created applications that ran over the network. Example applications included ones for remote video capture, processing, and display of video on computer terminals. In addition to working on the design of core network components, designing and building the high speed links, and designing and writing the device drivers for the interface cards, I also set up the group’s web server. The graduate students in the group managed all of the networking infrastructure of the group, including the routers and switches. Our system was based on the ATM protocol, and we offered several classes of service on our network. Furthermore, while some of our nodes were organized in a ring, we offered full mesh connectivity between a subset of nodes using permanent virtual circuits. I designed the system of distributing the virtual path/virtual circuit mappings which were distributed to each switch from my workstation, which acted as a controller for the virtual circuit setup.

11. The TNS group was the first group to initiate a remote video display over the web. I helped to build the web pages that initiated these video sessions via a web interface. Vice-President Al Gore visited our group in 1996 and received a

demonstration of – and remotely drove – a radio controlled toy car with a wireless video camera mounted on it; the video was encoded by TNS-designed hardware, streamed over the TNS-designed network and displayed using TNS-designed software.

12. I defended and submitted my Ph.D. thesis, titled “Designing Networks for Tomorrow’s Traffic,” in January 1998. As part of my thesis research, I analyzed local-area and wide-area flows, which included a large volume of TCP-based traffic, to show a more efficient method for routing packets in a network, based on traffic patterns at the time. My thesis also addressed real-time streamed audio and video.

13. From 1997 to 1999, I was a Senior Scientist and Engineer at NBX Corporation, a start-up that made business telephone systems for streaming packetized audio over data networks instead of using traditional telephone lines. NBX was later acquired by 3Com Corporation, and the phone system is still used today by numerous businesses. As part of my work at NBX, I designed the core audio reconstruction algorithms for the telephones, as well as the packet transmission algorithms. I also designed and validated the core packet transport protocol used by the phone system. The protocol was used for all signaling in the phone system, including for the setup of conference calls. The NBX system also featured a computer interface for initiating phone calls, which could also initiate conference calls. The NBX system also supported TAPI, the Telephony Application

Programming Interface, thus allowing other computer programs to integrate with our system telephony features. I also designed the quality of service implementation for the system, which utilized the IEEE 802.1p protocol for adding traffic classes as well as supporting virtual local area networks using the IEEE 802.1Q protocol. We obtained U.S. Patent No. 6,967,963, entitled “Telecommunication method for ensuring on-time delivery of packets containing time-sensitive data,” as a result of part of this work.

14. From 1999-2004, I was employed by Empirix or its predecessor company, Teradyne. Empirix was a leader in test tools for telecommunications protocols and systems, providing functional testing tools as well as load testing tools. From 2000-2001, I conceived and built a test platform for testing Voice-over-IP (VoIP). The first application on this new test platform was a cloud emulator for simulating the effects of transmitting VoIP over a busy network. I also prototyped a security product for web sites, by studying various types of web site attacks and designing and building a program which would determine whether security flaws existed in a customer’s web site. We tested the product on several customer web sites.

15. In 2006, as part of my role at BBN Technologies, I helped found PodZinger Inc., now known as RAMP Inc. PodZinger utilized BBN’s speech recognition algorithms to search through the spoken words in audio and video

segments. While I was Vice President of Operations and Technology, PodZinger followed its initial prototype with a full streaming audio and video search solution have been awarded several United States patents. BBN also worked on network security issues, and I worked with BBN researchers in reviewing their network security projects, such as in zero-day network attack prevention.

16. I have several patent applications pending including the following examples:

- U.S. Patent No. 7,975,296, “Automated security threat testing of web pages”,
- U.S. Patent No. 7,877,736, “Computer language interpretation and optimization for server testing”,
- U.S. Patent No. 7,801,910, “Method and apparatus for timed tagging of media content”,
- U.S. Patent 7,590,542, “Method of Generating Test Scripts Using a Voice-Capable Markup Language”,
- U.S. Patent No. 6,967,963, “Telecommunication method for ensuring on-time delivery of packets containing time-sensitive data”, U.S. Patent Publication No. 20070106685, “Method and apparatus for updating speech recognition databases and reindexing audio and video content using the

same”,

- U.S. Patent Publication No. 20070106693, “Methods and apparatus for providing virtual media channels based on media search”,
- U.S. Patent Publication No. 20070106760, “Methods and apparatus for dynamic presentation of advertising, factual, and informational content using enhanced metadata in search-driven media applications”,
- U.S. Patent Publication No. 20070112837, “Method and apparatus for timed tagging of media content”,
- U.S. Patent Publication No. 20070118873, “Methods and apparatus for merging media content”,
- U.S. Patent Publication No. 20090222442, “User-directed navigation of multimedia search results”.

17. I have also published several papers related to networking. Those papers include “IP switching: server driven flow classification,” H. H. Houh, *Proceedings of the Washington University Workshop on Integration of IP and ATM*, November 1996, “ViewStation Applications: Implications for Network Traffic,” C. J. Lindblad, D. Wetherall, W. Stasior, J. F. Adam, H. H. Houh, M. Ismert, D. Bacher, B. Phillips, and D. L. Tennenhouse, *IEEE Journal of Selected Areas in Communications*, 1995, and “The VuNet Desk Area Network: Architecture,

Implementation, and Experience,” H. H. Houh, J.F. Adam, M. Ismert, C. J. Lindblad, and D. L. Tennenhouse, *IEEE Journal of Selected Areas in Communications*, 13 (4), May, 1995.

III. LEVEL OF ORDINARY SKILL IN THE ART

18. I understand there are multiple factors relevant to determining the level of ordinary skill in the pertinent art, including (1) the levels of education and experience of persons working in the field at the time of the invention; (2) the sophistication of the technology; (3) the types of problems encountered in the field; and (4) the prior art solutions to those problems.

19. A POSITA in the field of the '431 patent, as of its priority date of September 3, 2004, would have been someone knowledgeable and familiar with network communications techniques and quality of service techniques available in the mid-2000s. Such a POSITA would have a bachelor's degree in computer science, computer engineering, electrical engineering, or equivalent training, and approximately two years of experience working in the field of network communications, or more particularly, the use of logical topologies and quality of service techniques. Additional work experience can substitute for specific educational background, and vice versa.

20. For purposes of this Declaration, in general, and unless otherwise noted, my statements and opinions, such as those regarding my own experience and what a

POSITA would have understood or known generally (and specifically related to the references I consulted herein), reflect the knowledge that existed in the relevant field as of the priority date of the '431 patent.

IV. RELEVANT LEGAL STANDARDS

21. I am not an attorney. In preparing and expressing my opinions and considering the subject matter of the '431 patent, I am relying on certain basic legal principles that Cisco's counsel has explained to me.

22. I understand that prior art to the '431 patent includes patents and printed publications in the relevant art that predate the priority date of the '431 patent. For purposes of this Declaration, I am applying September 3, 2004, as the priority date of the '431 patent.

23. I have been informed by Cisco's counsel that a claimed invention is unpatentable under 35 U.S.C. § 103 if the differences between the claimed invention and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a POSITA. I have also been informed by Cisco's counsel that the obviousness analysis considers factual inquiries, including the level of ordinary skill in the art, the scope and content of the prior art, and the differences between the prior art and the claimed subject matter.

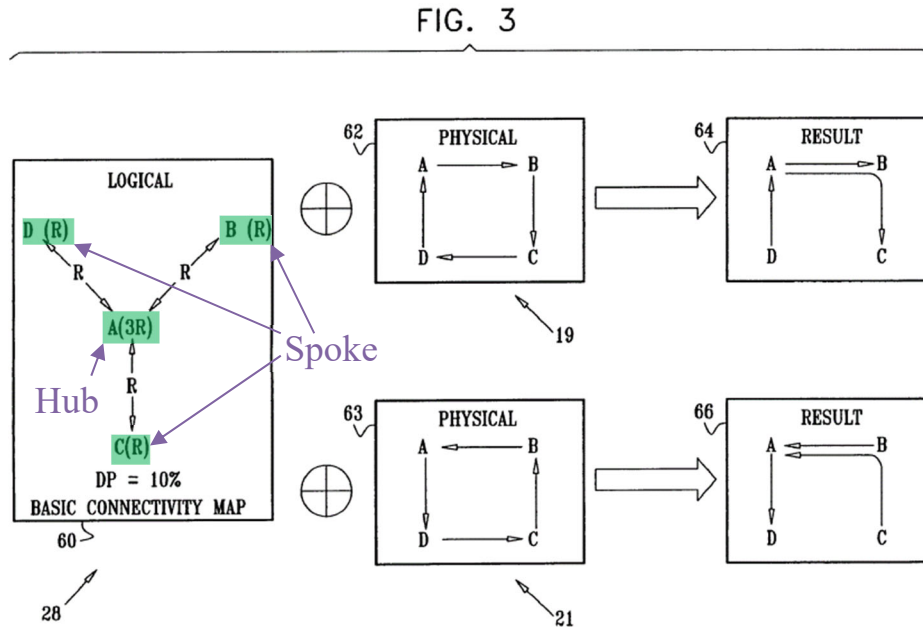
24. I have been further informed by Cisco's counsel that there are several recognized rationales for combining references or modifying a reference to show

obviousness. These rationales include: (a) combining prior art elements according to known methods to yield predictable results; (b) simple substitution of one known element for another to obtain predictable results; (c) use of a known technique to improve a similar device (method, or product) in the same way; (d) applying a known technique to a known device (method, or product) ready for improvement to yield predictable results; (e) choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and (f) some teaching, suggestion, or motivation in the prior art that would have led a POSITA to modify the prior art or to combine prior art teachings to arrive at the claimed invention.

V. OVERVIEW OF THE '431 PATENT

25. The '431 patent focuses on “methods and systems for bandwidth allocation that make more efficient use of the guaranteed bandwidth available on the ring network.” '431 patent, 2:7-10. The ring network includes nodes “coupled by links according to a physical topology,” with “[o]ne or more data transmission services operat[ing] between the nodes.” '431 patent, 2:11-14. Each data transmission service “has a logical connection topology that may be different from the physical topology.” '431 patent, 2:14-16. The '431 patent provides some examples of logical topologies including a “hub-and-spoke” topology and a “full mesh” topology. *See* '431 patent, 2:27-31, 7:63-8:1 (hub and spoke), 10:9-16 (full

mesh). Figure 3 illustrates an example of the hub-and-spoke logical topology side-by-side with the ring physical topology:



'431 patent, Fig. 3 (annotated).

26. An “operator of the network” inputs into a “manager node” information that “defines a logical topology that connects nodes 14 of the network” as well as “required bandwidths for each of the nodes.” ’431 patent, 7:12-28. Once the manager node has the information, the controller of the manager node “maps the logical topology ... to the existing physical topology of the network 12.” ’431 patent, 7:38-41. The manager node sums the bandwidth requirements of each link to result in a mapping bandwidth for each link and “allocates actual bandwidths to each of the links.” ’431 patent, 7:42-62.

27. As I will explain below, these concepts were well known as of the priority date of the '431 patent.

VI. CLAIM CONSTRUCTION

28. It is my understanding that in order to properly evaluate the '431 patent, the terms of the claims must first be interpreted. It is my understanding that for the purposes of this *inter partes* review, the claims are to be construed under the so-called *Phillips* standard, under which claim terms are given their ordinary and customary meaning as would have been understood by a POSITA in light of the specification and prosecution history, unless the inventor has set forth a special meaning for a term. I have also been informed that claim terms only need to be construed to the extent necessary to resolve the obviousness inquiry. I have reviewed the entirety of the '431 patent, as well as its prosecution history. It is my opinion that for purposes of applying the prior art presented herein to evaluate the patentability of the Challenged Claims, no claim terms require express construction.

VII. IDENTIFICATION OF HOW THE CLAIMS ARE UNPATENTABLE

29. The discussion in this Declaration provides a detailed analysis of how the asserted prior art references teach each limitation of the Challenged Claims.

30. As part of my analysis, I have considered, and discuss in detail, the scope and content of the prior art and any differences between the alleged invention and the prior art.

31. It is my opinion that the alleged invention recited in the Challenged Claims would have been obvious in view of the teachings of the asserted prior art and the knowledge of a POSITA.

**VIII. CHALLENGE 1: THE COMBINATION OF BAKER AND WRIGHT
RENDERS OBVIOUS CLAIMS 1-4, 7-9, 11, AND 25-26**

A. Summary of Baker

32. U.S. Patent Pub. No. 2004/0095946 to Baker (Ex. 1005, “Baker”) was filed November 18, 2002, and issued September 1, 2007. Baker is titled “Logical Star Topologies for Non-Star Networks.” Baker was not before the Examiner during prosecution of the ’431 patent.

33. Like the ’431 patent, Baker describes “overlaying a logical ... topology on a non-star network, such as a ring network,” including “automatically assigning network resources to a collection of elements in a network.” Baker, [0012], [0016]. Network resources include bandwidth. Baker, [0062]. The logical topology in Baker is accomplished via “virtual paths.” Baker, [0031]. Baker’s example of a logical topology focuses on a logical star topology. Baker, [0012]; *see, e.g.*, Figure 5 (example of a star topology):

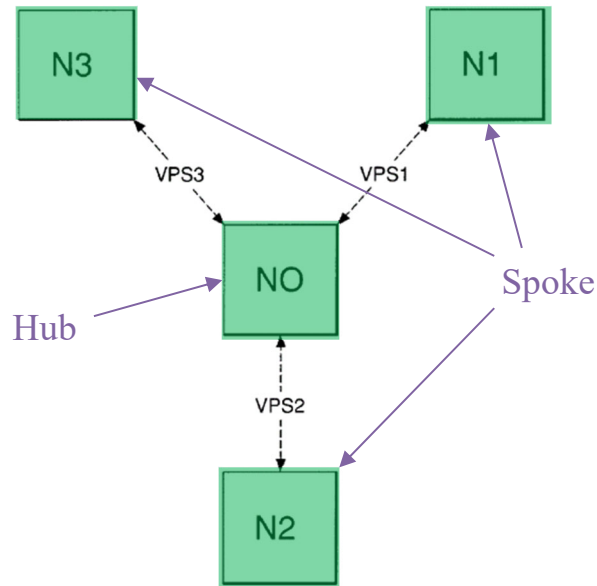


FIG. 5

Baker, FIG. 5 (annotated).

34. Baker’s approach for “automatically assigning network resources” includes “detecting the topology of connected elements in the network, partitioning resources of the network, allocating the network resources, and assigning the network resources to the network elements.” Baker, [0016]. This procedure overlays the logical star topology to the underlying physical ring topology, and is performed by an “Administer Ring” routine implemented at a head node of the network. Baker, [0012], [0051]-[0053]. The result of the routine “is the assignment of one or more virtual paths from the head node to each of the other nodes in the ring” equating to a logical star topology. Baker, [0054].

B. Summary of Wright

35. U.S. Patent Pub. No. 2004/0174884 to Wright (Ex. 1006, “Wright”) was filed March 5, 2003, and published September 9, 2004. Wright is titled “Method for Traffic Engineering of Connectionless Virtual Private Network Services.” Wright was not before the Examiner during prosecution of the ’431 patent.

36. Wright’s physical components of a network include “several edge nodes 102, service nodes 104 ... and internal transport links 108” that provide all of the “possible physical routes for sending packets through the VPN [virtual private network].” Wright, [0015]. Further, Wright discloses a “logical connectivity without regard to the physical implementation.” Wright, [0016]. The logical connectivity is “constrained to a specific restricted topology (e.g., a virtual topology)” through the physical network in order to “minimize the amount of bandwidth reserved on the links 108 to provide a bandwidth QoS [quality of service].” Wright, [0016]-[0017]. The logical connectivity data “are in terms of edge nodes and communication requirements between edge nodes,” such as “queuing and link scheduling mechanisms to provide the bandwidth guarantees for each link.” Wright, [0024], [0018].

37. To achieve the desired traffic engineering, Wright discloses receiving “[l]ogical connectivity data for the edge nodes,” also referred to as “logical connectivity requirements.” Wright, [0007], [0024]. Wright creates the restricted

topology for the VPN service based on the logical connectivity data and the data about the physical connections of the network “to provide logical connections” which have known bandwidth requirements. Wright, [0015], [0017], [0024]. Wright uses this restricted topology, based on the logical connectivity data, to calculate the required reserved physical bandwidth between and at each node. Wright, [0017], [0024]. Once calculated, Wright reserves the required bandwidth “on each link in the restricted topology.” Wright, Abstract, [0005]-[0007], [0018], [0024].

C. Reasons to Combine Baker with Wright

38. A POSITA would have combined Baker with Wright because they both relate to the management of network resources for connections of a logical topology over the underlying connections of a physical topology. Baker, [0016] (“the invention is a method for automatically assigning network resources to a collection of elements in a network. The method includes detecting the topology of connected elements in the network, partitioning resources of the network, allocating the network resources, and assigning the network resources to the network elements”), [0030] (“a logical star topology is overlaid on an underlying non-star network, such as a ring network”); Wright, [0005] (“the method comprises receiving physical connectivity data for a connectionless VPN ... Logical connectivity data for the edge nodes is received. A restricted topology is created in response to the physical connectivity data and to the logical connectivity data. ... A bandwidth requirement

for each link in the restricted topology is calculated. The bandwidth requirement is reserved on each link in the restricted topology.”).

39. Baker discloses overlaying a logical topology (its chief example being a “logical star topology”) “on an underlying non-star network, such as a ring network.” Baker, [0030]. But Baker was not concerned with where the logical topology came from. It was well-known to POSITAs for a node in a network to receive logical topology information. *See, e.g.*, Wright, [0005]; Azuma, 3:63-67 (“Each node in the network retains ... logical topology information relating to routing of paths formed in the links.”); 6:26-36 (“the logical topology must be updated whenever the path establishments are changed as requested by customers. Each node executes the process for updating ... the logical topology autonomously. The ... logical topology table relating to the network maintained in each node are communicated from a node to all the other nodes in the network”). Wright confirms this well-known fact as well. A POSITA would have been motivated to turn to Wright for details about how logical topologies are obtained. Wright discloses a node receiving “logical connectivity data” that is used to define a “restricted topology” over a physical topology (i.e., a logical topology over a physical topology). Wright, [0005]. It would have therefore been obvious for a POSITA to turn from Baker to Wright to supplement Baker with Wright’s details about receiving logical connectivity data.

40. Baker also discloses generally the concept of “assigning network resources to a collection of elements in a network.” Baker, [0016]. Baker explains in passing that the “head node” of the network results in “resources such as bandwidth [being] more effectively managed.” Baker, [0062]. While Baker further mentions “bandwidth management” as one of the features enabled by its disclosure, Baker otherwise leaves it up to a POSITA with respect to what “network resources” can be assigned in a network, as well as how. A POSITA would have therefore been motivated to turn to Wright, which discloses more details about how to assign and manage bandwidth as a type of the network resource disclosed in Baker, both for links between nodes and in the nodes themselves. *See, e.g.*, Wright, [0016]-[0018], [0024]. This includes determining the bandwidth requirements of the logical connections, and the resulting physical link bandwidth requirements imposed by the aggregation of those logical connections. *Id.*

41. Further, Baker discloses traffic as signals being transmitted between nodes through the physical network “in accordance with the overlaid logical star topology.” Baker, [0012]; *see also* [0037]-[0038] and [0080] (traffic). Baker is agnostic regarding the types of services that would be provided by or associated with the traffic. A POSITA would have further been motivated to turn to Wright for additional details of types of traffic that traverse the network. Wright discloses a virtual private network (VPN) service as a type of traffic on the physical network in

accordance with a logical topology. Wright, [0005]. Wright's VPN service is an example of the type of traffic Baker contemplated using its network. *See* Wright, [0003], [0015] (traffic of VPN). Wright provides other examples of service traffic including voice over IP, video-on-demand, and video conferencing. Wright, [0025].

42. A POSITA would have had a reasonable expectation of success in combining the teachings of Wright with Baker. As an initial matter, Wright's network teachings are compatible with the teachings of Baker. Baker discloses "using Asynchronous Transfer Mode (ATM) over SONET [Synchronous Optical Network]" for the physical topology of its network. Baker, [0037]. Similarly, Wright discloses that it is applicable to "any link technology known in the art including using a synchronized optical network (SONET) to provide the links 108 and virtual circuits with bandwidth guarantees through an ATM network to provide the links 108," which a POSITA would have understood to refer to ATM over SONET, since ATM and SONET are at different strata of network architecture. Wright, [0015]; *see also* Holender, FIG. 3 and 5:12-35 (network environment has multiple strata, with SONET "at the bottom" and ATM "on top of that"). Thus, Baker and Wright both contemplate using compatible underlying physical network technologies (i.e., SONET using ATM).

43. Further, Baker and Wright both contemplate overlaying logical networks onto the SONET/ATM underlying physical network. Baker teaches that "a

logical star topology is overlaid on an underlying non-star network, such as a ring network” which “correspond[s] to the topology of the actual physical network.” Baker, [0030]. Likewise, Wright imposes a logical topology on a physical topology. “Logical connectivity data for the edge nodes is received” for implementation of one or more “virtual private network (VPN) services” over a physical topology. Wright, [0005]-[0007]. Wright does this to determine a “restricted topology where a single path exists between each pair of edge nodes within the VPN.” Wright, [0014]. Thus, the conceptual structure is compatible between Baker and Wright, with both utilizing similar physical networks with logical networks imposed on them. A POSITA would have had a reasonable expectation of success in applying Wright’s teachings to Baker’s teachings in view of this compatibility.

44. Further, a POSITA would have recognized that Baker’s head node is capable of implementing the teachings of Wright, including receiving Wright’s logical connectivity data, and determining the bandwidth requirements of the logical connections and corresponding physical link bandwidth requirements from the aggregation of those logical requirements. In Baker, it is the “head node” that “executes the Administer Ring routine” “with respect to the logical star topology overlay” taught in Baker. Baker, [0051]-[0052]. Baker’s head node executes the Administer Ring routine as part of “a set of special ‘star overlay’ procedures.” Baker, [0051]. The head node, which per Baker is set to also be peer group leader (“PGL,”

a concept where a logical node within a peer group of nodes is designated with “certain responsibilities with respect to routing and communication of ... topology information to other nodes,” giving the PGL “certain privileges with respect to topology and routing control.” Baker, [0046]), can be configured beforehand with “additional resources ... e.g., processing power, redundant hardware for protection, and memory ... to better help the PGL/head node accomplish its assigned tasks.” Baker, [0047].

