

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

QUALCOMM INCORPORATED
Petitioner

v.

NETWORK SYSTEM TECHNOLOGIES, LLC
Patent Owner

Patent No. 7,373,449

Inter Partes Review No. IPR2024-00338

DECLARATION OF DR. NADER BAGHERZADEH

TABLE OF CONTENTS

I. INTRODUCTION.....	1
II. EXPERT QUALIFICATIONS AND BACKGROUND	2
III. MATERIALS CONSIDERED	11
IV. UNDERSTANDING OF LEGAL STANDARDS	13
A. Prior Art.....	13
B. Obviousness.....	14
C. Claim Construction.....	18
V. PERSON OF ORDINARY SKILL IN THE ART.....	21
VI. TECHNOLOGY OVERVIEW	23
A. Technical Background.....	23
B. Overview of the ‘449 Patent.....	34
1. Exemplary Claims of the ‘449 Patent	34
2. Technical Summary of the ‘449 Patent.....	35
3. The ‘449 Patent’s Network is Different Than Off-Chip Networks	42
VII.OVERVIEW OF PETITIONER’S REFERENCES	45
A. Goossens2002 (Ex. 1005)	45
B. Drake (Ex. 1006)	47
C. Goossens2003 (Ex. 1007)	49
VIII. CLAIM CONSTRUCTION	50
A. “First Module” and “Communication Manager” Are Separate and Distinct 50	
B. “Communication Manager” and “Resource Manager” Are Separate and Distinct.....	55
C. The Preamble of Claim 10	58
D. District Court Constructions.....	59
1. “connection properties” (claims 2, 6-7, 10, 13-14, 16).....	59

2. “resource manager determining whether a target connection with the desired connection properties is available” (claims 2, 6, and 10)	60
3. “Integrated circuit” (claims 2, 6, 9-16)	61
4. “connection” (claims 2, 6, 9-16)	61
5. “independently configurable” (claim 10).....	62
IX. ANALYSIS OF THE OBVIOUSNESS GROUNDS.....	62
A. The Challenged Claims	62
B. Petitioner’s Positions are Inconsistent and Unclear	65
C. Ground 1: Purported Obviousness over Goossens2002 in view of Drake (Claims 2, 6, 9-16).....	66
1. Neither Goossens2002 Nor Drake Discloses “the connection properties of the different communication channels of said connection being adjustable independently” / “any communication channel being independently configurable” (Claims 2, 10).....	68
2. A POSITA Would Not Have Combined Goossens2002 and Drake to Meet the Claim Limitations Regarding the “Communication Manager” and “Resource Manager”	71
3. The Alleged Combination of Goossens2002 and Drake Fails to Meet the Claim Limitations Regarding the “Communication Manager” and “Resource Manager”	104
D. Ground 2: Purported Obviousness over Goossens2003 in view of Drake (Claims 2, 6, 9-16).....	117
1. A POSITA Would Not Have Combined Goossens2003 and Drake to Meet the Claim Limitations Regarding the “Communication Manager” and “Resource Manager”	118
2. The Alleged Combination of Goossens2003 and Drake Fails to Meet the Claim Limitations Regarding the “Communication Manager” and “Resource Manager”	148
X. CONCLUSION	162

I. INTRODUCTION

1. I have been retained on behalf of Patent Owner Network System Technologies, LLC (“NST” or “Patent Owner”), as an expert consultant.

2. As part of this work, I have been requested by counsel for NST to provide this declaration concerning the technical subject matter relevant to the *inter partes* review (“IPR”) petition of U.S. Patent No. 7,373,449 (“the ’449 patent”) filed Samsung Electronics Co., Ltd. (“Samsung”). I am informed that Qualcomm Incorporated (“Qualcomm”) has been joined to this proceeding and that Samsung has been terminated from this proceeding and therefore refer to Qualcomm as “Petitioner” herein.