45. In combination, Baker’s head node would therefore be configured with sufficient resources to accomplish tasks including those taught by Wright, such as receiving logical topology and logical connectivity data, determining the bandwidth requirements of the logical connections and physical links, and allocating bandwidth to the physical links. Thus, a POSITA would have further had a reasonable expectation of success in applying Wright’s teachings to Baker’s head node, because there would be sufficient computing resources provided to implement them.

46. Combining Wright’s teachings with Baker’s teachings would have been predictable and within a POSITA’s skillset. It was already known to overlay logical topologies to physical topologies, including managing bandwidth from the result. *See, e.g.,* Wright, [0016]-[0018]; Devi, [0015] (“a single logical link 104 may represent more than one physical link”). The combination of Baker’s head node using Wright’s teachings related to receiving Wright’s logical connectivity data, and

determining the bandwidth requirements of the logical connections and corresponding physical link bandwidth requirements from the aggregation of those logical requirements, would predictably result in Baker's head node assigning network resources (including bandwidth) as determined based on the logical topology information the head node received, as taught by Wright. *See* Baker, [0016]; Wright, [0016]-[0018], [0024].

47. Thus, the combination of Baker and Wright is nothing more than the combination of known elements (Baker's head node and Wright's procedure teachings, and Baker's traffic teachings and Wright's VPN service teachings), according to known methods (using Wright's teachings in Baker's network, executed by Baker's head node), to yield predictable results (Baker's head node receiving the logical topology information, determining bandwidth requirements, and allocating bandwidth based thereon as taught by Wright, with Baker's network providing the VPN service teachings of Wright).

48. Combining Baker's and Wright's teachings would result in a head node that receives logical topology information and uses it to determine bandwidth requirements of the logical connections and how to allocate that bandwidth for the underlying physical links. Doing so would provide the advantage of supporting connectionless VPN services as a type of traffic that can use Baker's network, with "bandwidth QoS guarantees." *See* Wright, [0014]; *see also* [0003]-[0004]

(drawbacks of prior bandwidth management for connectionless VPNs), [0015]. This is achieved all while benefitting from having “fewer problems associated with traffic bottlenecks and single points of failure than physical star networks” and benefitting “from the robustness of the underlying ring while retaining the routing simplicity” of the logical star topology. Baker, [0013].

49. The combination permits but does not require physical incorporation of elements from Wright into Baker. Nevertheless, the physical incorporation of Wright’s nodes receiving connectivity data, performing bandwidth allocation, and service traffic types into Baker’s Administer Ring process would teach the claim limitations.

D. Detailed Analysis of Claims

1. Claim 1

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

50. To the extent that the preamble is limiting, Baker discloses it.

51. **First**, Baker discloses a method for assigning bandwidth in a network. Baker’s “invention is a **method for automatically assigning network resources** to a collection of elements **in a network.**” Baker, [0016]. Baker’s method includes “partitioning resources of the network, allocating the network resources, and assigning the network resources to the network elements.” Baker, [0016]. According to Baker, one of the “resources” it is concerned with is “bandwidth.” Baker, [0062].

Baker's assigning of "network resources" therefore includes the assigning of "bandwidth" in the network.

52. Second, Baker discloses that the network being managed includes nodes coupled by links arranged in a physical topology. Baker illustrates in Figure 1 (reproduced and annotated below) "a **bidirectional physical communications ring** where N0 through N7 represent **routing and switching nodes**, PH1 through PH8 represent **bidirectional physical links between nodes**," onto which a logical topology is overlaid (illustrated by the arrows directly between each of the nodes and N0). Baker, [0031]-[0032]; *see also* [0030] (ring topology can "correspond to the topology of the actual physical network").

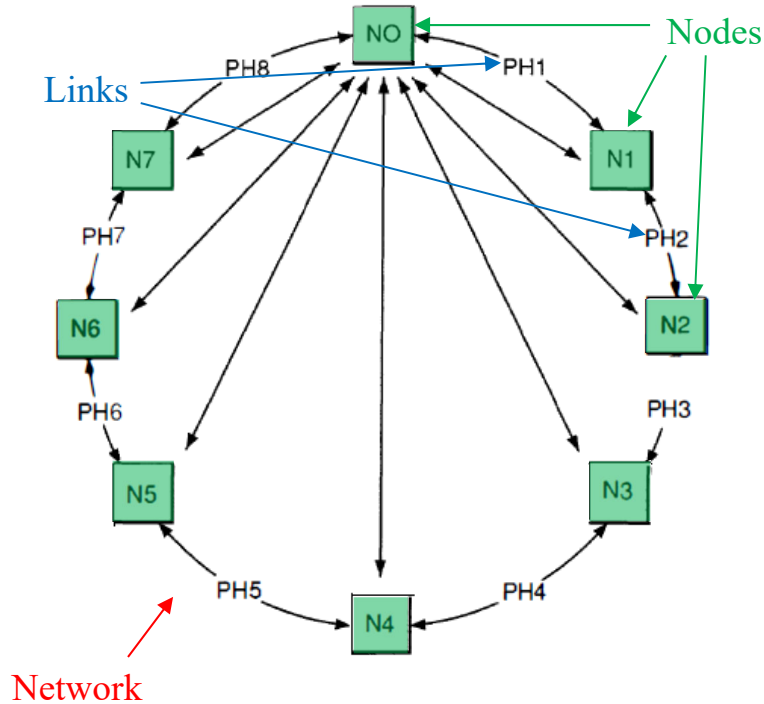


FIG. 1

Baker, FIG. 1 (annotated).

53. Because the links exist “between nodes,” Baker therefore demonstrates nodes (including nodes N0 through N7) and links (including links PH1 through PH8) arranged in a physical topology (a ring topology). Baker illustrates another “exemplary ring network” (a physical topology) in Figure 2, which likewise includes links (PH1 through PH4) coupling nodes (N0 through N4) in a network:

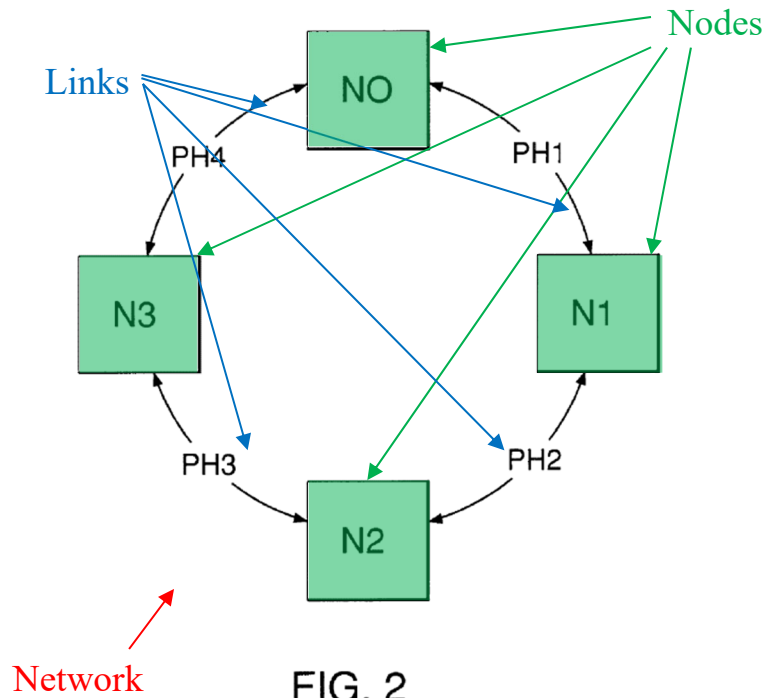


FIG. 2

Baker, FIG. 2 (annotated), [0019].

54. Therefore, Baker discloses “[a] method for assigning bandwidth in a network including nodes coupled by links arranged in a physical topology,” as recited in the preamble.

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

55. The combination of Baker and Wright renders this limitation obvious.

56. **First**, Baker discloses defining logical connections between the nodes.

In Baker’s disclosure, “a logical star topology is overlaid on an underlying non-star network, such as a ring network.” Baker, [0030]. This is illustrated in Figure 1 (reproduced and annotated below), which shows “a bidirectional physical

communications ring where N0 through N7 represent routing and switching nodes, PH1 through PH8 represent bidirectional physical links **between nodes**,” as pointed out with respect to [1.0] above, “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.” Baker, [0031]; *see also* [0032], [0076]. These virtual paths (the “*logical connections*”) are in Figure 1 (below), between nodes. Baker also refers to these virtual paths as logical paths; for sake of simplicity virtual path will be used. *See* Baker, [0032] (“the terms ‘virtual’ and ‘logical’ are used interchangeably”), [0088] (“logical or virtual paths”).

57. Though the virtual paths are not explicitly labeled in Figure 1 of Baker like the physical links are, it is my opinion that a POSITA would have understood from Baker’s description at [0031] that the unlabeled arrows in Figure 1 correspond to the disclosed virtual paths VP1 through VP7, as I show in annotated Figure 1:

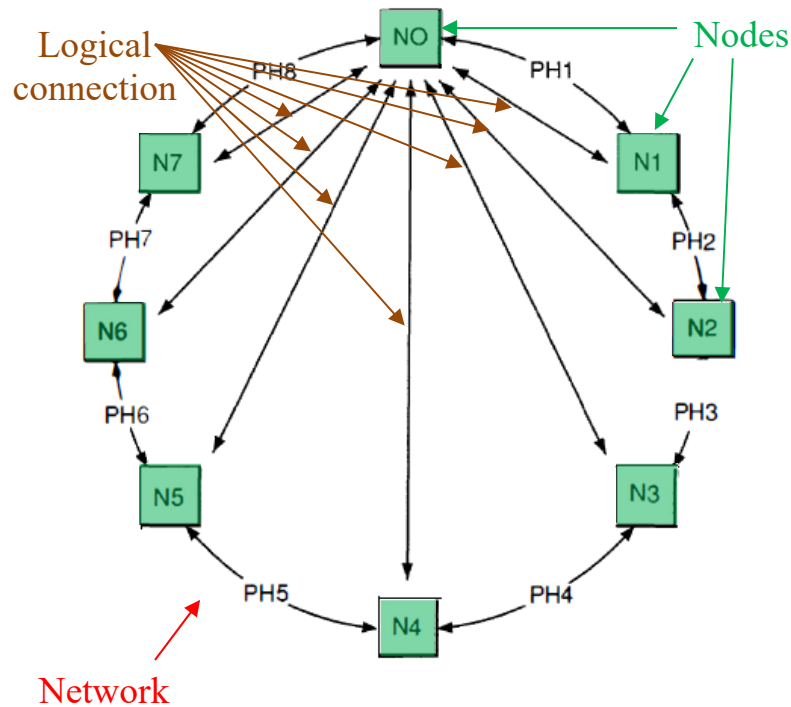


FIG. 1

Baker, FIG. 1 (annotated).

58. Baker illustrates in Figure 4 (below) another example of overlaying logical connections based on Figure 2's exemplary ring network with "one or more virtual paths from the head node to each of the other nodes in the ring." Baker, [0054]. Baker continues:

This 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 VPG1, VPG2 and VPG3 represent a set of one or more virtual paths assigned between the head node and another node in the network.

The dotted lines in FIG. 4 represent virtual paths, while the solid lines represent the communication links of the underlying ring network.

Baker, [0054]; see also FIG. 4:

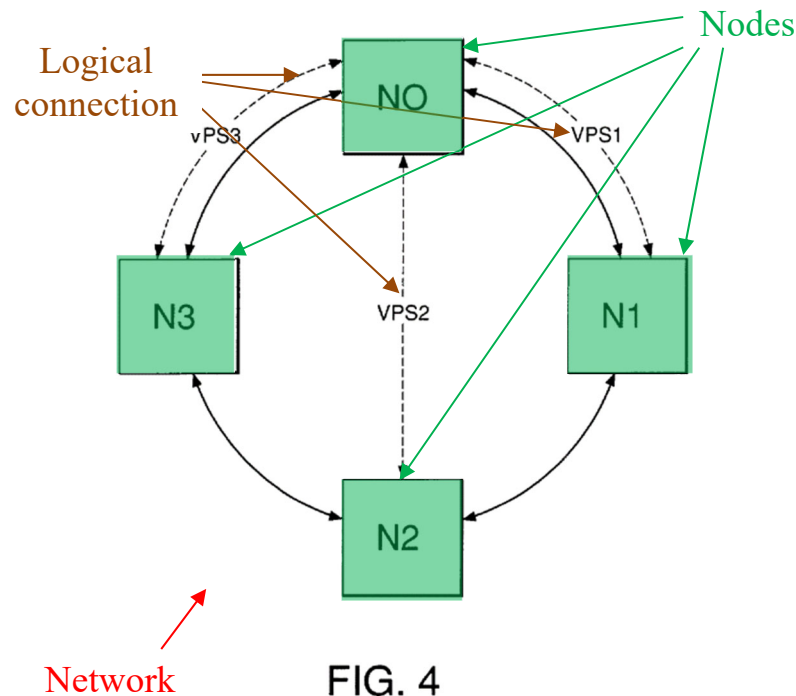


FIG. 4

Baker, FIG. 4 (annotated).

59. It is my opinion that “VPG1” in the description of the specification corresponds to “VPS1” in Figure 4, and further that “VPG2” corresponds to “VPS2,” and “VPG3” corresponds to “VPS3” in Figure 4. This is because Figure 4 illustrates the overlay of the logical, virtual paths between nodes. Baker, [0054] (“dotted lines in FIG. 4 represent virtual paths”). Further, Figure 4 illustrates the result of the “Administer Ring” routine, which assigns VP (virtual path) addresses to node pairs

(i.e., to logically link two nodes). *See* Baker, [0053]. Thus, Figure 4 illustrates another example of “*logical connections*” (the virtual paths) between the nodes.

60. The creation of each “virtual path” in Baker “amounts to **predefining** a route through the network in advance of a communication.” Baker, [0076]. Therefore, the creation of multiple virtual paths, as disclosed in Baker, discloses “*defining between the nodes logical connections.*”

61. Second, Baker discloses that the “*logical connections*” (virtual paths) between the nodes are associated with a “*data transmission service to be provided over the network.*”

62. Baker discloses that ATM virtual path rings transport “data traffic.” Baker, [0038]. Baker discloses, in particular, that “traffic **logically carried** on L1 of the star overlay from N1 to N0 is carried on the combination of service paths S1, S2, and S3 of the underlying ring topology.” Baker, [0080]. The “data traffic” in Baker corresponds to one or more “*data transmission service[s].*” This is consistent with the ’431 patent, which refers to services periodically, such as to state that “the following description assumes that the bandwidths referred to are for **traffic of a data transmission service** requiring guaranteed bandwidths.” ’431 patent, 7:29-31; *see also* 2:11-26, 1:20-30 (services that handle traffic).

63. Further, a POSITA would have understood that each logical connection is associated with one or more service paths, that each provide for transmission of

data traffic. For example, Baker's virtual paths L1-L3 (see FIG. 11 below) "support information flow between their respective interconnected nodes," with "service traffic logically carried on L1" in an example. See Baker, [0080]. The "information flow" between nodes is also a "*data transmission service.*" Accordingly, Baker's virtual paths are "*associated with a data transmission service to be provided over the network.*"

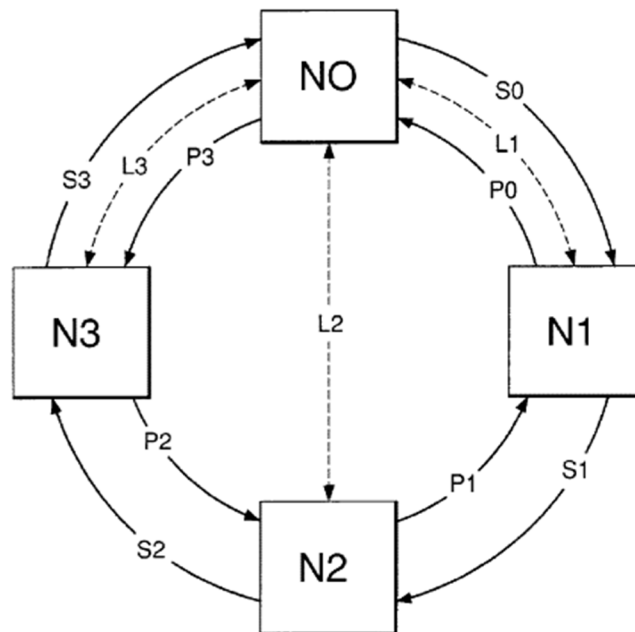


FIG. 11

Baker, FIG. 11.

64. As another example of "*data transmission service,*" Baker also discloses that its logical overlay structure results in "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.” Baker, [0012]. This demonstrates that the signals are “*associated*” with the logical connections of the star topology. A POSITA would have recognized that such “signals” in Baker would be associated with one or more “*data transmission service[s]*.”

65. Third, Wright further renders obvious a “*data transmission service*” with its “VPN service” in combination with Baker. Wright, like Baker, builds logical topologies over physical topologies. *See, e.g.*, Wright, [0002]. In Wright, “[l]ogical connectivity data for the edge nodes is received,” as well as physical connectivity data, for “traffic engineering” for implementation of one or more “virtual private network (VPN) services” over a physical topology. Wright, [0005]-[0007]. Wright’s logical connectivity data, like Baker’s virtual paths, are used so that nodes can communicate with each other “without regard to the physical implementation.” *See* Wright, [0016] and [0003]. Wright uses the connectivity data to determine a “restricted topology, where a single path exists between each pair of edge nodes within the VPN,” to meet the objective of providing “bandwidth QoS guarantees ... to ensure adequate bandwidth for the service.” Wright, [0014]. The “service” in paragraph [0014] (quoted above) refers to the “connectionless VPN service.” *See, e.g.*, Wright, [0001], [0005], [0013], [0014].

66. Wright's VPN service supports "traffic between the endpoints of the VPN." Wright, [0003], [0015]. Wright's VPN service is provided as "packet-by-packet routing for a layer 3 service, or alternatively, an emulated VPLS for a layer 2 service." Wright, [0015]; *see also* [0025] (voice over IP, video-on-demand, and video conferencing as other service examples). This is the same as in the '431 patent, where sources of the traffic include "Video On Demand Service (VODS) ... [and] **Virtual Private LAN Service (VPLS)**." '431 patent, 1:60-2:1. Accordingly, it would have been obvious that Wright's use of logical connectivity data for traffic engineering for the VPN services over the network teaches "*logical connections associated with a data transmission service to be provided over the network.*"

67. In combination, Baker's logical connections would be associated with Wright's service (the "*data transmission service to be provided over the network*") as an example of a source of traffic. This is because Wright's traffic of the VPN service is an example of the traffic that Baker's logical connections are configurable to convey (and, therefore is another example of the "*data transmission service*"). *See* Wright, [0003], [0015], [0025]. Moreover, as noted previously Wright and Baker teach use of the same underlying communication technologies including ATM and SONET. *See* Baker, [0037]; Wright, [0015].

68. Therefore, the combination of Baker and Wright renders obvious “*defining between the nodes logical connections associated with a data transmission service to be provided over the network.*”

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

69. Baker discloses this limitation.

70. Baker discloses that the “logical star topology is overlaid on an underlying non-star network, such as a ring network,” and specifically that “the **underlying physical network** has a non-star topology.” Baker, [0030], [0013]. Indeed, Figure 1’s example is a “Physical Ring with Logical Star Overlay,” thus demonstrating the logical connections of the logical star overlay having a different topology than the underlying physical topology (in this example, a logical star topology vs. a ring topology). Baker, [0031]; *see also* [0032], Figure 1, with the logical connections having a different topology than the physical connections:

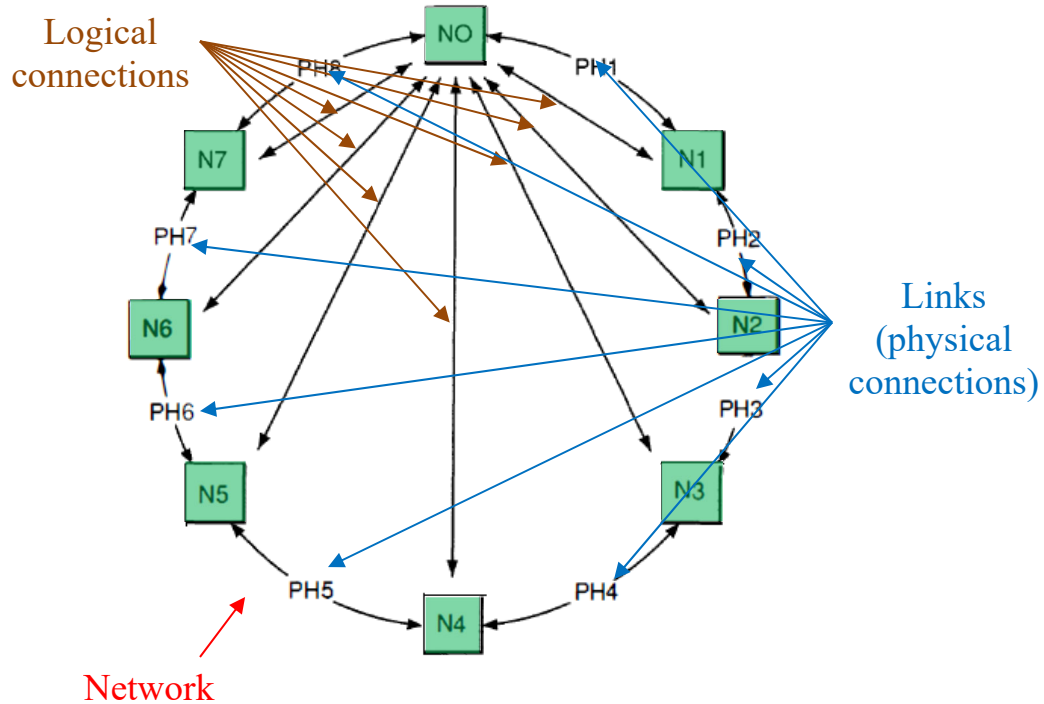
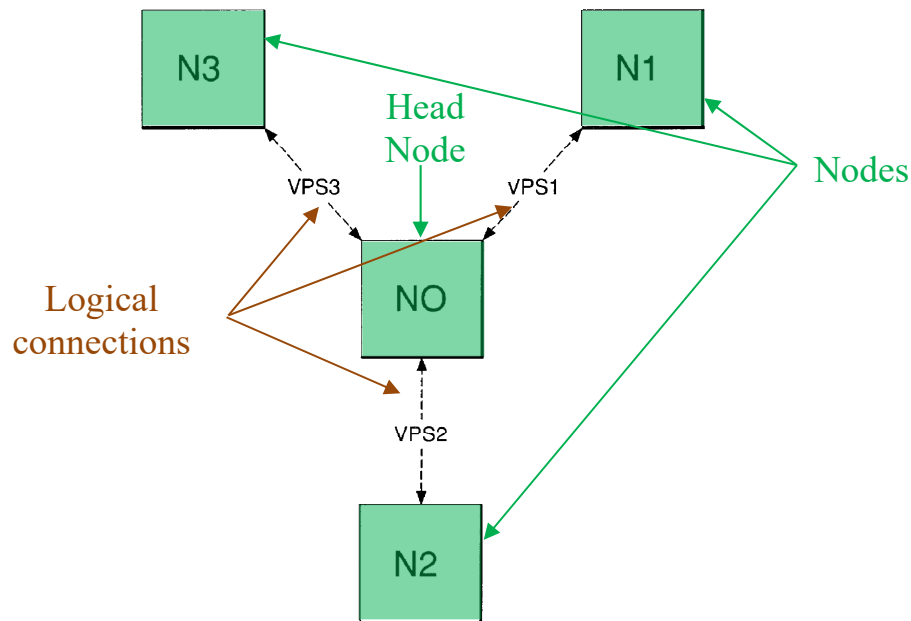


FIG. 1

Baker, FIG. 1 (annotated).

71. The logical star architecture (the “star topology that is overlaid on the underlying ring network” as in FIG. 4, *see* Baker, [0054]) is explicitly illustrated in Baker’s Figure 5, with the “logical star architecture” that is overlaid onto the “underlying ring depicted in FIG. 2.” Baker, [0059] and [0022]; *see also* FIG. 5:



Baker, Fig. 5 (annotated).

72. This logical topology in Baker’s Figure 5, like the topology in Baker’s Figure 1, is a “logical star topology” that is different from the underlying physical topology (an underlying ring topology in FIG. 2, for example, or the ring topology of the physical network in Figure 1).

73. Therefore, Baker discloses “*the logical connections having a connection topology different from the physical topology.*”

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

74. The combination of Baker and Wright renders this limitation obvious.

75. **First**, Baker discloses logical connections between the nodes with its virtual paths, and Baker alone and in combination with Wright’s logical connectivity

data renders obvious that the logical connections are associated with a data transmission service, including Baker's traffic. *See* [1.1]. This also includes Wright's VPN services with bandwidth guarantees as a type of data transmission service for logical connections (i.e., Baker's) to implement. *See* Wright, [0014]; [1.1].

76. Baker's management of network resources includes bandwidth as a type of resource. Baker, [0016], [0062]. It would have been obvious to a POSITA that Baker's management of network resources like bandwidth would be based on information about the type of service desired (such as Baker's traffic and Wright's VPN service as examples), including the paths constituting the logical connections between node endpoints, any user requirements for the traffic, and amount of bandwidth needed, sought, or used by the service. Such information would impact how Baker managed virtual path assignments in order to manage the network resources among the network elements, including bandwidth. *See* Baker, [0016], [0054].

77. Second, to the extent that Baker does not explicitly explain that network resource management includes determining the bandwidth requirements of the connections in the logical topology based on service parameters, this would have been further rendered obvious by Wright.

78. In Wright, "the restricted topology may be chosen to identify the required bandwidth and to provide guarantees for that bandwidth in the service

architecture.” Wright, [0018]. To achieve this, “ATM virtual circuits are dimensioned to the required bandwidth.” Wright, [0018]. Wright illustrates this concept with an example related to FIG. 3. In the example, two logical connections are provided – node A to node B, and node A to node C. Wright, [0017]; FIG. 3. Each logical connection (A-B and A-C) has its own “bandwidth requirement” – e.g., “[c]onsider 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.” Wright, [0017]. Wright’s disclosure of identifying bandwidth requirements for logical connections – e.g., the A-B and A-C connections, discloses “*determining respective bandwidth requirements for the logical connections.*”

79. Further, Wright also teaches “*determining respective bandwidth requirements for the logical connections*” with calculating a “bandwidth requirement for each link in the restricted topology.” Wright, [0005]-[0007]. Wright’s links 302, 304, and 306 of the restricted topology in Figure 3 are examples of “each link in the restricted topology.” Wright, [0017], [0005]-[0007]. And, according to Wright, “bandwidth requirements” are calculated based on the “logical connectivity requirements,” which are “in terms of edge nodes and communication requirements between edge nodes.” Wright, [0024]. Thus, a POSITA would have understood Wright as teaching determining point-to-point bandwidth requirements for logical connections. See Wright, [0024] and FIG. 5:

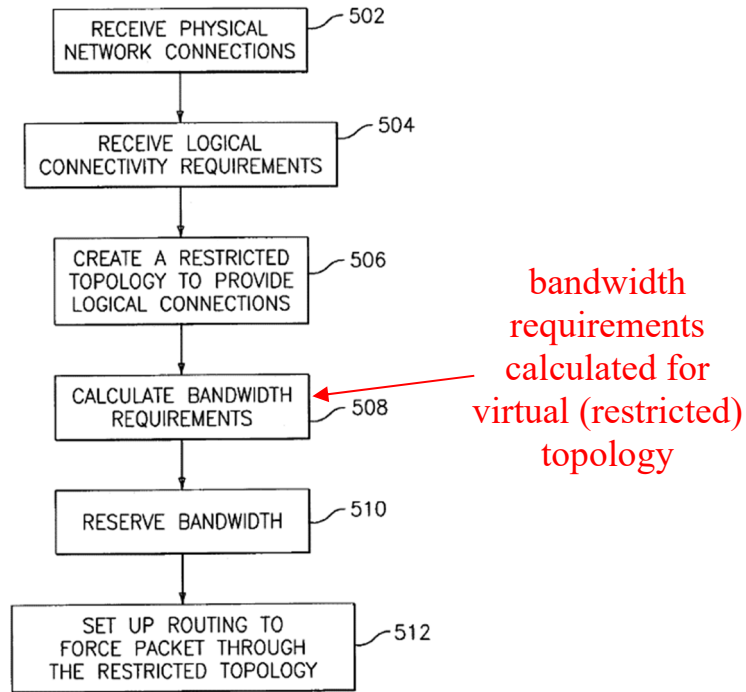


FIG. 5

Wright, FIG. 5 (annotated).

80. It would have been obvious to a POSITA that the calculation for Wright’s “bandwidth requirements on links within the restricted topology” would include the logical connections’ bandwidth requirements (such as the connections noted above for the example in FIG. 3, including A-B and A-C connections). This is because, according to Wright’s FIG. 5 flow, the calculation for the bandwidth requirements is based on the “restricted topology” that provides “logical connections,” using the “logical connectivity requirements” which include the “required bandwidths” between the A, B, and C nodes. Wright, [0017], [0024].

81. Additionally, a POSITA would have understood that the bandwidth requirements for the logical connections would be based on parameters of the service for which Baker's traffic is sent/received (such as Wright's VPN service for a particular example of service the traffic is associated with). In Wright's example, the parameters are described as "logical connectivity requirements" which are expressed **"in terms of edge nodes and communication requirements between edge nodes."** Wright, [0024]. These "logical connectivity requirements" (including bandwidth) are *"parameters of the service."*

82. Wright further demonstrates that the logical connectivity requirements (e.g., bandwidth requirements) are *"based on parameters of [a] service."* For example, Wright teaches that the "bandwidth allocation at each link could specify a minimum bandwidth, or a maximum bandwidth," which are together examples of *"parameters of the service."* See Wright, [0018]. As another example, Wright teaches that a "packet switched connectionless VPN" service may include "[Quality of Service] guarantees." Wright, [0020]. The QoS guarantee is an example of a *"parameter[] of the service."* Wright also describes, with respect to an example of providing VPN service, that "the bandwidth requirement would correspond to the number of active calls" that can be supported. Wright, [0020]. Yet further, Wright looks at whether the required bandwidth in a VPN service with QoS is "symmetric" or "asymmetric." Wright, [0020]. The number of active calls and type of bandwidth

requirement (symmetric or asymmetric) are further “*parameters of the service.*” In another example, Wright teaches applying its disclosure “for dynamic session based services where admission to these services with QoS guarantees is controlled on a session by session basis (e.g., video-on-demand, video conferencing).” Wright, [0025].

83. With respect to the last example in Wright noted above (video conferencing), I note that Wright also teaches applying its disclosure to “connectionless services in an access network, such as voice over IP (VoIP).” Wright, [0025]. As compared to VoIP, a POSITA would have recognized and known that video conferencing would typically require a different amount of bandwidth than VoIP (typically much more bandwidth). It would have therefore been obvious to a POSITA to determine the bandwidth requirement for a communication service based on parameters specifying the type of service (e.g., whether voice or video) on the network.

84. In combination, Wright’s “logical connectivity requirements” would be included with Baker’s logical topology information. Before Baker’s overlaying of the logical topology to the physical topology, a POSITA would apply Wright’s teachings for determining the bandwidth requirements of each virtual path for the logical topology (analogous to Wright’s “logical connections,” *see* Wright, [0024] and [0017]). Wright motivates a POSITA to determine the bandwidth requirements

before Baker's overlaying of the logical topology to the physical topology, because Wright teaches making the bandwidth determinations for the logical connections between nodes before reserving bandwidth. *See* Wright, [0024].

85. Therefore, the combination of Baker and Wright renders obvious “*determining respective bandwidth requirements for the logical connections based on parameters of the service.*”

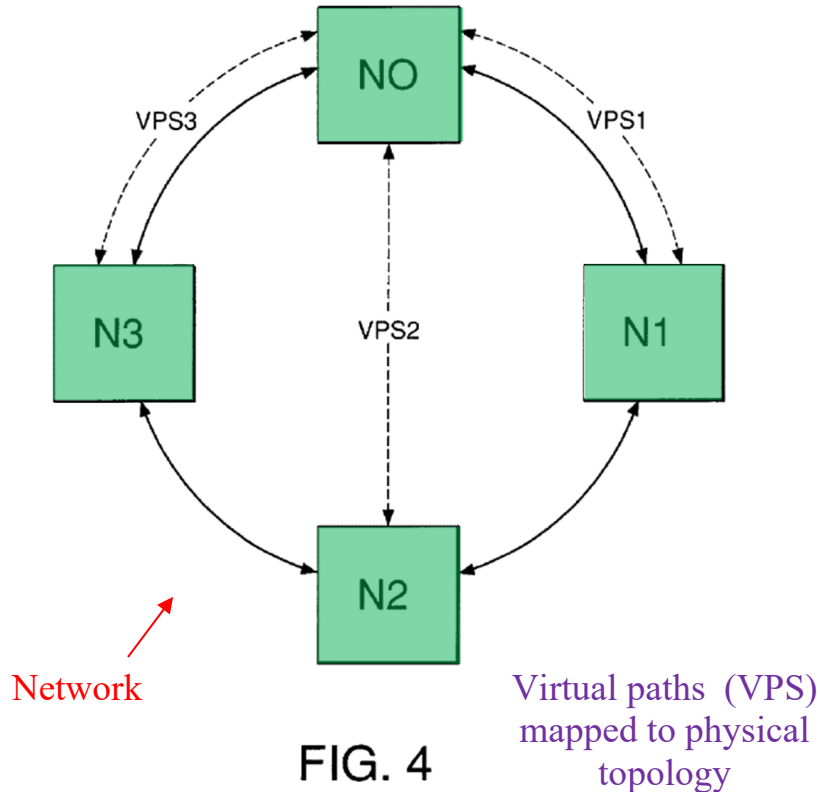
- e. **[1.4] *mapping the connection topology to the physical topology, so that each of the logical connections is associated with one or more links of the physical topology; and***

86. Baker discloses this limitation.

87. According to Baker, “a set of special ‘star overlay’ procedures including ‘Administer Ring’” are executed to overlay the logical topology to the physical topology. Baker, [0051]. In the Administer Ring procedure, when first executed (i.e., the logical topology has not been overlaid yet), the number of physical nodes on the ring is determined and “the [virtual path, “VP”] address space” partitioned “by the number of nodes, optionally leaving a scatter [sic] of VP addresses in reserve for topology changes and growth.” Baker, [0053]. Then, for each node, one or more VPs are assigned between the head node and the given node (for the star topology in Baker's example). Baker, [0053]-[0054]; [0056] (applied to FIG. 2). Baker explains that

[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. **This 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 VPG1, VPG2 and VPG3 represent a set of one or more virtual paths assigned between the head node and another node in the network. **The dotted lines in FIG. 4 represent virtual paths, while the solid lines represent the communication links of the underlying ring network.**

Baker, [0054]; *see also* [0032], Figure 1 (connection of each node to node N0), and Figure 4 (likewise each node's connection to node N0 both logically and physically):



Baker, FIG. 4 (annotated).

88. In Baker the act of overlaying logical connections to a physical topology is also referred to as “[t]he mapping between logical paths and physical paths for this overlay.” See Baker, [0083]-[0084]. Baker provides other examples of mapping each virtual path to one or more physical links carrying traffic for the virtual path. This includes describing “[t]raffic logically carried on [virtual path] L2 in the abstraction” as being either “physically carried on PH1” (physical path) or “on the combination of PH2 and PH3.” Baker, [0069]-[0070]. Baker describes in another example “mapping between logical paths and physical paths” with respect to FIG. 10. Baker, [0083], *more generally* [0078]-[0085]. These examples of overlaying

(i.e., mapping) virtual paths of a logical topology to physical paths of a physical topology discloses the “*mapping*.”

89. Therefore, Baker discloses “*mapping the connection topology to the physical topology, so that each of the logical connections is associated with one or more links of the physical topology.*”

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

90. The combination of Baker and Wright renders obvious this limitation.

91. **First**, as noted at [1.0], Baker discloses “a method for automatically assigning network resources to a collection of elements in a network,” including “partitioning resources of the network, **allocating the network resources**, and assigning the network resources to the network elements.” Baker, [0016]. According to Baker, one of the “resources” it is concerned with is “bandwidth.” Baker, [0062]. Accordingly, it would have been obvious to a POSITA that Baker teaches allocating bandwidth as one of the network resources. Baker’s allocation techniques for network resources (including bandwidth) are executed according to “a set of special ‘star overlay’ procedures including” an “Administer Ring” routine. *See* Baker, [0051]-[0056] and Figure 3.

92. **Second**, Baker combined with Wright further renders obvious that the allocating of the bandwidth on physical links is in response to the bandwidth

requirements of each connection that will support the traffic of the service (the traffic generally, per Baker, as well as the VPN service of Wright) and the mapping (as taught by Baker). Baker teaches mapping the logical connections to the physical topology's links. *See* [1.4]. Baker teaches the importance of considering whether "sufficient bandwidth is available" for links in a network. *See* Baker, [0009]. A POSITA would have found it obvious to allocate bandwidth to the physical topology's links in view of Wright, which provides additional details with respect to ensuring sufficient bandwidth for the given service, such as Baker's data traffic, Baker's transmitted signals, Baker's information flow, Wright's VPN service, Wright's voice-over-IP, Wright's video-on-demand, and Wright's video conferencing. *See* analysis at [1.1] and [1.4].

93. Wright teaches that logical connections (which come from the restricted topology) are determined for "traffic engineering of connectionless VPN service" on the impacted physical links. Wright, [0024] (referring back to Figure 3, in association with which the specification describes determining a bandwidth requirement for each logical connection in the restricted topology, *see* Wright, [0017]). The "bandwidth requirements on links within the restricted topology" are calculated based on the received logical connectivity data, which includes "communication requirements between edge nodes" (i.e., "*service parameters*" as shown at [1.3]). Wright, [0024]. It would have been obvious to a POSITA that these

“communication requirements” would include “*bandwidth requirements*” for the logical connections. *See* analysis at [1.3]. The “communication requirements” would have included bandwidth requirements for the logical connections in order for Wright’s calculation of bandwidth requirements on the physical links to be calculated.

94. “[T]he required bandwidth is reserved” based on this calculation “on each link in the restricted topology.” Wright, [0024], [0005]. It would have been obvious to a POSITA that the links on which “required bandwidth is reserved” refers to the physical links from the physical connectivity data. For example, Wright teaches that the restricted topology (referred to also as the virtual topology) is implemented “utilizing the underlying service nodes 104, including the edge nodes 102, and links 108 depicted in FIG. 1” (which are “physical links”). Wright, [0015]-[0016]. As a result of Wright’s approach, “only the bandwidth actually required is reserved on the links 108.” Wright, [0017].

95. Moreover, even if the “links” referenced in paragraphs [0017] and [0005] of Wright relate to the virtual links 302, 304 and 306 of the restricted topology, it would have been obvious to a POSITA for bandwidth reservations on such virtual path links to also include reservation of bandwidth on the underlying physical links supporting those virtual path links (and, therefore, rendering obvious “*in response to ... the mapping*”). This is because Wright further teaches that the

bandwidth calculated on each of the links 302, 304, and 306 is done so that “only the bandwidth actually required is **reserved on the links 108**,” where “links 108” refers to the “physical links 108” of FIG. 1. Wright, [0017], [0015]; FIG. 1. Reserving the bandwidth for each of the physical links, as in Wright (as examples of Baker’s physical links), renders obvious “*allocating a bandwidth for the service on each of the links.*”

96. The combined teachings of Wright and Baker result in Wright’s allocating of the bandwidth in response to both the “communication requirements between edge nodes” identified in Wright’s “logical connectivity data,” as well as mapping to physical links – Wright’s creation of a restricted topology and the “set of special ‘star overlay’ procedures” that includes the “Administer Ring” procedure per Baker. *See* [1.4]; Baker, [0051]; Wright, [0024], [0007]. In Wright, the bandwidth is allocated to the physical links after defining the logical network in relation to the physical links (the “*mapping*”). As a result, a POSITA would have implemented Wright’s allocation as part of Baker’s special overlay procedure after the mapping from the Administer Ring routine is achieved. The combination would therefore result in Wright’s reserving bandwidth teachings occurring after Baker’s mapping to the physical links after the Administer Ring routine. *See generally* Wright, [0024] and FIG. 5:

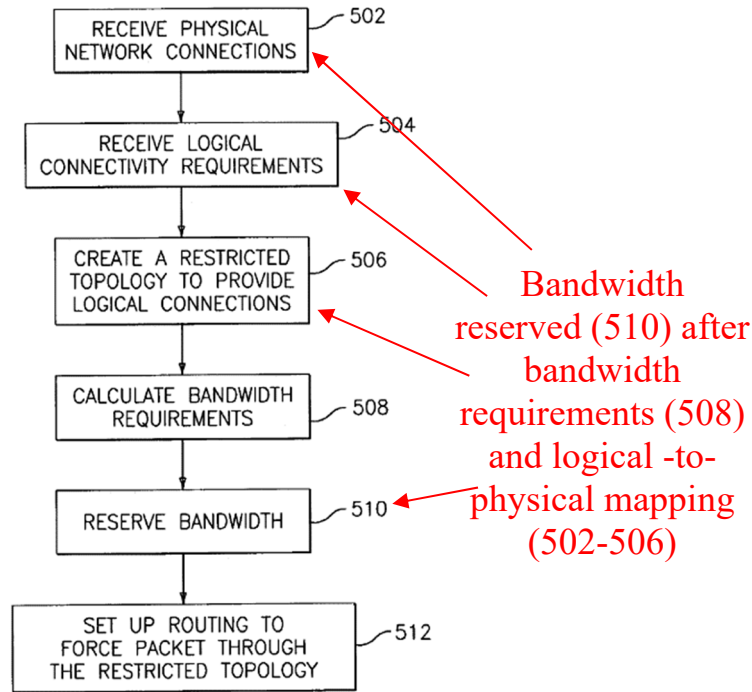


FIG. 5

Wright, FIG. 5 (annotated).

97. Wright's FIG. 5 shows bandwidths being reserved ("*allocating*") to physical links after the logical network has been established over the physical network, and after bandwidth requirements have been determined (*see* step 508). Wright, [0024]. Moreover, Wright teaches that "only the bandwidth actually required is reserved" so as to provide bandwidth guarantees (e.g., allocations) that are "designed to ensure adequate bandwidth for the service." Wright, [0014], [0017]. Thus, the combined teachings of Baker and Wright render obvious the "*allocating ... in response to the bandwidth requirements of the logical connections and to the*

mapping” as a concluding step of Baker’s “set of special ‘star overlay’ procedures” that includes the “Administer Ring” routine. *See* Baker, [0051].

98. Therefore, the combination of Baker and Wright renders obvious “*allocating a bandwidth for the service on each of the links in response to the bandwidth requirements of the logical connections and to the mapping.*”

2. **Claim 2**

a. **[2.0] *The method according to claim 1,***

99. *See* analysis at [1.0]-[1.5].

b. **[2.1] *wherein the network comprises a ring network, and wherein the physical topology comprises a ring topology.***

100. Baker discloses this limitation.

101. Baker discloses that the network is a ring network, and the physical topology of the ring network is a ring topology.

According to embodiments of the invention, a logical star topology is overlaid on an underlying non-star network, **such as a ring network**. Depending on the particular implementation, **the underlying ring topology may correspond to the topology of the actual physical network** or it may itself correspond to a logical ring topology overlaid on a further underlying non-ring (and non-star) network.

Baker, [0030]. The physical ring network with the ring topology is illustrated in Figure 1 as well as Figure 2. *See* analysis at [1.0]; Baker, [0019].