3. I am being compensated for my time in the amount of \$700 per hour. I have no financial interest in NST or the ’449 patent, and my compensation is not contingent upon the substance of my declaration, any statements or opinions made, or the outcome of this proceeding.

4. I am informed and understand that the ’449 Patent was, or currently is, being asserted in district court litigation. I understand that the ’449 Patent is asserted against Petitioner in the Western District of Texas (“the Qualcomm Litigation”). I understand that the ’449 Patent was asserted in the Eastern District of Texas against Samsung (“the Samsung Litigation”). I also understand that the

‘449 Patent was asserted against Texas Instruments in the Eastern District of Texas (“the TI Litigation”).

II. EXPERT QUALIFICATIONS AND BACKGROUND

5. I am currently a professor in the Department of Electrical Engineering and Computer Science at the University of California, Irvine. I have held this position since 2003.

6. Previously, I held the position of Professor and Chair of Electrical Engineering and Computer Science (ECE) at the University of California, Irvine, from 1998 to 2002. Prior to that, I was an Associate Professor in the ECE Department at the University of California, Irvine from 1993 to 1997. Prior to that, I was an Assistant Professor in the ECE Department at the University of California, Irvine from 1987 to 1992.

7. I earned a Bachelor of Science degree, with honors, in Electrical Engineering from the University of Texas at Austin in 1977. I earned a Master of Science degree in Electrical Engineering from the University of Texas at Austin in 1979, with a focus on communications theory and signal detection algorithms. I earned a Ph.D. in Computer Engineering from the University of Texas at Austin in 1987 with a focus on parallel processing and computer architecture.

8. I have over 45 years of experience in the Electrical Engineering and Computer Science field. That experience includes holding the position of Member

of Technical Staff, No. 5 ESS Hardware/Software T1 Line Interface Design at AT&T Bell Labs from 1980 to 1984. In this position I received the Outstanding Achievement award from AT&T Bell Labs in 1984. While at Bell Labs I developed T1 line framing and error monitoring algorithms that were stored on electrically erasable programmable read-only memory (EEPROM)—a charge based non-volatile memory which is considered the predecessor to contemporary flash memory. Additionally, I designed the microprocessor-based board that included the EEPROM among many other components for directly interfacing the T1 line.

9. I have particular experience in the development of System-on Chip (SoC) architecture with hundreds of cores (processors) based on the Network-on-Chip (NoC) technique. In multi-core processors, a NoC is responsible for data routing between different cores using basic networking principles. I have worked on various aspects of NoC design such as optimizing the efficiency of multi-core processing architectures by decreasing computing overhead and latency incurred from data transfer in a NoC using various routing policies and function configurations when running applications. The following paragraphs describe both my foundational and particular experience with this technology.

10. In 2002, I received the Best Paper award in Institute of Electrical and Electronics Engineers (IEEE) Transactions on Very Large Scale Integration (VLSI) Design related to task scheduling for multicore processors. I also received another

Best Student Paper award co-authored with my doctoral students in the proceedings of Asia and South Pacific Design Automation Conference (ASPDAC) '02. In 2020, I received the Best Paper award in the proceedings of the IEEE International Conference on Edge Computing (EDGE).

11. In 2014, I received the Khwarizmi International Award and became an IEEE Fellow. In 2015, I received Professor of the Year for the Department of Electrical Engineering and Computer Science at the University of California at Irvine.

12. Over the past 45+ years my research has focused on hardware, software, and VLSI design of low-power and high-performance multicore computer systems for wireless communication applications in mobile systems, computer graphics processing, 3D integrated circuits, memory structures (e.g., static random-access memory (SRAM), dynamic random-access memory (DRAM), flash memory, and register files), Network-on-Chip (NoC), and AI accelerators.