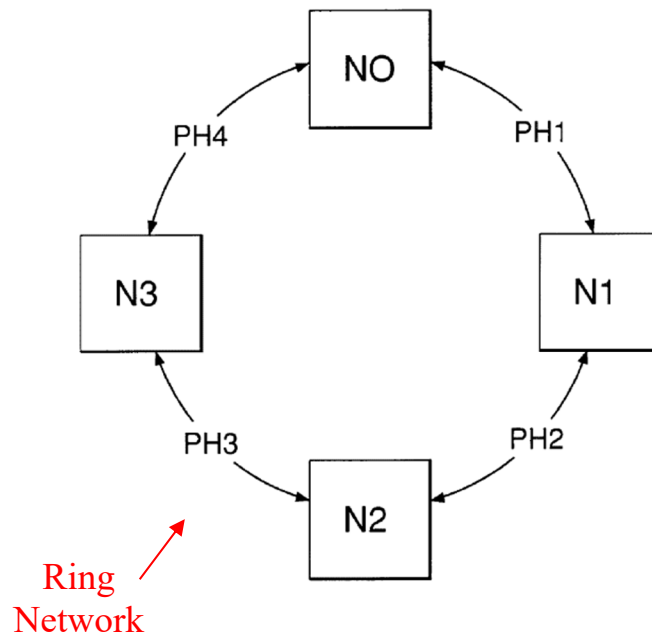


FIG. 2

Baker, FIG. 2 (annotated).

102. Therefore, Baker discloses “*wherein the network comprises a ring network, and wherein the physical topology comprises a ring topology.*”

3. **Claim 3**

a. [3.0] *The method according to claim 1,*

103. *See analysis at [1.0]-[1.5].*

b. [3.1] *wherein the connection topology is chosen from one of a hub-and-spoke topology and a full mesh topology.*

104. Baker discloses, and in combination with Wright renders obvious, this limitation.

105. Baker discloses the logical topology being a “logical star topology [that] is overlaid on an underlying non-star network, such as a ring network.” Baker, [0030]. After overlaying the logical star topology (the “*connection topology*,” see [1.2]), Baker illustrates the resulting logical star topology in Figure 5:

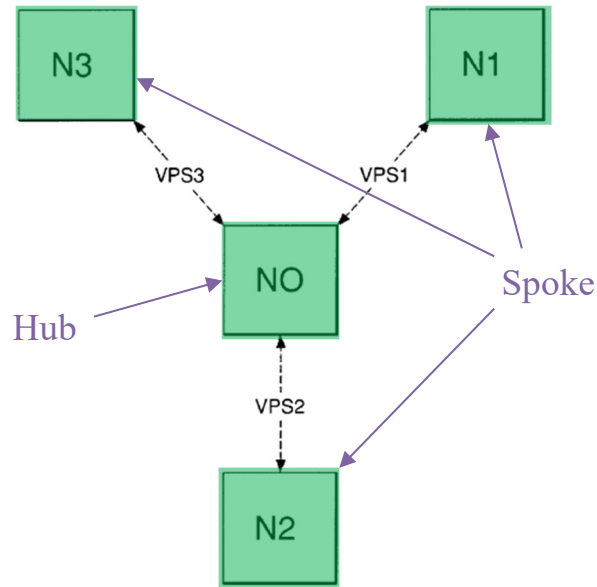
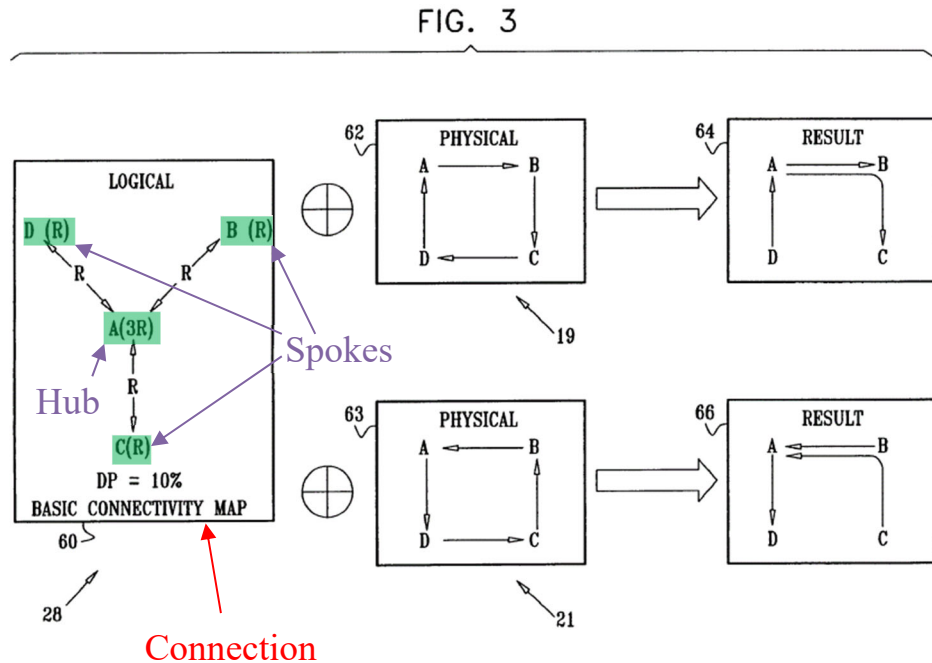


FIG. 5

Baker, FIG. 5 (annotated).

106. A POSITA would have recognized that Baker’s logical star topology discloses a “*hub-and-spoke topology*.” Baker, itself, describes the star topology in terms of a hub and spokes. See Baker, [0011]. Indeed, this is identically illustrated in Figure 3s’ hub-and-spoke topology of the ’431 patent:



'431 patent, Fig. 3 (annotated).

107. Accordingly, Baker's logical star topology discloses the "hub-and-spoke topology." Because the claim requires that the connection topology be "chosen from one of a hub-and-spoke topology and a full mesh topology," either option renders this claim invalid, such that Baker's logical star topology alone discloses the limitation.

108. However, Baker also discloses a "full mesh" network, further rendering obvious both options. See Baker, [0046]. Wright discloses a full logical mesh topology as an option for a logical topology. Wright, [0014], [0016] ("If a full logical mesh approach was implemented ..."). While Wright notes how "[u]sing a full logical mesh approach may result in a requirement to reserve more bandwidth than

is required and is available,” Wright does not discourage a POSITA to do so. *See* Wright, [0015]. Instead, Wright explains how its “restricted topology” may be more efficient in contrast to a full mesh approach. Wright, [0014]-[0016]. As a POSITA would have understood, the size of the network would impact the decision on whether to use a “full logical mesh approach” or something more akin to Wright’s “restricted topology.” It was known that a full mesh approach would work with smaller networks, but would not scale well in very large networks (since the number of connections scales in a squared relationship to the number of nodes in the network). *See, e.g.*, Houh, pp. 60-61 (a full mesh being an example of a “dense mesh”); Sanderson, [0007] (in a full mesh, as the number of nodes increases, the number of connections “grows exponentially”).

109. In general, full logical mesh topologies in networks were well-known as of the earliest possible priority date of the ’431 patent. For example, Ricciulli teaches that an “overlay network is capable of logical complete connectivity” which is a “full connectivity mesh to all other overlay network nodes.” Ricciulli, 6:17-20, 40-43; *see also* FIG. 3a (illustrating the full connectivity mesh); *see also* Chen, 3:32-37, claims 14, 17 (logical topology type includes full mesh). Since both topologies were well-known and among a limited set of options, it would have been obvious to a POSITA to try either or both.

110. Therefore, Baker discloses, and in combination with Wright renders obvious, “*wherein the connection topology is chosen from one of a hub-and-spoke topology and a full mesh topology.*”

4. Claim 4

a. [4.0] *The method according to claim 1,*

111. See analysis at [1.0]-[1.5].

b. [4.1] *wherein the data transmission service comprises a guaranteed bandwidth service.*

112. The combination of Baker and Wright renders this limitation obvious.

113. As discussed in [1.1], Baker and Wright provide multiple examples of a “*data transmission service*” including Baker’s “information flow” and “service traffic,” as well as Wright’s VPN service, VoIP, video-on-demand, and video conferencing. As further demonstrated at [1.1], Wright teaches providing “a quality of service guarantee on a connectionless VPN service” using a “restricted topology where a single path exists between each pair of edge nodes within the VPN,” to meet the objective of providing “**bandwidth guarantees ... to ensure adequate bandwidth for the service.**” Wright, [0001], [0014]. See also [0004] (the guarantee of bandwidth is for a “connectionless service”), and analysis at [1.1] (demonstrating that “service” in Wright refers to the “VPN service,” with citations to Wright, [0001], [0005], [0013], [0014], and examples of services on the VPN including VoIP, video-on-demand, or video conferencing). As Wright further teaches,

“network services” including connectionless services “may be characterized by a quality of service (QoS) metric, or guarantee.” Wright, [0002]. And providing such guarantees involves “the allocation of network resources along the path of the service instance,” of which “[b]andwidth allocation is a fundamental requirement.” Wright, [0003].

114. A POSITA would have recognized that Wright’s “bandwidth guarantees” for the service renders obvious the “*data transmission service compris[ing] a guaranteed bandwidth service.*” This is because the “bandwidth guarantees” in Wright are for services such as VPN, with “an emulated VPLS for a layer 2 service.” Wright, [0015]. The ’431 patent itself acknowledges that sources of the traffic include “Virtual Private LAN Service (VPLS)” in which “guaranteed bandwidth is often required.” ’431 patent, 1:60-2:1, 2:27-35. Accordingly, because Wright’s bandwidth guarantees are likewise for VPN services with VPLS, Wright renders obvious the service comprising “*a guaranteed bandwidth service.*”

115. Therefore, the combination of Baker and Wright renders obvious “*wherein the data transmission service comprises a guaranteed bandwidth service.*”

5. Claim 7

a. [7.0] *The method according to claim 1,*

116. See analysis at [1.0]-[1.5].

- b. [7.1] *wherein mapping the connection topology to the physical topology comprises generating a bandwidth requirement for each of the links.*

117. The combination of Baker and Wright renders this limitation obvious.

118. **First**, As demonstrated at [1.4], Baker discloses mapping the connection topology (e.g., the logical star topology in Baker) to the physical topology (the underlying ring network). As demonstrated at [1.3], the combination of Baker and Wright teaches determining the bandwidth requirements of the logical connections of a logical topology (e.g., Baker's virtual paths of the logical star topology, and Wright's logical connectivity requirements leading to the restricted, or virtual, topology). *See* Wright, [0017]-[0018], [0024]. And, as demonstrated at [1.5], "the bandwidth requirement is reserved on each link in the restricted topology," rendering obvious "*allocating a bandwidth*" on each of the physical links. Wright, [0005], [0024].

119. **Second**, once Wright's required bandwidth information about the logical connections is known (*see* [1.3]), Wright teaches "calculat[ing] bandwidth requirements on links within the restricted topology." Wright, [0024]. A POSITA would have understood these "links" in Wright paragraph [0024] to refer to the "physical links" of the "physical connectivity," since Wright describes the restricted topology (a virtual topology, analogous to Baker's logical topology in combination) as being implemented "utilizing the underlying service nodes 104, including the

edge nodes 102, and links 108 depicted in FIG. 1.” *See* Wright, [0015]-[0016]. Thus, the “links within the restricted topology” would be understood to be those physical links impacted by the virtual, restricted topology taught in Wright.

120. Continuing with the example discussed at [1.3] relating to logical connections A-B and A-C (FIG. 3), Wright describes calculating the bandwidth requirement for a given link by determining the sum of virtual path bandwidths overlying that physical link. As one example, Wright describes 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.” Wright, [0017]. Connections A-B and A-C “share the same link 304” from edge node 102 “A” to service node 104 “D,” where link 304 is a physical link in the illustration of FIG. 3. Wright, [0017]. “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.” Wright, [0017]. Another way is to calculate the bandwidth “to be the maximum of the required bandwidths from edge node 102 ‘B’ to edge nodes 102 ‘A’ and ‘C’” on the underlying physical link. Wright, [0017].

121. In combination, Baker’s head node would calculate the bandwidth requirements for each of the physical links between nodes in the physical topology, according to Wright’s calculation teachings (including either a sum or a maximum of the overlying virtual paths for a given physical link). Further, Wright’s bandwidth

calculation teachings would occur after the logical connectivity bandwidth determination in Wright. Wright teaches that the calculation is done after the restricted topology is determined, which is based on the logical connectivity and the physical topology. *See* Wright, [0024]. In other words, Wright's calculation uses as an input the restricted topology. Because the restricted topology is itself based on the logical connectivity and physical topology information, Wright's calculation is therefore also based on the logical connectivity data.

122. For these reasons, it would have been obvious to a POSITA for the calculation of total bandwidth per link from the logical connections to be done as one of the steps of mapping the logical connections to the underlying physical links (e.g., Baker's "Administer Ring" procedure). Baker, [0052]. Doing so, per Wright, would result in the calculated "bandwidth requirements on links" that are then reserved for each of the links after Baker's mapping is completed. *See* Wright, [0024], [0017].

123. Third, in view of Wright's teaching of reserving the required bandwidth on "each link," it would have been obvious to a POSITA that the appropriate ("required") bandwidth for each physical link would be determined for allocation on each link prior to actually allocating the bandwidth. Wright confirms this as the case, by teaching that first "the reserved bandwidth is calculated," after which "the bandwidth actually required is reserved on the [physical] links 108."

Wright, [0017]. It would have been obvious to a POSITA to determine (i.e., “*generat[e]*”) a bandwidth requirement on each physical link as part of the mapping step (e.g., according to the combined teachings of Baker and Wright with Baker’s “special ‘star overlay’ procedure” including the “Administer Ring” routine, *see* [1.4]), because the required bandwidth in Wright is calculated before it is actually reserved/allocated on the physical links (analogous to how the “*mapping*” of claim 1 of the ’431 patent immediately precedes the “*allocating*” step).

124. Thus, the Baker-Wright combination’s mapping between the logical connections and the physical topology and calculating the bandwidth requirements based on that mapping renders obvious “*wherein mapping the connection topology to the physical topology comprises generating a bandwidth requirement for each of the links.*”

6. Claim 8

a. [8.0] *The method according to claim 1,*

125. *See* analysis at [1.0]-[1.5].

b. [8.1] *wherein parameters of the service comprise respective node-bandwidths required by each of the nodes to provide the service.*

126. The combination of Baker and Wright renders this limitation obvious.

127. First, as demonstrated at [1.0], Baker discloses “a method for automatically assigning network resources to a collection of elements in a network,” including “partitioning resources of the network, allocating the network resources,

and assigning the network resources to the network elements.” Baker, [0016]. According to Baker, one of the “resources” it is concerned with is “bandwidth.” Baker, [0062].

128. Further, the combination of Baker and Wright renders obvious that the method for assigning network resources is based on “*parameters of the service*,” such as Baker’s traffic and Wright’s VPN service. *See* analysis at [1.1] (traffic or VPN service), [1.3] (based on parameters of the service). As explained at [1.3], “*parameters of the service*” in Wright include bandwidth requirements for logical connectivity. *See* Wright, [0017].

129. Second, Wright further renders obvious the “*parameters of the service*” including “*node-bandwidths*.” Wright teaches, as part of determining the “amount of bandwidth reserved on the links 108 to provide a bandwidth QoS,” that there is a recognized “maximum bandwidth that can be generated from edge node 102 ‘A’ traversing the link 304 to service node 104 ‘D’” in the example corresponding to Wright’s FIG. 3. Wright, [0017]. Similarly, the other edge nodes “B” and “C” have maximum limits as well. Wright, [0017]. This information is used, per Wright, to “calculate the required reserved bandwidth” of an “exemplary virtual topology.” Wright, [0017]. Wright’s use of the maximum bandwidth that can be generated at a node in calculating the required reserved bandwidth renders obvious the use of

“node-bandwidths” as “parameters of the service” for the bandwidth requirements for the logical connections.

130. Wright also renders this obvious in another way. Wright teaches that the “restricted topology may be chosen to identify the required bandwidth and to provide guarantees for that bandwidth in the service architecture.” Wright, [0018]. The restricted topology provides the logical connections and is created based on the connectivity requirements for the service, since in Wright the requirements are “in terms of **edge nodes** and communication requirements between edge nodes.” Wright, [0024]. According to Wright with respect to the nodes,

[a] key requirement for providing bandwidth guarantees is that that the service nodes 104, including the edge nodes 102, **provide the necessary queuing and link scheduling mechanisms to provide the bandwidth guarantees for each link.** In addition, the service nodes 104 should have the ability to route the VPN traffic, and only the VPN traffic, over that allocated bandwidth.

Wright, [0018].

131. Queuing of packets may occur at the service nodes 104 in the VPN 106 when packets arrive from several ingress links and “contend for service on a single egress link 108.” Wright, [0015]. A POSITA would have understood from this disclosure in Wright that the service (e.g., VPN service in Wright, traffic more generally in Baker) would include parameters like the “necessary queuing and link

scheduling mechanisms” of the nodes themselves to provide the bandwidth guarantees. *See* Wright, [0018], [0024]. Generally, a POSITA would have understood that these very mechanisms (queuing and link scheduling) disclosed in Wright are examples of “*node-bandwidth[]*.” *See, e.g.*, Olsen, 1:45-59 (“The basic building block of the model is the traffic management node (TMN). The TMN includes a classifier operable to identify and classify incoming traffic streams, a pre-queueing operator, a hierarchical queuing system, and a post-queueing operator. The queuing system includes a plurality of queues and is operable to apply scheduling policies to the traffic streams. The queues of the queuing system each include enqueue attributes configured to control a depth of the queue and dequeue attributes configured to control scheduling of the queue. The dequeue attributes include minimum bandwidth, maximum bandwidth, excess bandwidth, and priority, wherein each of the queues has one or more of the dequeue attributes defined.”), 5:20-28 (queue depth impacts how packets treated once limit reached).

132. In order to be able to provide a bandwidth guarantee, as Wright intends, a POSITA would have recognized that the nodes through which the paths traverse would desirably handle the traffic for that link including prioritizing traffic corresponding to the link above other possible traffic. *See, e.g.*, Wright, [0016] (showing that a restricted topology traverses a subset of nodes with a corresponding subset of links). Thus, the connectivity requirements taught by Wright (“*parameters*

of the service”) include not just the bandwidth requirements between nodes, but also requirements of the nodes themselves.

133. Therefore, the combination of Baker and Wright renders obvious “*wherein parameters of the service comprise respective node-bandwidths required by each of the nodes to provide the service.*”

7. **Claim 9**

a. **[9.0] *The method according to claim 1,***

134. See analysis at [1.0]-[1.5].

b. **[9.1] *and comprising monitoring traffic generated in the network by the data transmission service, and adjusting the bandwidth in response to the traffic.***

135. The combination of Baker and Wright renders this limitation obvious.

136. **First**, Baker renders obvious monitoring traffic generated in the network. This is accomplished by the head node that executes the “Administer Ring” routine. When executed, the head node

checks to see whether this is the initial run of the routine or **whether a topology update has occurred. A topology state change could be triggered by a change in the PTSE database resulting from an addition or subtraction of a node from the ring, a node failure, a change in traffic patterns**, or other occurrences outlined in the PNNI specification. These would be detected by the head node via PNNI topology update messages.

Baker, [0052].

137. The head node's checking of whether a "topology update has occurred" during the Administer Ring routine, and particularly the information received related to traffic patterns, renders obvious "*monitoring traffic generated in the network.*" Further, it would have been obvious to a POSITA that in order for Baker's detection of a change in traffic patterns to occur, monitoring of the traffic would be involved. *See, e.g.,* Holender, 4:51-53 (demonstrating that it was known for a controller, such as Baker's controller, to include "functions for monitoring and controlling ... the traffic"). And, as demonstrated with respect to the analysis at [1.1], it would have been obvious that Baker's traffic is associated with a "*data transmission service,*" as is Wright's traffic for a VPN service. Indeed, Wright's VPN services with bandwidth guarantees are examples of data transmission services that carry generated traffic. *See* analysis at [1.1]; Wright, [0005]-[0007].

138. Second, Baker discloses making an adjustment in response to the change in traffic. Continuing with the Administer Ring routine example, Baker discloses that when the head node detects a change, the routine will either reassign VP addresses to accommodate, or allocate reserved addresses without reassigning others. *See* Baker, [0057]. In Baker's example, this is described with respect to "an additional node NA" being inserted into the physical topology. *See* Baker, [0057]. However, Baker teaches other examples of a "topology state change" including "subtraction of a node from the ring, a node failure, **a change in traffic patterns,** or

other occurrences.” Baker, [0052]. Thus, Baker’s teachings with respect to the Administer Ring routine are applicable to traffic pattern changes as well. Using the Administer Ring routine in situations where traffic patterns change would allow Baker’s network to reallocate virtual paths according to the traffic patterns.

139. Third, the combination of Baker and Wright renders obvious adjusting the bandwidth in response to the traffic. As discussed at [1.5], Baker in combination with Wright renders obvious the allocation of bandwidth as part of Baker’s “special ‘star overlay’ procedure” that includes the Administer Ring routine (which discloses the claimed “*mapping*”). *See* Baker, [0016] and [0062], *and* Wright, [0005], [0024]. Thus, Baker teaches repeating the Administer Ring routine in response to changes including traffic changes, and Wright teaches performing the bandwidth allocation after such a mapping (per the combination, whenever Baker’s Administer Routine occurs).

140. It would have therefore been obvious to a POSITA that the combination of these teachings results in Baker adjusting the bandwidth allocation (per Wright’s teachings) in response to a repetition of the Administer Ring routine (which is triggered by a change, including a change in traffic patterns, per Baker).

141. Therefore, the combination of Baker and Wright renders obvious “*comprising monitoring traffic generated in the network by the data transmission service, and adjusting the bandwidth in response to the traffic.*”

8. Claim 11

a. [11.0] *The method according to claim 1,*

142. See analysis at [1.0]-[1.5].

b. [11.1] *wherein allocating the bandwidth comprises comparing a mapping bandwidth determined in response to the bandwidth requirements of the logical connections and to the mapping with a full bandwidth determined by assuming all possible logical connections in the network are provided for.*

143. The combination of Baker and Wright renders this limitation obvious.

144. First, the combination of Baker and Wright renders obvious “allocating a bandwidth for the service on each of the links in response to the bandwidth requirements of the logical connections and to the mapping” based on a combination of Baker’s teaching of “allocating the network resources” and Wright’s teaching of reserving the required bandwidth “on each link in the restricted topology.” Baker, [0016]; Wright, [0024], [0005].

145. The ’431 patent states that the “mapping bandwidth” refers to “[t]he bandwidth for each link [that] is derived by summing the individual connection requirements of the link.” ’431 patent, 8:67-9:2. The “full bandwidth” is referred to as “bandwidth[] for each link if every possible connection in the network is provided for.” ’431 patent, 7:46-49. The result is a full mesh analysis of every possible connection over every possible link. See, e.g., ’431 patent, comparison between Table III (full bandwidth for hub-and-spoke) and Table VI (mapping bandwidth for

full mesh). A comparison of Tables III and VI show the same listing of connections – while for Table III this is for full bandwidth (all possible connections), for Table VI this is for mapping bandwidth of a full mesh topology. '431 patent, 9:18-22 (full bandwidth), 10:26-67 (full mesh, where Table VI relates to Table V, and Table V shows a “balanced full mesh map”). Thus, a POSITA would have understood the full bandwidth (all possible connections) to correspond to a full mesh scenario.

146. Second, Wright renders obvious a “*mapping bandwidth*” and a “*full bandwidth*.” In general, Wright’s bandwidth requirements for the links, which are then allocated for those links, renders obvious the “*mapping bandwidth*.” As a particular example in Wright, “an exemplary logical connectivity mesh associated with the connectionless VPN network” is illustrated in Figure 2. Wright, [0016]. The “required reserved bandwidth” in Wright for the logical connectivity mesh is calculated in one way by reserving “‘x+y’ Mb/s,” where “x” refers to the “bandwidth requirement” of a virtual path between edge nodes “A” and “B” and “y” refers to the “bandwidth requirement” of a virtual path between edge nodes “A” and “C” as they overlap between edge node “A” and service node “D.” Wright, [0017] and example in FIG. 3. The reserved bandwidth in Wright, per this example, is calculated by summing the bandwidths of virtual paths sharing a physical link. This is, therefore, a “*mapping bandwidth*.”

147. Further, the logical connectivity mesh from FIG. 2 is different from “a full logical mesh approach,” since a full mesh’s “logical connectivity would mirror the physical connectivity depicted in FIG. 1.” Wright, [0016]. This “full logical mesh approach” in Wright corresponds to the “*full bandwidth determined by assuming all possible logical connections in the network are provided for,*” because it corresponds to all possible logical connections on the physical topology (where the logical connectivity mirrors the physical connectivity).

148. Third, Wright contrasts (i.e., “*compares*”) the full mesh approach with the “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.” Wright, [0014] (“contrasted to a full mesh approach”), [0016]. It is along the physical links underlying the logical connectivity mesh that bandwidth is reserved for a desired bandwidth QoS. Wright, [0016] (“Bandwidth is reserved along this subset of links to support a bandwidth QoS.”). It would have been obvious to a POSITA that this comparing between the full mesh and restricted topology would occur as part of the reserving step of Wright. This is because, in Wright, the bandwidth requirements are not fully known until after the calculating step is done, and the only step that follows Wright’s calculating step is the reserving step (“*allocating*”). See Wright, [0024] and Figure 5.

149. As such, Wright teaches comparing the full mesh approach (“*full bandwidth determined by assuming all possible logical connections in the network are provided for*”) with the logical topology overlaid on the physical network with its bandwidth requirements for each logical connection, as explained at [1.3] (“*a mapping bandwidth determined in response to the bandwidth requirements of the logical connections and to the mapping*”). Wright’s disclosure is substantially the same as the description in the ’431 patent as summarized above. In combination with Baker, a POSITA would apply Wright’s teachings regarding the logical connectivity mesh (which, in Wright, relates to the virtual topology – Wright, [0016]-[0017]) to Baker’s logical connections between nodes for a logical topology, such as a logical star topology, before completing allocation of bandwidth to the physical links supporting the logical topology.

150. Therefore, the combination of Baker and Wright renders obvious “*wherein allocating the bandwidth comprises comparing a mapping bandwidth determined in response to the bandwidth requirements of the logical connections and to the mapping with a full bandwidth determined by assuming all possible logical connections in the network are provided for.*”

9. Claim 25

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

151. To the extent that the preamble is limiting, Baker renders it obvious.

152. First, Baker discloses a method “*for assigning bandwidth in a network including nodes coupled by links arranged in a physical topology.*” See analysis at [1.0].

153. Second, Baker discloses using a head node, which is part of the physical topology of the network, to overlay the logical topology onto the physical topology. As discussed in [1.4], in Baker the head node executes “a set of special ‘star overlay’ procedures including ‘Administer Ring’” to overlay the logical topology to the physical topology. Baker, [0051]. Thus, the “head node” is an “*apparatus.*”

154. Therefore, Baker discloses “[a]*pparatus for assigning bandwidth in a network including nodes coupled by links arranged in a physical topology,*” as recited in the preamble.

b. [25.1] *a controller which is adapted to:*

155. Baker discloses this limitation.

156. As noted at [25.0], Baker discloses a “head node” which is responsible for “execut[ing] the Administer Ring routine” in order to “execute a set of special ‘star overlay’ procedures,” which includes the Administer Ring routine. Baker,

[0051]-[0052]. The head node is the node that has “the highest leadership priority,” meaning that it is assigned as the “peer group leader” (PGL), a concept used by PNNI (“Private Network-Network Interface”). Baker, [0051]; [0044]. In Figure 2, N0 “is configured to be the head node.” Baker, [0049].

157. The PGL, due to its assigned tasks, can be given “additional resources ... e.g., processing power, redundant hardware for protection, and memory” in order to meet its requirements relating to “topology and routing control.” Baker, [0047], [0046]. It would have been obvious to a POSITA that the PGL includes one or more components configured to perform the additional tasks and corresponding requirements for control, and is therefore a “*controller*” implemented by the head node. Baker’s disclosure of the processing hardware of the head node used to implement the star overlay procedures is an example of the one or more components to perform the tasks, and also correspond to the “*controller*.” See Baker, [0047], [0046] (the additional resources of processing power, redundant hardware, and memory). Indeed, a POSITA would have recognized and known that Baker’s disclosure of the processing hardware, and PGL, disclose the “*controller*.” See Wright, [0006] (disclosing “a computer program product ... for execution by the processing circuit for performing a method”) and [0026] (“when the computer program code is loaded into and executed by a computer, the computer becomes an apparatus for practicing the invention”).

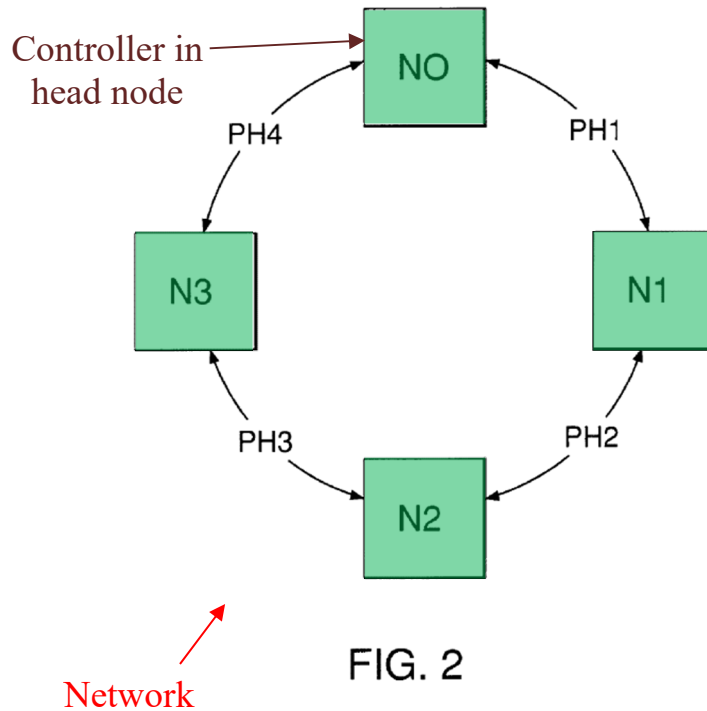


FIG. 2

Baker, FIG. 2 (annotated).

158. Therefore, Baker discloses “a controller which is adapted to.”

- c. [25.2] *[a controller which is adapted to] 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,*

159. The combination of Baker and Wright renders this limitation obvious.

160. **First**, the combination of Baker and Wright renders obvious “*defining between the nodes logical connections associated with a data transmission service to be provided over the network.*” See analysis at [1.1].

161. **Second**, it would have been obvious to a POSITA for Baker’s PGL to receive the definition of logical connections. Baker teaches that the “‘head’ node is designated that will execute a set of special ‘star overlay’ procedures.” Baker,

[0047]. The head node is “aware of the fact that it is both the PGL and the lead node with respect to the logical star topology overlay,” and “knows that it must execute a set of special ‘star overlay’ procedures including ‘Administer Ring’.” Baker, [0051]. It would have been obvious to a POSITA that the PGL would “know” it is to perform the overlay procedures because the PGL has received information about the virtual paths to be established by that procedure.

162. Further, it was well-known for information (e.g., what virtual paths to set up and assign to nodes in Baker’s network, as well as how to assign between what nodes for the logical topology itself) to be received for the PGL of the head node to implement. This was nothing more than a trivial detail. *See, e.g.,* Azuma, 3:63-67 (“Each node in the network retains ... logical topology information relating to routing of paths formed in the links.”); 6:26-36 (“the logical topology must be updated whenever the path establishments are changed as requested by customers. Each node executes the process for updating ... the logical topology autonomously. The ... logical topology table relating to the network maintained in each node are communicated from a node to all the other nodes in the network”).

163. Third, Wright confirms that this would have been obvious. In Wright, when the “logical connectivity requirements are received,” the device “creat[es] a restricted topology to provide logical connections” over the physical topology. Wright, [0024]; FIG. 5:

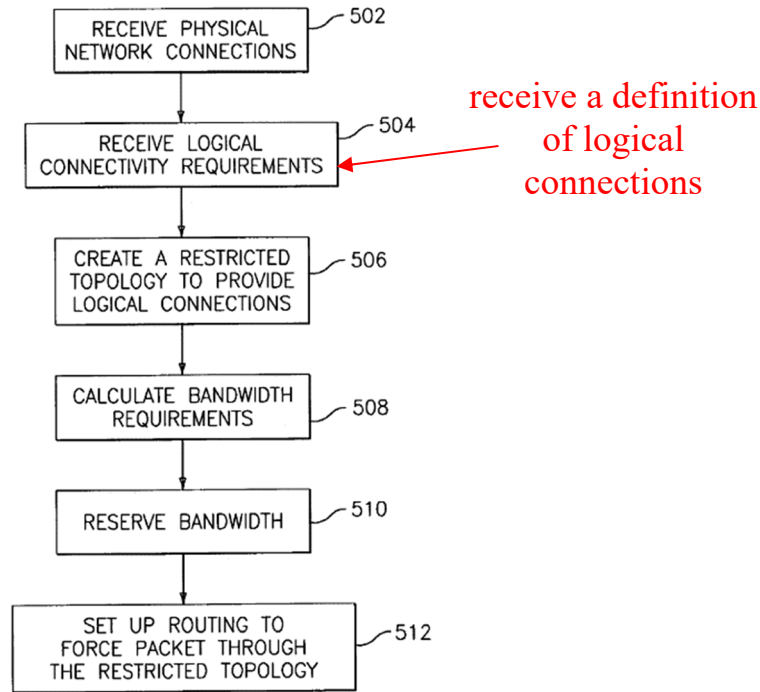


FIG. 5

Wright, FIG. 5 (annotated).

164. Thus, Wright discloses receiving a “*definition of logical connections*” (receiving the logical connectivity data) that are “*associated with a data transmission service to be provided over the network*” (including Baker’s traffic generally, and also Wright’s VPN services).

165. In combination, therefore, it would have been obvious to a POSITA for Baker’s PGL of the head node to receive Baker’s logical topology information (e.g., definitions of virtual paths and/or the overall logical topology) according to Wright’s teachings of receiving logical connectivity requirements. *See* Wright, [0024].

166. Therefore, the combination of Baker and Wright renders obvious “[a controller which is adapted to] 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.”

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

167. Baker discloses this limitation. See analysis at [1.2].

e. [25.4] *[a controller which is adapted to] determine respective bandwidth requirements for the logical connections based on parameters of the service,*

168. The combination of Baker and Wright renders this limitation obvious.

169. **First**, the combination of Baker and Wright renders obvious “determining respective bandwidth requirements for the logical connections based on parameters of the service.” See analysis at [1.3].

170. **Second**, the combination of Baker and Wright further renders obvious the PGL of the head node of Baker performing the determination. As noted at [25.2], the combination of Baker and Wright teaches Baker’s PGL of the head node receiving logical topology information according to Wright’s teachings. See Wright, [0024]. As further noted at [25.1], Baker’s PGL has additional hardware resources. Baker, [0047], [0046]. In view of these teachings, it would have been obvious for Baker’s head node to further perform the determination of “bandwidth requirements

for the logical connections” as taught by the combination of Baker and Wright, because Baker’s head node has the additional resources to do so.

171. Therefore, the combination of Baker and Wright renders obvious “[a controller which is adapted to] determine respective bandwidth requirements for the logical connections based on parameters of the service.”

- f.** **[25.5] *[a controller which is adapted to] 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***

172. Baker discloses this limitation. See analysis at [1.4] (demonstrating that the head node in Baker, and therefore the PGL with additional processing resources per [25.1], is adapted to perform the recited operation).

- g.** **[25.6] *[a controller which is adapted to] 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.***

173. The combination of Baker and Wright renders obvious this limitation.

174. First, the combination of Baker and Wright renders obvious “allocating a bandwidth for the service on each of the links in response to the bandwidth requirements of the logical connections and to the mapping.” See analysis at [1.5].

175. Second, it would have been obvious to a POSITA that Baker’s allocating of network resources, including bandwidth according to the combined

teachings of Baker and Wright, would be performed by the PGL of the head node. Baker teaches that the head node is responsible for more effectively managing “resources such as bandwidth” as the PGL. Baker, [0062]. And, as noted at [25.1], Baker’s PGL has additional hardware resources, such that it would have been obvious for Baker’s PGL of the head node to perform the allocation of “*bandwidth for the service on each of the links*” as recited and further taught by Wright. *See* Baker, [0047], [0046]; Wright, [0005], [0024].

176. Therefore, the combination of Baker and Wright renders obvious “[*a controller which is adapted to] 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.*”

10. Claim 26

a. [26.0] *Apparatus according to claim 25,*

177. *See* analysis at [25.0]-[25.6].

b. [26.1] *wherein the controller is comprised in one of the nodes.*

178. Baker discloses this limitation.

179. As discussed in [25.1], in Baker the PGL of the head node (the “*controller*,” with the hardware implementing the PGL another example of a “*controller*”) executes “a set of special ‘star overlay’ procedures including

‘Administer Ring’” to overlay the logical topology to the physical topology. Baker, [0051] and [0047], [0046].

180. In particular, as discussed in [25.1] the head node is the node that has “the highest leadership priority,” meaning that it is assigned as the “peer group leader” (PGL), a concept used by PNNI (“Private Network-Network Interface”). Baker, [0051]; [0044]. In Baker’s Figure 2, N0 “is configured to be the head node.” Baker, [0049]. Because the PGL is a function of the head node, a POSITA would have recognized that the PGL (the “*controller*”) is “*comprised in one of the nodes*” (the head node). Further, the processing hardware that implements the star overlay procedures is also comprised in the head node. *See* Baker, [0047], [0046] (the additional resources of processing power, redundant hardware, and memory).

181. Therefore, Baker discloses “*wherein the controller is comprised in one of the nodes.*”

IX. CHALLENGE 2: THE COMBINATION OF BAKER, WRIGHT, AND HOLENDER RENDERS OBVIOUS CLAIMS 5, 10, 12-16, 20-24, AND 27-30

A. Summary of Holender

182. U.S. Patent No. 6,104,699 to Holender *et al.* (Ex. 1007, “Holender”) issued as a patent on August 15, 2000. Holender is titled “Method and Device for Partitioning Physical Network Resources.” Holender was not before the Examiner during prosecution of the ’431 patent.

183. Holender, similar to the '431 patent, is focused on “the partitioning of physical network resources” “among logical networks that share the capacity of the physical network.” Holender, 1:6-8, 3:54-58. For example, Figure 1 illustrates a “physical network PN on top of which a set of logical networks LN1, LN2, ..., LNX (assuming there are X logical networks) is established.” Holender, 4:22-26. “The topology of these logical or virtual networks will in general differ from the topology of the underlying physical network.” Holender, 4:26-30; FIG. 1.

184. Holender “offer[s] separate logical networks” for different services that have markedly different demands such as “bandwidth, grade of service or congestion control functions.” Holender, 3:60-67. Doing so results in service classes “arranged into groups ... of similar properties ... handled together in a logical network.” Holender, 3:67-4:4. These service classes are also referred to as “traffic classes” that are arranged into the noted groups. Holender, 4:66-5:5, 4:4-15.

B. Reasons to Combine Baker and Wright with Holender

185. A POSITA would have been motivated to combine Baker and Wright with Holender for several reasons. Holender is focused on similar, analogous issues to those in Baker and Wright, including how to partition and manage physical resources in a network to support a logical topology overlaid thereon. *See* Holender, 1:6-8, 3:54-58 (partitioning physical resources among logical networks sharing the physical network’s capacity); Baker, [0016], [0030] (assigning network resources

for a logical topology overlaid onto a physical topology); Wright, [0005] (physical connections and logical connections used to calculate link bandwidth requirements for each link).

186. A POSITA would have been motivated to combine Baker and Wright with Holender to take advantage of Holender's teachings of providing multiple different logical networks over the same physical network. Baker teaches different types of logical topologies analogous to Holender's logical networks. *See* Holender, 4:28-30 (each logical network has a topology). For example, in Baker "the invention may involve the sequential overlaying of one or more logical topologies on top of the ultimate, actual physical network." Baker, [0030] (logical star), [0066] (logical ring). Baker suggests a sequential order for the multiple different logical networks (logically imposing one over the other, repeated until reaching the base physical network, *see* Baker, [0064]).

187. A POSITA would have been motivated to turn to Holender, which demonstrates that it was well-known for different logical networks to meet different services' unique demands, overlaid onto a common physical network. For example, even in Holender's background, Holender explains that known networks may have "[o]n top of a physical network PN ... established a number of logical networks LN." Holender, 1:12-27. Holender further teaches with respect to FIG. 1 that there can be multiple, e.g. "X logical networks" on top of a given physical network.

Holender, 4:22-30. Imposing multiple logical networks, as demonstrated by Holender, would have been a well-known alternative manner in which to overlay the multiple logical network types taught in Baker. Moreover, since Baker already teaches at least one logical network overlaid onto a physical network, it would have been obvious to a POSITA to simply duplicate that process with additional logical networks, as Holender confirms.

188. Moreover, a POSITA would have been motivated to make the combination with Holender in order to obtain the noted benefits that Holender's approach provides. Holender recognized that supporting different services on a logical network often results in "services with very different demands to e.g. bandwidth, grade of service or congestion control functions" on that same logical network. Holender, 3:60-63. Network management further becomes cumbersome if services with disparate requirements are grouped together. *See* Holender, 3:67-4:4. Holender teaches mitigating these issues by "offering separate logical networks" in order to "support different services" with disparate demand properties. Holender, 3:63-67. A POSITA would have been motivated to obtain the convenient benefit of arranging different services with corresponding service/traffic classes "into groups in such a way that those with similar demands to bandwidth are handled together in a separate logical network." Holender, 4:66-5:1; *see also* 3:67-4:14. By so doing, a POSITA would realize for Baker the benefit of simplified network management that

results from Holender's separating out of different services to different logical networks. *See* Holender, 3:67-4:4.

189. A POSITA would have had a reasonable expectation of success in combining the teachings of Holender with Baker's system and the combined teachings of Baker and Wright. Like Wright, Holender's network teachings are also compatible with Baker's network teachings. Baker discloses "using Asynchronous Transfer Mode (ATM) over SONET [Synchronous Optical NETwork]" for the physical topology of its network. Baker, [0037]. Likewise, Holender teaches that its invention is applied in a network with "[a] transmission stratum based on SDH ... or equivalent (SONET) at the bottom," and "a cross connect stratum based on either SDH or ATM ... on top of that, which acts as an infrastructure for the ATM VP/VC stratum." Holender, 5:12-35; *see also* FIG. 3 (showing the network strata); 5:36-37 ("Of course, it is to be understood that the present invention can be applied to any physical telecommunication network."); and 6:14-22.

190. Holender also overlays logical networks onto a physical network, just like Baker and Wright. Figure 1 of Holender illustrates a "physical network PN on top of which a set of logical networks LN1, LN2, ..., LNX (assuming there are X logical networks) is established." Holender, 4:22-26. Baker, similarly, teaches overlaying a logical star topology onto a physical topology (ring network), and Wright imposes a logical topology on a physical topology. Baker, [0030]; Wright,

[0005]-[0007]. Thus, the concepts of Baker, Wright, and Holender are similar and compatible, utilizing similar physical networks with logical networks imposed on them. A POSITA would have had a reasonable expectation of success in applying Holender's teachings to Baker's and Wright's combined teachings in view of this compatibility.

191. Combining Holender's teachings with Baker's and Wright's combined teachings would have also been predictable and within a POSITA's skillset. Baker already teaches traffic transmitted between nodes through the physical network. Baker, [0012]; *see also* [0038] and [0080] (traffic). Holender's teachings demonstrate that Baker's traffic can include "a wide variety of traffic types," with one or more corresponding service/traffic classes relating to the different traffic types of different services. Holender, 5:7-9, and generally 4:66-5:11.

192. Moreover, Baker already contemplated imposing multiple logical networks sequentially, motivating a POSITA to turn to Holender that demonstrates imposing multiple networks in parallel is a well-known option also. Holender, 4:22-30. The predictable result of combining Holender's teachings to Baker's and Wright's teachings includes the overlaying of multiple logical networks onto the physical network of Baker, and different classes available for different types of traffic in the network. Indeed, combining Holender's teachings with Baker's and Wright's teachings is nothing more than the combination of known elements

(Baker's and Wright's physical and logical networks, and Holender's multiple logical networks per physical network and different traffic types/classes of traffic), according to known methods (Holender's teaching of multiple parallel logical networks) to yield predictable results (Baker's and Wright's teachings being applied to multiple logical networks in parallel).