13. Since joining the University of California, Irvine in 1987, I have been teaching, researching, and consulting regarding almost all aspects of high performance computer systems, including but not limited to VLSI design, computer architecture, parallel implementation of computationally critical applications such as wireless communication signal processing and error correcting schemes, DRAMs, SRAMs, low power design, and interfacing multicores.

14. Over the course of my career, I have supervised more than 45 doctoral students and 30 masters' students who have taken key positions in the electrical engineering and computer engineering sector. I have served as post-doctoral advisor for more than 10 scholars that worked with my research group.

15. In 2000, I cofounded a company called Morpho Technologies, which was focused on the design and development of low power and high-performance digital signal processors (DSPs) for mobile applications. As part of my duties as the chief technologist for the company, I evaluated patents, technical reports, and presentations related to memory chip designs, DSPs, and parallel processing algorithms for mobile platforms.

16. For Morpho, I designed, developed, and tested the key components of a Coarse Grain Reconfigurable Architecture (CGRA), including the memory block responsible for exchanging data between the host processor and the multicore processor (SIMD array processor). Morpho's main objective was to use a fully programmable platform based on the idea of CGRA to meet the power and performance requirements of a Software Defined Radio (SDR) for mobile embedded applications. In particular, I was able to show the efficiency of mapping an OFDM algorithm on the Morpho architecture.

17. I also designed the main data storage of the microcontroller (a reduced instruction set computer, or "Tiny RISC") that was used for storing temporary data

between the Tiny RISC and the array processor, based on SRAM technology, which is a type of volatile memory. I was one of the primary contributors for the prototype board design of the Morpho chip, which utilized DRAMs, field-programmable gate arrays (FPGAs), flash memory and other prototype board components.

18. As part of my teaching and research experience, I have been responsible for developing circuits, electronic modules, and related architectures for a variety of multicore systems. For example, I designed the memory block responsible for managing out-of-order execution of data registers corresponding to different threads in the multithreaded superscalar DSP that was developed at University of California, Irvine. I also designed the original temporary data storage subcomponents for the VLIW integer processor (ViPER) and the original Tiny RISC processor. ViPER was considered the very first ever VLIW processor designed using Metal Oxide Semiconductor Implementation Service (MOSIS) 1.2-micron technology that included memory and logic circuits. I have also done extensive work on the design of efficient data correction schemes using reconfigurable computing based on the Morpho parallel array architecture.

19. In 2006, I analyzed the hardware implementation of low-density parity-check (LDPC) as a consultant for a local flash memory module design company. In this capacity, with the help of one of my doctoral students we modeled the hardware

and evaluated the computation complexity of using an application-specific integrated circuit (ASIC) for implementing LDPC on a flash memory-based board.

20. Throughout my career, I have worked on many aspects of computer architecture optimizations, encompassing hardware, processor allocation and scheduling on 2D NoC array, and software techniques. Ideas based on NoC design, modeling, and evaluation have been the hallmark of my research work for more than 15 years. I also extended my original ideas toward three-dimensional (3D) NoC and demonstrated some of the advantages of 3D integrated circuit (IC) design as well as potential complications that could arise from the thermal footprint of these architectures. NoC uses packet switching communication across a network of routers to facilitate core-to-core and core-to-memory communications. My main contributions have been on the critical aspects of NoC and IC design, including router design, through-silicon via (TSV) cross talk, power efficiency, task mapping and scheduling onto NoC, aging of ICs, and other related topics.

21. For NoC, I used Constraint Programming (CP) for solving the Voltage-Frequency Island (VFI) problem. In general, VFI is a superior design alternative in terms of thermal constraints, power consumption, and performance. Given a Communication Task Graph (CTG) and subsequent task assignments for cores, cores are allocated to the best possible places on the chip to minimize communication and power consumption. Moreover, an elegant CP model was

proposed to solve the VFI problem by mapping and grouping cores at the same time while scheduling the computation tasks as a limited capacity resource allocation model using realistic benchmark datasets.

22. I proposed a new architecture for NoC called diagonally linked mesh NoC, or DMesh NoC. This novel architecture not only enhances network transmission performance while maintaining a feasible implementation cost, but also provides a power-efficient solution for interconnection network scenarios. The proposed architecture uses an adaptive quasi-minimal routing algorithm so that it can improve average latency and saturation traffic load owing to its flexibility and adaptiveness. Based on these features, a congestion-aware routing algorithm was proposed to balance traffic load so as to alleviate congestion caused by high throughput network activities. Simulation results showed that saturation load is improved dramatically for various traffic patterns. Implementation results also suggested that employing diagonal links is a more area-efficient method for improving network performance than using large buffers. It was also shown that a congestion-aware router requires negligible cost overhead but provides better throughput.

23. I proposed a Quality of Service (QoS)-aware wireless NoC architecture that not only enables quality-oriented network transmission with a feasible implementation overhead but also maintains a well-balanced workload

inside hybrid networks to enhance system throughput. The proposed advanced routers employ congestion management which first grants high priority packets from more congested areas and then directs them to paths without contention. This adaptive load-balanced routing effectively relaxes congestion situations and prevents networks from excessive contention. Simulation results showed that average latency of high priority is significantly improved. Flexible buffer management further improved transmission performance and resource utilization efficiency.

24. I have worked on an efficient method for reaching the destination corresponding to 3D NoC nodes where power and latency have been considerably reduced as compared to what has been reported in the past. I devised an adaptive routing algorithm for partially connected 3D NoCs where an analytical formulation based on queuing theory for the first time was developed and its results were checked by simulation. I have worked on an energy and performance aware application mapping algorithm for inhomogeneous 3D NoCs that showed significant improvements. 2.5D NoC was the subject of another project that I did, for which I introduced a Controlled Load Balancing Mechanism (CLBM) for an efficient load balancing approach with more than 25% average latency and power reduction improvements with little accumulated overhead.

25. Through-silicon via (TSV) is one of the key enabling technologies for facilitating connections among cores of different layers of 3D ICs used for implementing NoC architectures with 100's of cores. Some of my first work on designing routing algorithms for 3D NoC appeared in top IEEE journals where I introduced a new and robust method that is adaptive and can tolerate faults on the vertical TSV links. As part of this work, I proposed a novel algorithm to systematically generate hybrid 3D NoC topologies for a given application such that the vertical connections are minimized while the NoC performance is not sacrificed. Experimental results using synthetic and real-world traffic patterns show that the proposed algorithm generates optimized architectures with lower energy consumption and a significant reduction in packet delay as compared to the existing solutions.

26. Currently, I am working on developing accelerators and optimization techniques for implementation of efficient machine learning platforms. As part of this work, I am taking standard matrix vector computations that are the most demanding aspect of the Convolutional Neural Network (CNN) algorithms and implementing them on highly parallel structures, taking advantage of inherent parallelism of neural network layers. The focus of this work has been on developing low power inference engines for edge based AI nodes.

27. I have been involved in numerous research projects, journal articles, and books. The specific research projects, journal articles, and books may be found in my *Curriculum Vitae* (Ex. 2071). Over the years, I have also received funding accumulating over eight million dollars. The specific funding and associated projects may be found in my *Curriculum Vitae*.

28. Additional details on my background and experience can be found in my *curriculum vitae*, attached hereto as Ex. 2071.