193. Combining Holender's teachings with Baker's and Wright's teachings would result in multiple logical networks being overlaid in parallel onto Baker's physical network to support a variety of traffic types (i.e., services) with different service/traffic classes. Doing so would provide the advantage of different logical networks supporting different services of potentially different bandwidth, grade of service, control demands, delay sensitivity, loss sensitivity, etc. *See* Holender, 3:60-4:8. A POSITA would have therefore been motivated to turn from the combination of Baker and Wright to Holender's teachings.

194. The combination permits but does not require physical incorporation of elements from Holender into Baker. Nevertheless, the physical incorporation of Holender's multiple logical networks onto Baker's physical topology would teach the claim limitations.

C. Detailed Analysis of Claims

1. Claim 5

a. [5.0] *The method according to claim 1,*

195. *See* analysis at [1.0]-[1.5].

- b. [5.1] *wherein the data transmission service comprises a class of service defined by a protocol under which the network operates.*

196. The combination of Baker, Wright, and Holender renders this limitation obvious.

197. **First**, as discussed and demonstrated at [1.1], Baker and Wright render obvious a “*data transmission service*” in various ways.

198. **Second**, Baker and Wright both teach that their networks operate using ATM. In Baker, routing and signaling protocols are manipulated “on an (ATM) Virtual Path Ring (VPR) to effect the creation of the logical star while maintaining compatibility with those protocols.” Baker, [0045]. Wright teaches using “any link technology known in the art including using ... virtual circuits with bandwidth guarantees through an ATM network to provide the links 108.” Wright, [0015].

199. A POSITA would have recognized that ATM (a “*protocol under which the network operates*”), as used in Baker and Wright, supported different Quality of Service classes. This was well-known. *See, e.g.*, Jorgensen, [0279] (“ATM can also support multiple quality of service (QoS) classes for differing application requirements by providing separate virtual circuits for different types of traffic.”). It would have therefore been further obvious to a POSITA that each of the different examples of traffic taught by both Baker and Wright in combination would comprise one of the QoS classes defined by ATM for supporting differing application

requirements. Thus, the ATM protocol (in view of a POSITA's background knowledge of ATM supporting multiple classes) that the data traffic Baker and Wright uses renders obvious "*wherein the data transmission service comprises a class of service defined by a protocol under which the network operates.*"

200. Third, Holender confirms that it was obvious that network transmissions comprise classes of service defined by a protocol. Holender teaches a "[l]ogical resource separation for offering different Grade of Service classes, virtual leased networks with guaranteed resources and peak rate allocated virtual paths are some examples of interesting features in the design, dimensioning and management of physical networks." Holender, 2:54-59. These different groupings of Grade of Service classes are elsewhere described as "traffic groups." Holender, 4:66-5:9. Holender teaches that "traffic groups are handled separately in different logical subnetworks. In particular, this is advantageous **for an ATM network carrying a wide variety of traffic types.**" Holender, 4:66-5:9; *see also* 3:60-4:14 (service classes arranged into groups, and different logical networks provided for different groups/services). Thus, it would have been obvious for a POSITA to benefit from Holender's advantages by employing Holender's traffic grouping teachings with Baker and Wright's ATM networking teachings.

201. Fourth, in combination, it would have been obvious to a POSITA for Baker's and Wright's teachings of providing a logical topology for a data

transmission service (e.g., Baker's traffic, Wright's VPN service) on an ATM network to operate with a given grade of service class, since it was known that ATM defined different classes of service. A POSITA would have combined Holender's particular teachings of using a logical network to support a particular service class or group of classes with similar requirements over a physical network, like an ATM network, with the teachings of Baker and Wright. This would result in providing a logical topology for a data transmission service on an ATM network in Baker that operates with one of Holender's disclosed service classes or groups.

202. Therefore, the combination of Baker, Wright, and Holender renders obvious "*wherein the data transmission service comprises a class of service defined by a protocol under which the network operates.*"

2. Claim 10

a. [10.0] *The method according to claim 1,*

203. See analysis at [1.0]-[1.5].

b. [10.1] *wherein the data transmission service comprises a plurality of subclasses of traffic, and*

204. The combination of Baker, Wright, and Holender renders this limitation obvious.

205. First, as discussed and demonstrated at [1.1], Baker and Wright render obvious a "*data transmission service*" in various ways. It would have been obvious to a POSITA for the data transmission services taught by Baker and Wright to

“comprise[] a plurality of subclasses of traffic,” since Baker and Wright teach different types of traffic, which a POSITA would have recognized as having different priorities. *See* Baker, [0080] and [0038] (data traffic), [0012] (signals); Wright, [0005]-[0007] (VPN services), [0015] (VPN provided as emulated VPLS). For example, Wright teaches multiple examples of different traffic for different services that would take advantage of the VPN service, such as “connectionless services ... such as voice over IP ... dynamic session based services ... (e.g., video-on-demand, video conferencing).” Wright, [0025]. Each of these examples demonstrates a different *“subclass[] of traffic.”*

206. Second, this is further rendered obvious in view of Holender, which extends the concepts disclosed in Baker and Wright to multiple logical networks. Holender explains 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.” Holender, 3:60-63. As a result, it sometimes can “turn out to be better to support different services by offering separate logical networks” on the same physical resources. Holender, 3:54-58, 63-67.

207. As a result of supporting different services via different logical networks, Holender discloses that managing a network “can be simplified if service classes are arranged into groups in such a way that only those of similar properties are handled together in a logical network.” Holender, 3:67-4:4. Holender teaches

that “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.” Holender, 4:66-5:5. I note that this reference to “traffic classes” is another term Holender uses for “service classes,” because the discussion of service classes similarly contemplates handling classes with similar characteristics together in a given logical network, and separating out other services classes to other logical network(s). *See* Holender, 4:4-14.

208. For example, a given “group” in Holender provides an example of Wright’s “*data transmission service*” as it includes one or more traffic/service classes, with each class having “similar properties” to the other classes in the group. *See* Holender, 3:67-4:4. Each of the classes, being part of a common group, are therefore examples of “*subclasses*” due to their relationship to the group and other classes in the group. This is consistent with the ’431 patent’s example, where guaranteed traffic includes “a specific subclass of guaranteed traffic, such as guaranteed broadcast traffic.” ’431 patent, 12:39-44.

209. A POSITA would have applied Holender’s teachings to the Baker-Wright combination, resulting in the logical network disclosed in Baker having a particular service class (or classes in a group) that have similar network resource demands (e.g., bandwidth demands, delay sensitivity, loss sensitivity, etc.). *See* Reasons to Combine Baker and Wright With Holender, Section IX.B. Moreover,

since Holender's "traffic classes are arranged into groups" for handling together in a single logical network, applying Holender's teachings to Baker-Wright results in a given logical network (which supports a given data transmission service, like Wright's VPN service) having a group of traffic classes being handled together by the logical network (as taught by Holender).

210. Yet further, each of Holender's groups would potentially have varying bandwidth demands. *See* Holender, 4:66-5:7 (groups of traffic classes with "similar demands to bandwidth"), 8:59-62. To accommodate this, Holender teaches handling different traffic groups "separately in different logical subnetworks." Holender, 5:5-7. When the different logical subnetworks taught by Holender are viewed in the aggregate, it would have been obvious to a POSITA that the aggregate is a "*data transmission service compris[ing] a plurality of subclasses of traffic.*"

211. Therefore, the combination of Baker, Wright, and Holender renders obvious "*wherein the data transmission service comprises a plurality of subclasses of traffic.*"

c. [10.2] *wherein allocating the bandwidth comprises allocating a reserved bandwidth to one of the subclasses.*

212. The combination of Baker, Wright, and Holender renders this limitation obvious.

213. First, as demonstrated at [1.5], the combination of Baker and Wright renders obvious “*allocating a bandwidth for the service on each of the links in response to the bandwidth requirements of the logical connections and to the mapping*” based on Baker’s teaching of “allocating the network resources” and Wright’s teaching of reserving the required bandwidth “on each link in the restricted topology.” Baker, [0016]; Wright, [0024], [0005].

214. Second, Holender further renders obvious allocating bandwidth to a subclass. It would have been obvious to a POSITA that the allocating taught by Baker and Wright in combination (*see* [1.5]) would have included allocation of the reserved bandwidth (per Wright) to each of the traffic classes (which are “*subclasses of traffic*”) further taught by Holender. *See* [10.1].

215. Holender teaches that “traffic classes are arranged into groups.” Holender, 4:66-5:1. Each group is separately handled on its own logical network. Holender, 5:5-7 (“In other words, the two traffic groups are handled separately in different logical subnetworks.”). In particular, a given traffic group may have multiple “traffic types,” which a POSITA would understand from Holender to refer to the different traffic classes. Holender, 5:1-5. Further, each traffic type has “different bandwidth demands.” *See* Holender, 8:59-62. It would have been obvious to a POSITA, since Holender’s groups of traffic classes are “handled separately,” for the bandwidth allocations to be made separately for each group or traffic class.

This extends to cases where “each individual traffic type is handled in a separate logical network.” Holender, 5:1-11. Indeed, as discussed at [12.3] below, both Baker and Wright are focused on a per-logical-topology granularity for mapping and bandwidth management. *See* Baker, [0059], Wright, [0024]. A POSITA would have therefore been motivated to repeat the combined teachings of Baker and Wright on a per-logical-network basis according to Holender’s multiple logical network teachings. As a result, the limitation is rendered obvious.

216. Further, Holender teaches that the traffic types are associated with routes. Routes describe “a subset of logical links which belong to the same logical network” for a node pair in the logical network. Holender, 2:1-14. “[E]ach route carries only a single type of traffic,” such that “if several traffic types are to be carried, they are represented by parallel routes.” Holender, 7:8-11. Each route requires a given “amount of bandwidth” on a given logical link. Holender, 8:20-25. Accordingly, it would have been obvious to a POSITA that each traffic type (corresponding to a different route with a bandwidth requirement amount) would have its own bandwidth requirement (corresponding to the route bandwidth requirement) with its own corresponding bandwidth allocation.

217. A POSITA considering the teachings of Holender together with Baker and Wright would have recognized that Holender’s different traffic types (i.e., traffic classes, which are “*subclasses of traffic*”) would result in the allocation of Wright’s

reserved bandwidth on a per-traffic type basis. Indeed, Holender envisions allocating transmission resources, which includes bandwidth, among the logical links, according to the bandwidth requirements of each route on a given logical link. Holender, 6:10-13, 8:14-25. In combination with Baker and Wright, this also renders obvious the allocation of a reserved bandwidth to one of the subclasses (any of the traffic types/routes that have bandwidth allocated for their corresponding physical resources).

218. Accordingly, the combination of Baker, Wright, and Holender renders obvious “*wherein allocating the bandwidth comprises allocating a reserved bandwidth to one of the subclasses.*”

3. Claim 12

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

219. To the extent that the preamble is limiting, Baker discloses this limitation. *See* analysis at [1.0].

- b. ***[12.1] defining between the nodes a first set of logical connections associated with a first data transmission service to be provided over the network, and a second set of logical connections associated with a second data transmission service to be provided over the network, the first set of logical connections having a first connection topology, the second set of logical connections having a second connection topology,***

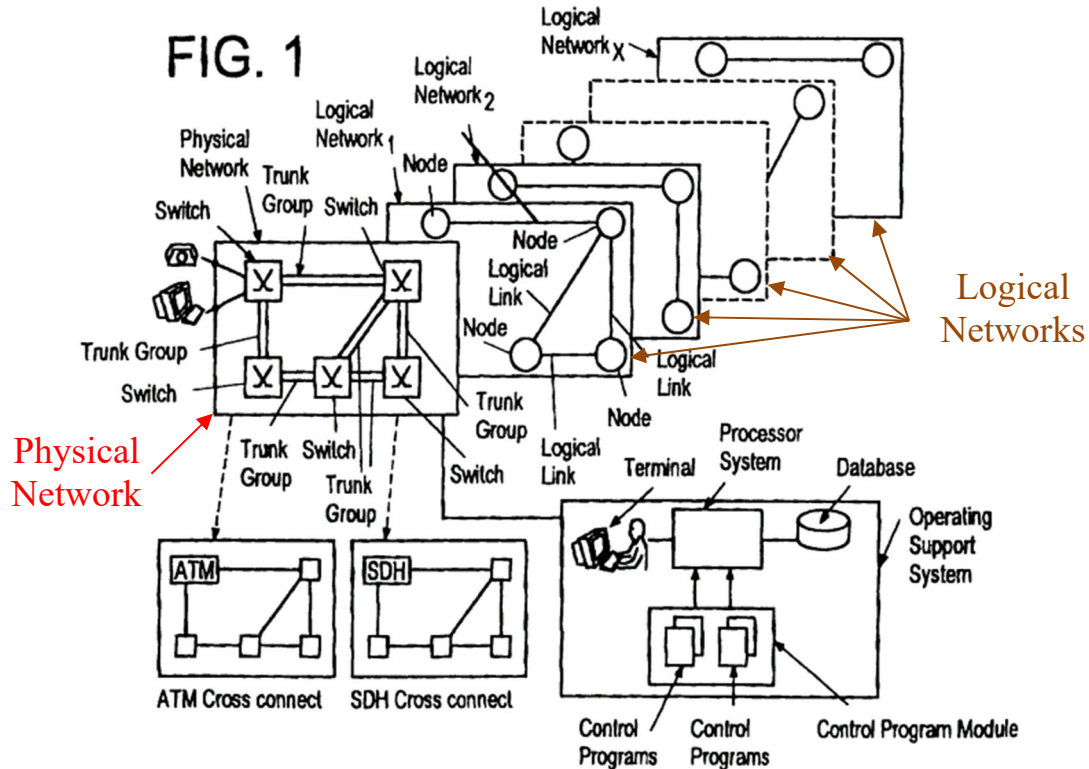
220. The combination of Baker, Wright, and Holender renders this limitation obvious.

221. First, the combination of Baker and Wright renders obvious defining between the nodes logical connections associated with a data transmission service to be provided over the network. *See* analysis at [1.1]. Moreover, Baker discloses the set of logical connections having a connection topology. *See* analysis at [1.2].

222. Second, it would have been obvious to a POSITA that the combined teachings of Baker and Wright support more than one data transmission service over the network (e.g., Baker's traffic associated with one or more services in general, and Wright's disclosure of VPN service). For example, Wright teaches handling plural "VPN services with bandwidth QoS guarantees." Wright, [0014]; *see also* [0005], [0006] and Baker, [0038], [0080]. Further, Wright teaches supporting multiple services including VPN, VoIP, video-on-demand, and video conferencing services. Wright, [0025]. Applying the teachings of Baker and Wright to multiple data transmission services, on corresponding multiple logical networks, would have therefore been obvious in view of the multiple services taught, where Baker and

Wright's procedures and concepts are simply repeated for additional logical topologies overlaid onto the underlying physical topology.

223. Third, overlaying multiple logical networks onto an underlying physical topology is further rendered obvious in view of Holender. Holender teaches that on “top of a physical network **a number of logical networks are established in which logical links**, used by routes, share the same physical transmission and switching resources.” Holender, 2:50-53. Holender illustrates an example of multiple logical networks in Figure 1, where the “topology of these logical or virtual networks will in general differ from the topology of the underlying physical network.” Holender, 4:23-30; *see also* 4:54-65 (defining multiple logical topologies).



Holender, FIG. 1 (annotated).

224. These logical networks in Holender, with respectively determined logical links, offer “different Grade of Service classes, virtual leased networks with guaranteed resources and peak rate allocated virtual paths.” Holender, 2:54-59. Traffic may be separated into traffic groups, e.g., a first traffic group and a second traffic group, going so far as having “each individual traffic type [be] handled in a separate logical network.” Holender, 5:1-11. Each logical network in Holender “forms a logical view of parts of the physical network or of the complete physical network,” with different logical networks having different views of the physical network from the others. Holender, 1:16-27. That the different logical networks are

different from each other is further observable by a POSITA in Holender's Figure 1 (see above). As a result of these teachings, Holender renders obvious a one "*set of logical connections*" for a first logical network (for a first traffic group), and a second "*set of logical connections*" for a second logical network (for a second traffic group), each associated with a different "*data transmission service*" (to support different traffic groups which "support different services by offering separate logical networks." Holender, 3:60-4:14.

225. The combination of Holender with Baker and Wright results in Baker and Wright's procedures and concepts being applied to each "separate logical network" taught by Holender (i.e., Holender's establishing of multiple logical networks would be achieved by the combined teachings of Baker and Wright), each for a different "*data transmission service.*" See, e.g., Holender, 4:54-5:1 (defining each logical topology for multiple logical networks on top of the physical network).

226. As a result, the combination of Baker, Wright, and Holender renders obvious "*defining between the nodes a first set of logical connections associated with a first data transmission service to be provided over the network, and a second set of logical connections associated with a second data transmission service to be provided over the network, the first set of logical connections having a first connection topology, the second set of logical connections having a second connection topology.*"

c. **[12.2] *the first and second connection topologies being different from the physical topology;***

227. Baker combined with Holender renders obvious this limitation.

228. First, Baker discloses that a connection topology is different from the physical topology. *See* analysis at [1.2].

229. Second, as demonstrated at [12.1], Holender teaches that multiple logical topologies, i.e. “*first and second connection topologies,*” are established on top of the same physical topology, and that they are different from the underlying physical topology. Holender, 4:28-30.

230. In combination, Baker teaches that the logical topology is different from the physical topology, while Holender demonstrates that multiple such logical topologies are defined. *See, e.g.,* Baker, [0030], [0013] and FIGs. 1-2; Holender, 4:54-65.

231. Therefore, the combination of Baker and Holender renders obvious “*the first and second connection topologies being different from the physical topology.*”

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

232. The combination of Baker, Wright, and Holender renders obvious this limitation.

233. First, the combination of Baker and Wright renders obvious “*determining respective bandwidth requirements for the logical connections based on parameters of the service*” for a given service. See analysis at [1.3].

234. Second, as demonstrated at [12.1], Holender teaches that multiple logical topologies are established on top of the same physical topology. See, e.g., Holender, 4:54-65. Further, Wright teaches determining bandwidth per logical topology, and Baker focuses on bandwidth management for a particular logical topology. Wright, [0024] (determining bandwidth for one restricted topology, an example of a logical topology from Baker); Baker, [0059]. In combination, a POSITA would have been motivated to repeat Baker and Wright’s teachings for determining the bandwidth requirements for a set of logical connections for another logical topology (the “*second set of logical connections*”) based on Holender’s teachings of including multiple such logical topologies for a given physical topology. Moreover, a POSITA would have been motivated to repeat Baker-Wright’s teachings on a per-logical network basis in view of Baker’s and Wright’s disclosures.

235. Therefore, the combination of Baker, Wright, and Holender renders obvious “*determining respective first bandwidth requirements for the first set of logical connections based on first parameters of the first data transmission service*”

and respective second bandwidth requirements for the second set of logical connections based on second parameters of the second data transmission service.”

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

236. Baker alone, and in combination with Holender, renders obvious this limitation.

237. First, Baker discloses “*mapping the connection topology to the physical topology, so that each of the logical connections is associated with one or more links of the physical topology.*” See analysis at [1.4]. It would have been obvious to a POSITA that the act of mapping, as taught by Baker, also discloses “*generating a ... mapping*” according to the claim. The act of associating the physical network resources to the logical network resources, taught by Baker, results in the mapping between those resources that then exists. The result is the same, according to the claim: “*so that each of the first set of logical connections is associated with one or more links of the physical topology,*” which is the result of mapping from [1.4].

238. Second, this is also taught in Holender, which teaches “how to distribute or partition said physical network resources among the logical networks.” Holender, 2:59-67; *see also* 5:38-41. A POSITA would have understood Holender’s partitioning, or distributing, of the physical network resources among the logical

networks to be an act of mapping the logical topology to the physical topology. Indeed, Holender explains as well that “[a] physical link is logically subdivided into one or more logical links, each logical link having an individual traffic capacity referred to as logical link capacity ... each logical link may use more than one physical link or trunk group.” Holender, 1:53-57.

239. Therefore, Baker, alone and in combination with Holender, renders obvious “*generating a first mapping of the first connection topology to the physical topology, so that each of the first set of logical connections is associated with one or more links of the physical topology.*”

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

240. The combination of Baker and Wright renders this limitation obvious.
See analysis at [1.5].

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

241. The combination of Baker and Holender renders this limitation obvious.

242. As explained at [12.4] and [1.4], Baker teaches generating a mapping with respect to a given logical topology, and that combining with Holender further

renders this obvious. Further, it would have been obvious to repeat generating of a mapping for the second logical topology taught by the combination of Baker and Holender, for the different logical networks that “in general differ from the topology of the underlying physical network.” See Holender, 4:23-30. This would have been nothing more than the mere repeating of Baker’s mapping for additional logical topologies overlaid onto the underlying physical topology as taught by Holender. See Holender, 4:54-65, analysis at [12.1] generally. Moreover, as demonstrated at [12.3], this repetition would have been at a per-logical-network level of granularity. The combination of Baker and Holender thus renders obvious performing the generating of a mapping for any additional logical topologies overlaid onto the underlying physical topology.

243. Therefore, the combination of Baker and Holender renders obvious “*generating a second mapping of the second connection topology to the physical topology, so that each of the second set of logical connections is associated with one or more links of the physical topology.*”

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

244. The combination of Baker, Wright, and Holender renders this limitation obvious.

245. As explained at [12.5] and [1.5], Baker combined with Wright teaches allocating bandwidth for a data transmission service on each of the links in response to the bandwidth requirements of the set of logical connections and the mapping. Further, it would have been obvious to repeat this allocating of bandwidth for the second logical topology as taught in combination with Holender. This would have been nothing more than the mere repeating of Baker's and Wright's allocating of bandwidth for additional logical topologies overlaid onto the underlying physical topology as taught by Holender. *See* Holender, 4:54-65, analysis at [12.1] generally. Moreover, as demonstrated at [12.3], this repetition would have been at a per-logical-network level of granularity. The combination of Baker, Wright, and Holender thus teaches performing the allocating of bandwidth for any additional logical topologies overlaid onto the underlying physical topology.

246. Therefore, the combination of Baker, Wright, and Holender renders obvious “*allocating a second bandwidth for the second data transmission service on each of the links in response to the second bandwidth requirements of the second set of logical connections and to the second mapping.*”

- i. **[12.8] *summing the first and the second bandwidths to determine a total allocation for each of the links.***

247. The combination of Baker, Wright, and Holender renders this limitation obvious.

248. First, as discussed in [1.5], [12.5], and [12.7], each data transmission service (e.g., traffic generally taught by Baker, as well as Wright’s VPN service) with corresponding logical topology has an allocated bandwidth on each link in response to the bandwidth requirements of the logical connections and mapping.

249. Second, Holender teaches that “the sum of logical link capacities on the same physical link cannot exceed the capacity of the physical link.” Holender, 6:60-65. In Holender, this sum of logical link capacities refers to “a fixed physical network with N nodes and K physical links, on top of which a number of logically separated logical networks are established.” Holender, 6:50-52. The capacities of each logical link for each given logical network are what is summed in Holender to arrive at the “sum of logical link capacities on the same physical link.” Holender, 6:60-65. That is, the bandwidth required on a link from each logical network is summed.

250. It would have been obvious, according to these teachings of Holender, to sum the allocated bandwidths from all of the logical networks in order to make sure the sum will not exceed the available capacity for the physical link(s). Combined with Baker and Wright, this results in summing the bandwidth capacities from each logical topology for each physical link in Baker’s physical topology. *See* Baker, [0009] (“assuming that sufficient bandwidth is available” on links in a ring network); Wright, [0004] (physical links have bandwidth limits), [0016] (same).

251. Third, this limitation is further rendered obvious in view of Wright's teachings as understood by a POSITA. Wright teaches reserving and summing bandwidths to determine the total allocation. "All packets ... travel along a subset of the links 302, 304 and 306. Bandwidth is reserved along this subset of links to support a bandwidth QoS." Wright, [0016]. Wright teaches summing bandwidths to determine a total reserved bandwidth for each impacted link. For example, to calculate the total reserved bandwidth Wright describes adding the first bandwidth and the second bandwidth. Wright, [0017] ("Consider that the bandwidth requirement from edge node 102 'A' to edge node 102 'B' is 'x' Mb/s [e.g., the first bandwidth] and from edge node 102 'A' to edge node 102 'C' is 'y' Mb/s [e.g., the second bandwidth]. One way to calculate the required reserved bandwidth ... is to reserve 'x+y' Mb/s."). It would have been obvious for this summing to be repeated for each logical topology.

252. Therefore, the combination of Baker, Wright, and Holender renders obvious "*summing the first and the second bandwidths to determine a total allocation for each of the links.*"

4. Claim 13

a. [13.0] *The method according to claim 12,*

253. See analysis at [12.0]-[12.8].

- b. [13.1] *wherein the network comprises a ring network, and wherein the physical topology comprises a ring topology.*

254. Baker discloses this limitation. *See* analysis at [2.1].

5. **Claim 14**

- a. [14.0] *The method according to claim 12,*

255. *See* analysis at [12.0]-[12.8].

- b. [14.1] *wherein the first connection topology comprises a hub-and-spoke topology and the second connection topology comprises a full mesh topology.*

256. The combination of Baker, Wright, and Holender renders this limitation obvious.

257. **First**, Baker renders obvious the “*first connection topology comprises a hub-and-spoke topology*” as well as a “*full mesh*” network. *See* analysis at [3.1]. Further, Wright also renders obvious a “*full mesh topology*.” *See id.*

258. **Second**, as demonstrated at [12.1], Holender teaches that multiple logical topologies are established on top of the same physical topology, each with a different topology. *See* Holender, 1:21-25, 9:4-7, FIG. 1. Thus, in combination Baker and Wright’s teachings would be repeated for another logical topology (the “*second connection topology*”) based on Holender’s teachings. The combined teachings of Baker, Wright, and Holender result in a first logical topology (e.g., a logical star topology per Baker), as well as one or more additional logical topologies (as taught by Holender) such as the full mesh topology taught in Wright.

259. Therefore, the combination of Baker, Wright, and Holender renders obvious “*wherein the first connection topology comprises a hub-and-spoke topology and the second connection topology comprises a full mesh topology.*”

6. Claim 15

a. [15.0] *The method according to claim 12,*

260. See analysis at [12.0]-[12.8].

b. [15.1] *wherein at least one of the first and second data transmission services comprises a guaranteed bandwidth service.*

261. A POSITA would have recognized that Wright’s “bandwidth guarantees” for the services renders obvious the “*data transmission services compris[ing] a guaranteed bandwidth service,*” and is applicable to either or both of the data transmission services. See analysis at [4.1]; Wright, [0014]. Indeed, since claim 15 recites “*at least one of*” the services comprises the guaranteed bandwidth service, the analysis at [4.1] alone renders this obvious.

262. It would have been further obvious in view of Holender for additional data transmission services to include Wright’s guaranteed bandwidth service. See Holender, 4:54-65 (additional logical networks for additional services).

263. Therefore, the combination of Baker, Wright, and Holender renders obvious “*wherein at least one of the first and second data transmission services comprises a guaranteed bandwidth service.*”

7. Claim 16

a. [16.0] *The method according to claim 12,*

264. See analysis at [12.0]-[12.8].

b. [16.1] *wherein at least one of the first and second data transmission services comprises a class of service defined by a protocol under which the network operates.*

265. A POSITA would have recognized that Holender's "service classes" (also referred to as "traffic classes") for the service (on an ATM network) renders obvious the "*data transmission services compris[ing] a class of service defined by a protocol under which the network operates,*" and is applicable to either or both of the data transmission services. See analysis at [5.1]. Indeed, since claim 16 recites "*at least one of,*" the analysis at [5.1] alone renders this obvious.

266. It would have been further obvious in view of Holender for additional data transmission services. See Holender, 4:54-65 (additional logical networks for additional services).

267. Therefore, the combination of Baker, Wright, and Holender renders obvious "*wherein at least one of the first and second data transmission services comprises a class of service defined by a protocol under which the network operates.*"

8. Claim 18

a. [18.0] *The method according to claim 12,*

268. See analysis at [12.0]-[12.8].

- b. **[18.1] *wherein generating the first mapping comprises generating a first bandwidth requirement for each of the links, and wherein generating the second mapping comprises generating a second bandwidth requirement for each of the links.***

269. The Baker-Wright combination teaches mapping between the logical connections and the physical topology and calculating the bandwidth requirements based on that mapping. *See* analysis at [7.1]. Further, as demonstrated at [12.1], Holender teaches that multiple logical topologies are established on top of the same physical topology. It would have been obvious to repeat the teachings of Baker and Wright for the generating the bandwidth requirement for each of the links of a mapping for another logical topology based on Holender's teachings. *See* analysis at [7.1] and [12.1].

270. Therefore, the combination of Baker, Wright, and Holender renders obvious "*wherein generating the first mapping comprises generating a first bandwidth requirement for each of the links, and wherein generating the second mapping comprises generating a second bandwidth requirement for each of the links.*"

9. Claim 19

- a. **[19.0] *The method according to claim 12,***

271. *See* analysis at [12.0]-[12.8].

- b. **[19.1] *wherein the first parameters of the first service comprise respective first node-bandwidths required by each of the nodes to provide the first service, and***

wherein the second parameters of the second service comprise respective second node-bandwidths required by each of the nodes to provide the second service.

272. Wright teaches that the connectivity requirements (“*parameters of the service*”) include not just the bandwidth requirements between nodes, but also requirements of the nodes themselves, which in combination with Baker renders obvious parameters of the service comprising respective node-bandwidths required by each of the nodes to provide the service. *See* analysis at [8.1]. Further, as demonstrated at [12.1], Holender teaches that multiple logical topologies are established on top of the same physical topology. It would have been obvious for the “*parameters*” of both the first and second services to include the node bandwidths, based on Holender’s teachings. *See* analysis at [8.1] and [12.1].

273. Therefore, the combination of Baker, Wright, and Holender renders obvious “*wherein the first parameters of the first service comprise respective first node-bandwidths required by each of the nodes to provide the first service, and wherein the second parameters of the second service comprise respective second node-bandwidths required by each of the nodes to provide the second service.*”

10. Claim 20

a. [20.0] *The method according to claim 12,*

274. *See* analysis at [12.0]-[12.8].

b. [20.1] *and comprising monitoring traffic generated in the network by the first and second data transmission*

services, and adjusting the total allocation in response to the traffic.

275. The combination of Baker and Wright teaches monitoring traffic generated in the network by data transmission services, and adjusting the total allocation in response to the traffic. *See* analysis at [9.1]. Further, as demonstrated at [12.1], Holender teaches that multiple logical topologies are established on top of the same physical topology. It would have been obvious to repeat Baker and Wright's teachings for monitoring traffic of the service for another logical topology, and adjust accordingly, based on Holender's teachings. *See* analysis at [9.1] and [12.1].

276. Thus, the combination of Baker, Wright, and Holender renders obvious “*and comprising monitoring traffic generated in the network by the first and second data transmission services, and adjusting the total allocation in response to the traffic.*”

11. Claim 21

a. [21.0] *The method according to claim 12,*

277. *See* analysis at [12.0]-[12.8].

b. [21.1] *wherein the first data transmission service comprises a plurality of subclasses of traffic, and*

278. The combination of Baker, Wright, and Holender renders obvious this limitation. *See* analysis at [10.1].

- c. **[21.2] *wherein allocating the first bandwidth comprises allocating a reserved bandwidth to one of the subclasses.***

279. The combination of Baker, Wright, and Holender renders obvious this limitation. *See* analysis at [10.2].

12. Claim 22

- a. **[22.0] *The method according to claim 12,***

280. *See* analysis at [12.0]-[12.8].

- b. **[22.1] *wherein the first connection topology is different from the second connection topology.***

281. As demonstrated at [12.1], Holender teaches that multiple logical topologies are established on the same physical topology. Further, the combined teachings of Baker, Wright, and Holender render obvious different logical topologies being different from each other. *See* analysis at [14.1] (demonstrating a hub-and-spoke topology as well as a full mesh topology, which are different from each other).

282. Finally, Holender as part of disclosing different logical networks on a physical network teaches each logical network having views “different from that” of the other logical network. Holender, 1:21-25. These “views” in Holender refer to the different logical networks illustrated in Holender’s Figure 1, which are described elsewhere as “in general differ[ing] from the topology of the underlying physical network.” Holender, 4:28-30.

283. Therefore, the combination of Baker, Wright, and Holender renders obvious “*wherein the first connection topology is different from the second connection topology.*”

13. Claim 23

- a. [23.0] *The method according to claim 12, wherein summing the first and the second bandwidths to determine a total allocation for each of the links comprises:*

284. See analysis at [12.0]-[12.8].

- b. [23.1] *determining a first mapping bandwidth in response to the first bandwidth requirements of the first set of logical connections and to the first mapping;*

285. The combination of Baker and Wright renders obvious this limitation.

286. First, as discussed at [11.1], the ’431 patent states that the “mapping bandwidth” refers to “[t]he bandwidth for each link [that] is derived by summing the individual connection requirements of the link.” ’431 patent, 8:67-9:2.

287. Second, Wright teaches determining the total bandwidth requirement on each physical link imposed by the logical topology (e.g., as in combination with Baker’s logical topology and physical topology teachings as well). Wright teaches summing bandwidths on each link to determine a total reserved bandwidth. See Wright, [0016]. For example, to calculate the total reserved bandwidth, Wright teaches adding the first bandwidth and the second bandwidth to determine the total required bandwidth. Wright, [0017] (“Consider that the bandwidth requirement from

edge node 102 'A' to edge node 102 'B' is 'x' Mb/s [e.g., the first bandwidth] and from edge node 102 'A' to edge node 102 'C' is 'y' Mb/s [e.g., the second bandwidth, both from the same logical topology]. One way to calculate the required reserved bandwidth ... is to reserve 'x+y' Mb/s.”).

288. The bandwidth x+y Mb/s is an example of a “*first mapping bandwidth*,” which Wright teaches is determined based on the bandwidth requirements of each logical connection of the restricted topology (which, in combination with Baker, would apply to Baker’s logical connections over a given physical link). Since (as demonstrated at [11.1]) Baker-Wright renders obvious “*a mapping bandwidth determined*” as part of the “*allocating*,” and Baker-Wright-Holender renders obvious “*summing*” per [12.8], it would have been obvious to “*determin[e] a first mapping bandwidth*” as part of the “*summing*” for a total allocation amount.

289. Therefore, the combination of Baker and Wright renders obvious “*determining a first mapping bandwidth in response to the first bandwidth requirements of the first set of logical connections and to the first mapping.*”

- c. **[23.2] *determining a second mapping bandwidth in response to the second bandwidth requirements of the second set of logical connections and to the second mapping; and***

290. The combination of Baker, Wright, and Holender renders obvious this limitation.

291. As explained at [12.1], overlaying multiple logical networks onto an underlying physical topology (like in the Baker-Wright combination) is obvious in view of Holender, which teaches on “top of a physical network **a number of logical networks are established in which logical links**” share the same physical transmission and switching resources. Holender, 2:50-53. The combination of Holender with Baker and Wright results in Baker and Wright’s procedures and concepts being applied to each “separate logical network” as taught by Holender (i.e., Holender’s establishing of multiple logical networks would be achieved by the combined teachings of Baker and Wright). *See, e.g.*, Holender, 4:54-65.

292. It would have been obvious to a POSITA to repeat the teachings from the combination of Baker and Wright pointed out at [23.1] again with respect to any additional logical networks being overlaid onto the same physical links. *See, e.g.*, Wright, [0017]. A POSITA would have been motivated to do so in order to ensure that bandwidth demands from logical topologies do not exceed what is “physically available on the links.” *See* Wright, [0004], Holender, 6:63-65 (“Naturally, the sum of logical link capacities on the same physical link cannot exceed the capacity of the physical link.”).

293. A POSITA would have thus understood that the summing actions repeated with respect to a second logical topology (i.e., summing logical connection totals per physical link), per Holender’s and Wright’s teachings, is an example of a

“*second mapping bandwidth*” that is determined based on the bandwidth requirements of the second logical network over a given physical link.

294. Therefore, the combination of Baker, Wright, and Holender renders obvious “*determining a second mapping bandwidth in response to the second bandwidth requirements of the second set of logical connections and to the second mapping.*”

- d. [23.3] *comparing the first mapping bandwidth and the second mapping bandwidth with a full bandwidth determined by assuming all possible logical connections in the network are provided for.***

295. As demonstrated at [11.1], the combination of Baker and Wright renders obvious generally the concept of “*comparing a mapping bandwidth determined in response to the bandwidth requirements of the logical connections and to the mapping with a full bandwidth determined by assuming all possible logical connections in the network are provided for.*” See [11.1] (Wright teaching contrasting a full mesh approach with a restricted/virtual topology approach).

296. Moreover, as demonstrated at [12.1], Holender teaches overlaying multiple logical topologies onto given physical resources. See Holender, 2:50-53. This results in multiple mapping bandwidths being determined, a different mapping bandwidth corresponding to each logical topology being overlaid onto the same physical resources. See analysis of [23.1] (first mapping bandwidth) and [23.2] (second mapping bandwidth).

297. Based on the combined teachings of Baker, Wright, and Holender, it would have been obvious to a POSITA to repeat the comparing of the mapping and full bandwidths, as demonstrated at [11.1], for each logical topology (per Holender's teachings of multiple logical topologies), either each logical topology's mapping bandwidth respectively to the full bandwidth, or both combined to the full bandwidth.

298. For example, it would have been obvious to a POSITA to apply Wright's general teaching of summing bandwidth requirements on a given physical link for all logical connections that use that physical link to all the logical topologies with logical connections traversing that link. *See* Wright, [0017] and analysis at [23.1]. Doing so would aid in avoiding efforts to use more bandwidth than is available on the supporting physical link. *See* Wright, [0016] and Holender, 6:63-65 ("Naturally, the sum of logical link capacities on the same physical link cannot exceed the capacity of the physical link."); *see also* Zheng, 5:16-25 (ensure "that the sum of all the bandwidth required for each connection that passes over a segment is less than or equal to the total bandwidth available on the physical line"). In combination, therefore, Baker, Wright, and Holender teach summing the logical connection bandwidth requirements from all logical topologies overlaid onto the same physical links, which would be compared to the "*full bandwidth*."

299. Therefore, the combination of Baker, Wright, and Holender renders obvious “*comparing the first mapping bandwidth and the second mapping bandwidth with a full bandwidth determined by assuming all possible logical connections in the network are provided for.*”

14. Claim 24

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

300. To the extent that the preamble is limiting, Baker renders obvious a method for assigning bandwidth in a network including nodes coupled by links. *See* analysis at [1.0]; *see also* [12.0]. Further, Baker discloses that the physical network is a ring network. *See* analysis at [2.1] and [13.1].

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

301. The combination of Baker, Wright, and Holender renders obvious this limitation. *See* analysis at [12.1].

- c.** [24.2] *the first set of logical connections having a hub-and-spokes [sic] connection topology, the second set of logical connections having a full mesh connection topology;*

302. Baker combined with Wright and Holender renders obvious this limitation.

303. As demonstrated at [12.1]-[12.2], the combination of Baker and Holender teaches that multiple logical topologies, i.e. “*first and second connection topologies*,” are established on top of the same physical topology, and that they are different from each other. *See* analysis at [12.1]-[12.2].

304. In particular, the combination of Baker and Wright renders obvious one set of logical connections comprising a hub-and-spoke topology (logical star topology per Baker) and the other set of logical connections comprising a full mesh connection topology (as taught in Baker and Wright). *See* analysis at [14.1].

- d. **[24.3]** *determining respective first bandwidth requirements for the first set of logical connections based on first parameters of the first data transmission service and respective second bandwidth requirements for the second set of logical connections based on second parameters of the second data transmission service;*

305. The combination of Baker, Wright, and Holender renders obvious this limitation. *See* analysis at [12.3].

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

306. Baker discloses this limitation. *See* analysis at [12.4].

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

307. The combination of Baker and Wright renders obvious this limitation. See analysis at [23.1] (the “*first mapping bandwidth*” in [23.1] being an example of the “*first bandwidth*” determined at [24.5]).

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

308. The combination of Baker, Wright, and Holender renders this limitation obvious. See analysis at [12.6].

- h. **[24.7] *determining a second bandwidth for the second data transmission service on each of the links in response to the second bandwidth requirements of the second set of logical connections and to the second mapping;***

309. The combination of Baker, Wright, and Holender renders obvious this limitation. See analysis at [23.2] (the “*second mapping bandwidth*” in [23.2] being an example of the “*second bandwidth*” determined at [24.7]).

- i. **[24.8] *summing the first and the second bandwidths to determine a total bandwidth for each of the links; and***

310. The combination of Baker, Wright, and Holender renders this limitation obvious. See analysis at [12.8].

- j. **[24.9] *allocating one of the first bandwidth, the second bandwidth, and the total bandwidth to each of the links in response to respectively providing the first service, the second service, and both services, over the network.***

311. As demonstrated at [12.5] and [1.5], the combination of Baker and Wright renders obvious allocating a first bandwidth. As further demonstrated at [12.7], the combination of Baker, Wright, and Holender renders obvious allocating a second bandwidth. It would have been obvious to a POSITA to allocate one of the first bandwidth, the second bandwidth, and the total bandwidth to each of the links in response to providing all of the services (*see* analysis at [24.1]) over the network. Finally, as demonstrated at [12.8], the prior art renders obvious summing the bandwidths for a total allocation, with a focus on ensuring the allocated bandwidth does not exceed the available capacity of the underlying physical link. *See* Holender, 6:60-65 and Wright, [0025] (“admission to these services with QoS guarantees is controlled on a session by session basis”). As [24.9] is a Markush group, any of the above above-noted teachings from [12.5], [12.7], and [12.8] alone renders obvious this limitation.

312. Further, Wright teaches the concept of applying one or the other bandwidth requirements, or both together, as the allocated bandwidth to a given link. As a first example, Wright teaches when the combined bandwidth requirements are $x+y$ Mb/s, to use that value as the bandwidth to allocate. Wright, [0017]. As a second example, Wright teaches instead “calculat[ing] 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’.” Wright, [0017].

313. The concept of taking the maximum of “x” or “y” bandwidth requirements from logical connections on a given physical link demonstrates it was known to allocate one of the first bandwidth (e.g., “x” Mb/s in Wright’s simple example) or the second bandwidth (e.g., “y” Mb/s in Wright’s example) in addition to the option of the total bandwidth on each link. While the example in Wright is with respect to those logical connections from the same logical topology being imposed onto the same physical link, it would have been obvious to apply these teachings generally to the bandwidth requirements of different logical topologies overlaid onto the same physical links, according to the combined teachings of Holender with respect to multiple logical topologies over the same physical network. *See, e.g.*, analysis at [12.1]-[12.2], and [24.1]-[24.2].

314. Moreover, Holender demonstrates that it was known to make sure the sum of determined bandwidth will not exceed the available capacity for the physical link(s). *See* Baker, [0009] (“assuming that sufficient bandwidth is available” on links in a ring network); Wright, [0004] (physical links have bandwidth limits), [0016] (same); Holender, 6:60-65 (“sum of logical link capacities on the same physical link cannot exceed the capacity of the physical link”); *see also* analysis at [12.8]

(demonstrating it was known to ensure the allocated bandwidth does not exceed the actual available physical link capacity). It would have been obvious to therefore provide less than all of the requested services, such as providing only “*the first service*” or “*the second service*” to ensure that the demands do not exceed the physical link’s capacity.