III. MATERIALS CONSIDERED

29. In forming the opinions set forth in this declaration, I have considered and relied upon my education, knowledge of the relevant field, and my experience. I have also reviewed and considered the ‘449 patent (Ex. 1001) and its file history (Ex. 1002), and at least the following additional materials:

- Petition for *Inter Partes* Review of the ‘449 Patent (“Petition”)
- Declaration of Dr. Todd Mowry (Ex. 1003)
- Decision Granting *Inter Partes* Review of the ‘449 Patent (Paper 10) (“Institution Decision, Samsung”)
- Decision Granting *Inter Partes* Review of the ‘449 Patent (Paper 14) (“Institution Decision, Qualcomm”)
- K. Goossens, et al., Networks on Silicon: Combining Best-Effort and Guaranteed Services (“Goossens2002”) (Ex. 1005)

- U.S. Patent No. 5,461,611 (“Drake”) (Ex. 1006)
- K. Goossens, et al., Guaranteeing the Quality of Services in Networks on Chip (“Goossens2003”) (Ex. 1007)
- Joint Claim Construction Statement in the Qualcomm Litigation (Ex. 1032)
- The Court’s Claim Construction Order in the TI Litigation (Ex. 1035)
- Qualcomm’s Opening Claim Construction Brief in the Qualcomm Litigation (Ex. 2040)
- Bjerregaard, Tobias “A Survey of Research and Practices of Network-on-Chip,” Technical University of Denmark, ACM Computing Surveys, Vol. 38, March 2006 (Ex. 2072)
- Atagoziyev, Maksat “Routing Algorithms For On Chip Networks,” The Graduate School of Natural and Applied Sciences of Middle East Technical University (2007) (Ex. 2073)
- Excerpts of “Dictionary of Scientific and Technical Terms,” Fifth Edition, McGraw-Hill (Ex. 2074)
- Excerpts of “The Authoritative Dictionary of IEEE Standards Terms” Seventh Edition, IEEE 100, IEEE (Ex. 2075)
- “Supported token-ring functions” (2021) (Ex. 2076)

- Follows, Jonathan “Token Ring Solutions,” IBM (Ex. 2077)
- Transcript of the Deposition of Dr. Todd Mowry (Ex. 2078)

30. I have also considered the additional materials identified in the paragraphs below to the extent not specifically listed above.

IV. UNDERSTANDING OF LEGAL STANDARDS

31. I have a general understanding of validity based on my experience with patents, my career experience, and my discussions with counsel.

A. Prior Art

32. I understand that inventors may be entitled to a priority date earlier than an actual date of filing of a patent application that provides written description support for a particular claim to the extent that they can show a complete possession of such a particular claimed invention at such an earlier priority date, and reasonable diligence to reduce such a particular claimed invention to practice between such an earlier priority date and such an actual date of filing. I understand that if Plaintiff contends that particular claims are entitled to an earlier priority date than the actual date of filing, then Plaintiff has the burden to prove this contention with specificity.

33. I understand that an invention by another must be made before the priority date of a particular patent claim in order to qualify as “prior art” under 35 U.S.C. § 102 or 35 U.S.C. § 103. I also understand that a printed publication or a

product usage must be publicly available before the priority date of a particular patent claim in order to qualify as “prior art” under 35 U.S.C. § 102(a), that a printed publication or a product usage or offer for sale must be publicly available in the United States more than one year prior to the actual date of filing of a patent application that provides written description support for a particular claim in order quality as “prior art” under 35 U.S.C. § 102(b), and that the invention by another must be described in an application for patent filed in the United States before the priority date of a particular patent claim in order to qualify as “prior art” under 35 U.S.C. § 102(e). I understand that Petitioners have the burden of proving that any particular reference or product usage or offer for sale is prior art.

B. Obviousness

34. I have a general understanding of obviousness based on my experience with patents, my career experience, and my discussions with counsel.

35. I understand that a patent claim is invalid under 35 U.S.C. § 103 as being obvious only if the differences between the claimed invention and the prior art such that the subject matter as a whole would have been obvious at the time of invention to a POSITA. An obviousness analysis requires consideration of four factors: (1) scope and content of the prior art relied upon to challenge patentability; (2) differences between the prior art and the claimed invention; (3) level of ordinary skill in the art at the time of the invention; and (4) the objective evidence of non-

obviousness, such as commercial success, unexpected results, the failure of others to achieve the results of the invention, a long-felt need which the invention fills, copying of the invention by competitors, praise for the invention, skepticism for the invention, or independent development.

36. I understand that a prior art reference is proper to use in an obviousness determination if the prior art reference is analogous art to the claimed invention. I understand that a prior art reference is analogous art if at least one of the following two circumstances is met. First, a prior art reference is analogous art if it is from the same field of endeavor as the claimed invention, even if the prior art reference addresses a different problem and/or arrives at a different solution. Second, a prior art reference is analogous art if the prior art reference is reasonably pertinent to problem faced by the inventor, even if it is not in the same field of endeavor as the claimed invention.

37. I understand that it must be shown that a POSITA at the time of the invention would have had a reasonable expectation that a modification or combination of one or more prior art references would have succeeded. Furthermore, I understand that a claim may be obvious in view of a single prior art reference, without the need to combine references, if the elements of the claim that are not found in the reference can be supplied by the knowledge or common sense of one of ordinary skill in the relevant art. However, I understand that it is

inappropriate to resolve obviousness issues by a retrospective analysis or hindsight reconstruction of the prior art and that the use of such hindsight reconstruction is improper in analyzing the obviousness of a patent claim.

38. I further understand that the law recognizes several specific guidelines that inform the obviousness analysis. First, I understand that a hindsight reconstruction approach is not permitted. In other words, it is improper to use post-invention information to help perform the selection and combination of prior art references, and it is also improper to use the listing of elements in a claim as a blueprint to identify selected portions of different prior art references in an attempt to show that the claim is obvious.

39. Second, I understand that any prior art that specifically teaches away from the claim subject matter points to non-obviousness. In other words, prior art that would dissuade a POSITA from following the path of the claimed invention or lead a POSITA to a specifically different solution than the claimed invention points to non-obviousness. Conversely, I understand that any prior art that contains any teaching, suggestion, or motivation to modify or combine such prior art references points to obviousness of such a modification or combination. I further understand that a prior art reference must be considered in its entirety, including portions that would teach or lead away from the claimed invention.

40. Third, while many combinations of the prior art may be “obvious to try,” I understand that any obvious-to-try analysis will not render a patent invalid unless it is shown that the possible combinations are: (1) sufficiently small in number so as to be reasonable to include that the combination would have been selected; and (2) such that the combination would have been believed to be one that would produce predictable and well understood results.

41. Fourth, I understand that if a claimed invention that arises from the modification or combination of one or more prior art references uses known methods or techniques that yield predictable results, then that factor also points to obviousness.

42. Fifth, I understand that if a claimed invention that arises from the modification or combination of one or more prior art references is the result of known work in one field prompting variations of it for use in the same field or a different one based on design incentives or other market forces that yield predictable variations, then that factor also points to obviousness.

43. Sixth, I understand that if a claimed invention that arises from the modification or combination of one or more prior art references is the result of routine optimization, then that factor also points to obviousness.

44. Seventh, I understand that if a claimed invention that arises from the modification or combination of one or more prior art references is the result of a

substitution of one known prior art element for another known prior art element to yield predictable results, then that factor also points to obviousness.

45. I further understand that in connection with obviousness, there should be some reason or motivation that would have led a POSITA to combine or modify the relevant prior-art teachings to obtain the claimed invention. I further understand that there should be explanation as to how the relevant prior art teachings would be modified or combined and work together to obtain the claimed invention.

46. I further understand that a dependent claim incorporates each and every limitation of the claim from which it depends. Thus, my understanding is that if a prior art reference fails or a combination of prior art references fail to render obvious an independent claim, then that prior art reference fails or that combination of prior art references fail to render obvious all dependent claims that depend from the independent claim.

C. Claim Construction

47. I understand that claim construction is the process by which a court determines the scope and meaning of terms used in the claims of a patent. I understand that the goal of this process is to give claim terms the ordinary and customary meaning they would have had to a person of ordinary skill in the art (“POSITA”) at the time of the invention, after reading the entire patent and its prosecution history.