315. Therefore, the combination of Baker, Wright, and Holender renders obvious “*allocating one of the first bandwidth, the second bandwidth, and the total bandwidth to each of the links in response to respectively providing the first service, the second service, and both services, over the network.*”

15. Claim 27

a. [27.0] *Apparatus according to claim 25,*

316. See analysis at [25.0]-[25.6].

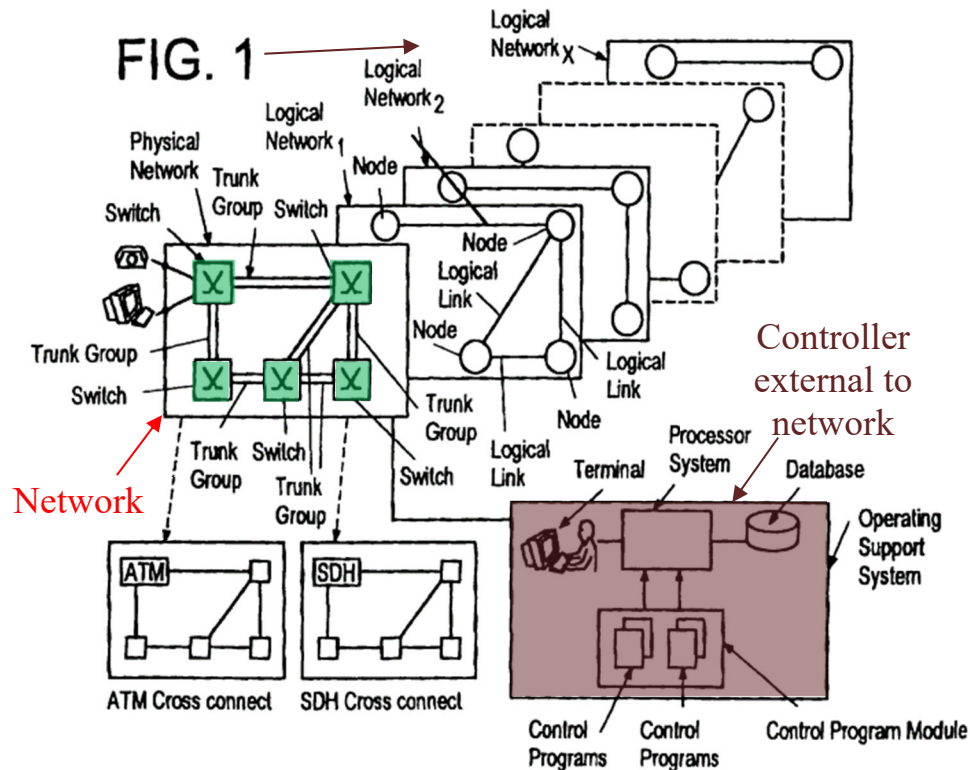
b. [27.1] *wherein the controller is external to the network.*

317. The combination of Baker and Holender renders this limitation obvious.

318. First, as demonstrated at [25.1], Baker teaches a “controller” with respect to its PGL, and necessary processing hardware to support the PGL’s operations, of the head node disclosure. See [25.1]; Baker, [0051].

319. Second, in Holender, the mapping of a logical network to a physical network, and the operations related to determining and allocating bandwidth, is performed by the “operation and support system OSS” external to the physical

network. Holender, 4:31-32, 54-65. The OSS's location works due to "[s]pecial data links, through which a network manager/operator controls the switches," from the OSS. Holender, 4:48-53. This is further illustrated in Holender's Figure 1, where the OSS is illustrated as external to the "physical network" being controlled:



Holender, FIG. 1 (annotated).

320. Holender's teachings of placing a controller at a separate location external to the network, facilitated by "[s]pecial data links, through which a network manager/operator controls the switches," apply to Baker's PGL/head node teachings, allowing control of the network to be located anywhere relative to the network being managed. *See* Holender, 4:48-53 and FIG. 1. In Holender, the location

of the processors and functions is a design choice, with the architecture of the system “usually that of a multiprocessor system,” or alternatively “a number of regional processors and a central processor” in a “not completely distributed system.” Holender, 4:32-53. This demonstrates that it would have been obvious to a POSITA to centralize part, or all, of Baker-Wright’s PGL functionality at Holender’s external controller as a simple design choice.

321. As a further alternative, it would have been obvious to try locating Baker-Wright’s PGL functionality at a location external to the network. Baker already demonstrated that it was known to locate the PGL functionality internal to a network. Baker, [0051]. And Holender demonstrated that it was known to locate part, or all, of controller functionality external to a network. Holender, 4:32-53. Accordingly, each of the possible solutions for placement of the controller had demonstrated a reasonable expectation of success in their implementation.

322. Therefore, the combination of Baker and Holender renders obvious “*wherein the controller is external to the network.*”

16. Claim 28

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

323. To the extent that the preamble is limiting, Baker renders it obvious. See analysis at [25.0].

b. [28.1] *a controller which is adapted to:*

324. Baker discloses this limitation. See analysis at [25.1].

c. [28.2] *[a controller which is adapted to:] receive a definition of a first set of logical connections, between the nodes, associated with a first data transmission service to be provided over the network, and a second set of logical connections, between the nodes, associated with a second data transmission service to be provided over the network, the first set of logical connections having a first connection topology, the second set of logical connections having a second connection topology,*

325. The combination of Baker, Wright, and Holender renders obvious this limitation.

326. **First**, the combination of Baker and Wright renders obvious a controller adapted to 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. See analysis at [25.2]-[25.3] and [1.1]-[1.2].

327. **Second**, the further combination with Holender renders obvious repeating the receipt of a definition, as taught by the Baker-Wright combination, for additional sets of logical connections for providing multiple data transmission services. See analysis at [12.1] (multiple sets of logical connections for multiple data transmission services); Holender, 4:54-65. As a result, the combination renders obvious receiving a “*definition of a first set of logical connections*” as claimed, as well as a “*definition ... of a second set of logical connections*” that are respectively

associated with data transmission services. Moreover, as further demonstrated at [12.1], the combination of Baker, Wright, and Holender renders obvious the first and second sets of logical connections having respective logical (“*connection*”) topologies.

328. Therefore, the combination of Baker, Wright, and Holender renders obvious “[*a controller which is adapted to:*] receive a definition of a first set of logical connections, between the nodes, associated with a first data transmission service to be provided over the network, and a second set of logical connections, between the nodes, associated with a second data transmission service to be provided over the network, the first set of logical connections having a first connection topology, the second set of logical connections having a second connection topology.”

d. [28.3] *the first and second connection topologies being different from the physical topology,*

329. See analysis at [12.2] and [25.3]. As discussed in [12.1], Holender teaches multiple logical connections.

e. [28.4] [*a controller which is adapted to:*] *determine respective first bandwidth requirements for the first set of logical connections based on first parameters of the first data transmission service and respective second bandwidth requirements for the second set of logical*

connections based on second parameters of the second data transmission service,

330. The combination of Baker, Wright, and Holender renders this limitation obvious.

331. First, as demonstrated with the analysis at [25.4], the combination of Baker and Wright renders obvious the controller determining bandwidth requirements for a set of logical connections based on parameters of the service. *See* analysis at [25.4] and [1.3] (demonstrating that the head node in Baker, and therefore the PGL with additional processing resources per [25.1], is adapted to perform the recited operation according to the teachings of Baker and Wright).

332. Second, the further combination with Holender renders obvious repeating Baker's and Wright's teachings for determining the bandwidth requirements for a set of logical connections for another logical topology, since Holender teaches providing multiple data connection services via multiple logical topologies. *See* analysis at [12.3]; Holender, 4:54-65.

333. Therefore, the combination of Baker, Wright, and Holender renders obvious “[a controller which is adapted to:] determine respective first bandwidth requirements for the first set of logical connections based on first parameters of the first data transmission service and respective second bandwidth requirements for the second set of logical connections based on second parameters of the second data transmission service.”

- f. **[28.5] *[a controller which is adapted to:] generate a first mapping of the first connection topology to the physical topology, so that each of the first set of logical connections is associated with one or more links of the physical topology,***

334. The combination of Baker and Holender renders obvious this limitation.

335. Baker teaches a controller that is adapted to map a connection topology to a physical topology, so that each of the logical connections is associated with one or more links of the physical topology. *See* analysis at [25.5] and [1.4]. The act of mapping a connection topology to a physical topology, as taught in Baker, also teaches the act of generating a mapping of the connection topology to the physical topology. *See* analysis at [12.4]. This is further shown by Holender, as also demonstrated in the analysis at [12.4].

336. Therefore, the combination of Baker and Holender renders obvious “[a controller which is adapted to:] generate a first mapping of the first connection topology to the physical topology, so that each of the first set of logical connections is associated with one or more links of the physical topology.”

- g. **[28.6] *[a controller which is adapted to:] allocate a first bandwidth for the first data transmission service on each of the links in response to the first bandwidth requirements of the first set of logical connections and to the first mapping,***

337. The combination of Baker and Wright renders obvious this limitation.

See analysis at [25.6]; *see also* analysis at [12.5].

- h. **[28.7] *[a controller which is adapted to:] generate a second mapping of the second connection topology to the physical topology, so that each of the second set of logical connections is associated with one or more links of the physical topology,***

338. The combination of Baker and Holender renders obvious this limitation.

339. First, Baker teaches a controller that is adapted to perform the mapping.

See analysis at [25.5] and [28.5].

340. Second, it would have been obvious to repeat the generating of a mapping for another logical topology (a “*second connection topology*”) to the physical topology as taught by the combination of Baker and Holender. See analysis at [12.6]; *see also* [12.1] and [12.4].

341. Therefore, the combination of Baker and Holender renders obvious “[*a controller which is adapted to:] generate a second mapping of the second connection topology to the physical topology, so that each of the second set of logical connections is associated with one or more links of the physical topology.*”

- i. **[28.8] *[a controller which is adapted to:] allocate a second bandwidth for the second data transmission service on each of the links in response to the second bandwidth requirements of the second set of logical connections and to the second mapping, and***

342. The combination of Baker, Wright, and Holender renders this limitation obvious.

343. First, the combination of Baker and Wright renders obvious a controller adapted to allocate a bandwidth for the service on each link in response to the bandwidth requirements of the logical connections and the mapping. *See* analysis at [25.6] and [28.6].

344. Second, it would have been obvious to repeat the allocating of a second bandwidth for the second data transmission service as taught by the combination of Baker and Holender. *See* analysis at [12.7] and [12.1]. The combination of Baker, Wright, and Holender, therefore, teaches performing the allocating of bandwidth for any additional logical topologies overlaid onto the underlying physical topology.

345. Therefore, the combination of Baker, Wright, and Holender renders obvious “*[a controller which is adapted to:] allocate a second bandwidth for the second data transmission service on each of the links in response to the second bandwidth requirements of the second set of logical connections and to the second mapping.*”

- j. **[28.9] *[a controller which is adapted to:] sum the first and the second bandwidths to determine a total allocation for each of the links.***

346. The combination of Baker, Wright, and Holender renders obvious this limitation.

347. First, Baker discloses a controller. *See* [28.1] and [25.1]; Baker, [0046].

348. Second, the combination of Baker, Wright, and Holender renders obvious summing the first and second bandwidths to determine a total allocation for each of the links. *See* analysis at [12.8].

349. It would have been obvious to a POSITA for Baker's PGL of the head node and supporting hardware (the "*controller*") to perform the act of summing as part of its allocating of the total bandwidth to each link when performing "topology and routing control." *See* generally [25.1] (demonstrating that Baker's PGL of the head node discloses a controller with its additional resources for executing the Administer Ring routine). Indeed, as explained in the analysis at [23.3], it would have been obvious to apply Wright's summing teachings to all the logical topologies overlaid onto a physical topology for the impacted physical links, including to ensure that the physical link capacity is not exceeded. *See* Wright, [0017] and analysis at [23.3]; Baker, [0046].

350. Therefore, the combination of Baker, Wright, and Holender renders obvious “[a controller which is adapted to:] sum the first and the second bandwidths to determine a total allocation for each of the links.”

17. Claim 29

a. [29.0] Apparatus according to claim 28,

351. See analysis at [28.0]-[28.9].

b. [29.1] wherein the controller is comprised in one of the nodes.

352. Baker discloses this limitation. See analysis at [26.1].

18. Claim 30

a. [30.0] Apparatus according to claim 28,

353. See analysis at [28.0]-[28.9].

b. [30.1] wherein the controller is external to the network.

354. The combination of Baker and Holender renders this limitation obvious. See analysis at [27.1].

X. CHALLENGE 3: THE COMBINATION OF BAKER, WRIGHT, AND ZHENG RENDERS OBVIOUS CLAIM 6

A. Summary of Zheng

355. U.S. Patent No. 6,757,247 to Zheng *et al.* (Ex. 1008, “Zheng”) was filed February 20, 1998, and issued June 29, 2004. Zheng is titled “Circuit and Method for Controlling Virtual Connections in a Ring Network.” Zheng was not before the Examiner during prosecution of the ’431 patent.

356. Zheng relates to “a circuit and method for controlling virtual circuit connections in a ring network.” Zheng, 1:8-10. The control, by a “connection controller 102,” is done in order to “determine when a connection can be allowed in network 100 without exceeding the bandwidth capacity for the ring segments of network 100.” Zheng, 5:4-10. This control is performed so “that the sum of all the bandwidth required for each connection that passes over a segment is less than or equal to the total bandwidth available on the physical line.” Zheng, 5:16-25.

357. As part of the determination, the controller can also consider “over-allocated” bandwidth – “bandwidth that is allocated to a virtual connection that exceeds the required or subscribed bandwidth for service on the virtual connection.” Zheng, 5:29-35. Certain devices in the network, like traffic shapers, may produce over-allocated bandwidth based on providing data in “integral multiples of a unit bandwidth,” which Zheng labels as granularity G . Zheng, 5:37-65. The amount of bandwidth delivered by the traffic shaper, including the over-allocated amount, is determined by multiplying the granularity G to the sum of all bandwidth from the sources, after a ceiling function is applied to a result of division of the bandwidth sum by the granularity G . Zheng, 6:1-18; *see also* Equation 3:

$$DB = \left\lceil \frac{\sum_j B_j}{G} \right\rceil \times G \quad (3)$$

Zheng, 6:1-5.

B. Reasons to Combine Baker and Wright with Zheng

358. A POSITA would have been motivated to combine Zheng with Baker and Wright for several reasons. Zheng, like Baker and Wright, focuses on how to manage physical resources (i.e., bandwidth) in a network. *See* Zheng, 1:8-10, 4:56-5:14 (controlling whether new requested connections are allowed depending on whether there is enough bandwidth to accommodate on each link of the connection); Baker, [0016], [0030] (assigning network resources); Wright, [0005] (physical connections inputs to calculate link bandwidth requirements for each link).

359. A POSITA would have been motivated to turn from Baker and Wright, which are short on details with respect to managing traffic flows that are highly variable (up to and including exceeding their peak rate), to Zheng in order to take advantage of Zheng's use of "over-allocated" bandwidth because it "assures quality of performance in the network." Zheng, 5:29-35. The "over-allocated bandwidth" is "[t]he amount by which the deliverable bandwidth exceeds the subscribed [or required] bandwidth." Zheng, 6:21-23, 5:31-34. Zheng teaches that the "over

allocated bandwidth is not wasted bandwidth” because it “may be used at different times by different traffic sources ... when a traffic source meets or exceeds its peak rate.” Zheng, 6:30-34. “Thus this over allocated bandwidth is essentially a shared bandwidth that prevents connection controller 102 from granting requests for bandwidth that would exceed the capacity of any segment of network 100.” Zheng, 6:34-37.

360. A POSITA would have had a reasonable expectation of success in applying Zheng’s over-allocated bandwidth teachings to the combined teachings of Baker and Wright. Like Baker and Wright, Zheng also teaches using networks such as ATM over a SONET ring network. Zheng, 1:36-40 (ATM over SONET), 1:52-54 (applying to ATM in a ring network), 3:48-53 (ATM connections); Baker, [0037] (ATM over SONET); Wright, [0015] (same). Further, Baker teaches using a PGL of a head node to “effectively manage the network feeder utilization” so that “resources such as bandwidth can be more effectively managed.” Baker, [0062]. In similar manner, Zheng teaches determining and taking into consideration the over-allocated bandwidth using “connection controller 102” when deciding whether to allow a connection (and, like Baker, this is to manage bandwidth on the connections). Zheng, 5:16-46.

361. In combination, Baker’s PGL of the head node would be configured with sufficient resources to accomplish its tasks in addition to the over-allocated

bandwidth and allocation tasks taught by Zheng. *See* Baker, [0047] (head node configured with sufficient resources to help it “accomplish its assigned tasks”). Thus, because Baker and Zheng’s teachings apply to similar networks (ATM over SONET), and both Baker and Zheng contemplated implementation of the functions at a centralized location (head node in Baker, connection controller in Zheng), the teachings of Baker and Zheng were compatible, resulting in a reasonable expectation of success in their combination.

362. Baker and Zheng’s applicability to the same types of networks (e.g., ATM over SONET) also demonstrate that the combination would have been predictable and within the POSITA’s skillset. This was nothing more than the combination of known elements (Baker’s PGL of the head node managing bandwidth, and Zheng’s use of over-allocated bandwidth for ensuring quality of performance), according to known methods (applying Zheng’s teachings in Baker’s head node), to yield predictable results (Baker’s PGL of the head node determining an over-allocated bandwidth, per Zheng’s teachings, for the deliverable bandwidth for a given link in Baker).

363. The combination permits but does not require physical incorporation of elements from Zheng into Baker. Nevertheless, the physical incorporation of Zheng’s operations into Baker’s head node for implementation would teach the claim limitations.

C. Detailed Analysis of Claim

1. Claim 6

a. [6.0] *The method according to claim 1,*

364. See analysis at [1.0]-[1.5] in Challenge 1.

b. [6.1] *and comprising multiplying the bandwidth by a correction factor to determine an actual bandwidth.*

365. The combination of Baker, Wright, and Zheng renders this limitation obvious.

366. As discussed in [1.0], Baker's method includes "partitioning resources of the network, allocating the network resources, and assigning the network resources to the network elements." Baker, [0016]. According to Baker, one of the "resources" it is concerned with is "bandwidth." Baker, [0062].

367. As discussed in [1.3], the combination of Baker and Wright renders obvious "*determining ... bandwidth requirements.*" Wright teaches, as part of identifying the "bandwidth requirement" on physical links, determining the logical connections' bandwidth requirements of the "virtual topology, or restricted topology." Wright, [0017]-[0018].

368. Wright further generally teaches that it was known, when summing bandwidth requirements on links, for more bandwidth to be reserved than "actually required" for the link. Wright, [0017]. While Wright shows one way in which that bandwidth is determined (by summing), Wright leaves up to a POSITA to determine

if there are any other ways to determine excess bandwidth, as well as how to use such excess bandwidth.

369. Zheng teaches an additional manner for determining excess bandwidth for allocation to virtual connections over physical links, and benefits for doing so. Zheng determines whether “a connection can be allowed in network 100 without exceeding the bandwidth capacity for the ring segments of network 100” so “that the sum of all the bandwidth required for each connection that passes over a segment is less than or equal to the total bandwidth available on the physical line.” Zheng, 5:4-25. As part of the bandwidth analysis, Zheng teaches dividing the summed bandwidth requirement, identified as $\sum_j B_j$ in equation 3, by a granularity value G ; applying a “ceiling function” to the result of that division; and multiplying the result of the ceiling function by the granularity value G to determine an overallocated bandwidth value. Zheng, 6:1-18; *see also* Equation 3:

$$DB = \left\lceil \frac{\sum_j B_j}{G} \right\rceil \times G \quad (3)$$

Zheng, 6:1-5; *see also* 6:46-7:7 and 5:36-37.

370. Equation 3 renders obvious the “*correction factor*” in two different ways. First, a POSITA would have recognized that dividing the summed bandwidth

by the granularity value G is the same as multiplying the summed bandwidth by $\frac{1}{G}$, a first example of the “*correction factor*.” Second, multiplying the result of the ceiling function by the granularity value G is another example of the “*correction factor*.”

371. In combination, the multiplication teaching of Zheng would result in Baker’s PGL of the head node multiplying the “bandwidth requirements” of logical connections on a physical link (taught by Wright) to determine “over-allocated” bandwidth as the actual bandwidth. Baker’s network would use the over-allocated bandwidth taught by Zheng for the same purpose as in Zheng - having an extra amount of bandwidth buffer should the traffic sources exceed their allowed peak rates.

372. Therefore, the combination of Baker, Wright, and Zheng renders obvious “*comprising multiplying the bandwidth by a correction factor to determine an actual bandwidth*.”

XI. CHALLENGE 4: THE COMBINATION OF BAKER, WRIGHT, HOLENDER, AND ZHENG RENDERS OBVIOUS CLAIM 17

A. Reasons to Combine Baker, Wright, and Holender with Zheng

373. A POSITA would have been motivated to combine Zheng with the combined teachings of Baker, Wright, and Holender substantially for the same reasons as given above with respect to Section IX.B (Holender) and Section X.B (Zheng).

B. Detailed Analysis of Claim

1. Claim 17

a. [17.0] *The method according to claim 12,*

374. See analysis at [12.0]-[12.8].

b. [17.1] *and comprising multiplying at least one of the first and second bandwidths by a correction factor to determine a corrected bandwidth.*

375. The combination of Baker, Wright, Holender, and Zheng renders obvious this limitation.

376. First, the combination of Baker, Wright, and Zheng renders obvious multiplying “*bandwidths by a correction factor to determine a corrected bandwidth.*” See analysis at [6.1]. Because the claim recites “*at least one of the first and second bandwidths,*” a Markush group, the analysis at [6.1] alone renders obvious this limitation.

377. Second, the combination of Baker, Wright, and Holender renders obvious a first and second bandwidth. See analysis at [12.1], [12.3] (first bandwidth) and [12.5] (second bandwidth). A POSITA would have found it obvious to repeat the multiplying taught by the Baker-Wright-Zheng combination with the first bandwidth for the second bandwidth of a second logical topology, according to Holender’s combined teachings, for at least one of the logical topologies taught by the combination (or all of them together, see e.g. analysis at [23.3]). Holender, 4:54-65.

378. Therefore, the combination of Baker, Wright, Holender, and Zheng renders obvious “*comprising multiplying at least one of the first and second bandwidths by a correction factor to determine a corrected bandwidth.*”

XII. CONCLUSION

379. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and that these statements were made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code.

Dated: 11/16/22

Henry Houh
Henry Houh, Ph.D.