48. I understand that it is possible that the patent specification may reveal a special definition given to a claim term by the patentee that differs from the meaning it would otherwise have to a POSITA. In such cases, I understand that the patentee's definition usually controls.

49. I understand that the prosecution history of a patent can inform the meaning of some claim language and must be taken into account in construing the claims.

50. I understand that, in some cases, the court may consider extrinsic evidence, such as dictionaries, treatises, and expert opinions, to understand the underlying technology and the way in which claim terms would be understood by a POSITA at the relevant time.

51. I understand that as a general rule, unless the steps of a method actually recite an order, the steps are not ordinarily construed to require one. However, I understand that such a result can ensue when the method steps implicitly require that they be performed in the order written. I understand that this determination involves a two-part inquiry: (1) whether the claim language requires an order as a matter of logic or grammar; and (2) if the answer to (1) is in the negative, whether the specification directly or implicitly requires such a narrow construction.

52. I understand that 35 U.S.C. § 112, ¶ 6 creates an exception to the general rules of claim construction called a “means-plus-function” limitation. I understand that a means-plus-function limitation describes what the limitation does (i.e., its function), opposed to what it is (i.e., its structure). I also understand that a means-plus-function limitation is construed to cover only the corresponding structure, material, or acts described in the specification for performing the function, and equivalents thereof.

53. I understand that a limitation is presumed to be a means-plus-function limitation if (i) the claim limitation uses the phrase “means for,” (ii) the phrase “means for” is modified by functional language, and (iii) the phrase “means for” is not modified by sufficient structure for achieving the specified function. I understand that to determine whether a claim recites sufficient structure, it is sufficient if the claim term is used in common parlance or by persons of skill in the pertinent art to designate structure, even if the term covers a broad class of structures and even if the term identifies the structures by their function.

54. I understand that in determining whether a claim term invokes § 112, ¶ 6, the essential inquiry is not merely the presence or absence of the word ‘means’ but whether the words of the claim are understood by persons of ordinary skill in the art to have a sufficiently definite meaning as the name for structure.

55. I understand that interpreting a means-plus-function limitation is a two-step process. First, the claimed function must be identified. Second, the corresponding structure in the specification, if any, that corresponds to the claimed function(s) must be identified. I understand that structure disclosed in the specification is corresponding structure only if the specification or prosecution history clearly links or associates the structure to the function recited in the claims. I also understand that where there are multiple claimed functions, the specification must disclose adequate corresponding structure to perform all of those functions. I further understand that the claim is indefinite if the specification fails to disclose adequate corresponding structure.

V. PERSON OF ORDINARY SKILL IN THE ART

56. I understand that, in assessing the level of ordinary skill, one may consider several factors, including: (1) the education level of the inventor; (2) the education level of active workers in the field; (3) the types of problems encountered in the art; (4) prior art solutions to these problems; (5) the rate of innovation in the field; and (6) the sophistication of the technology.

57. I understand that the District Court in the TI Litigation adopted the following definition for a person of ordinary skill in the art (“POSITA”): “a POSITA would have at least a Bachelor’s degree in electrical engineering,

computer engineering, or a related field, and at least two years of work experience in the field of SoC and NoC technologies.” Ex. 1035.

58. I understand that Petitioner and Dr. Mowry propose the following level of ordinary skill in the art for this IPR:

[a] POSA at the time of the ‘449 patent would have had at least a Bachelor’s degree in computer science, electrical engineering, computer engineering, or an equivalent technical degree, and two or more years of experience with system-on-chip, interconnect, or networking technologies. Additional education might compensate for less experience, and vice-versa.

Ex. 1003 at ¶ 32.

59. I understand that in the Institution Decision, the Board agreed with and adopted Petitioner and Dr. Mowry’s proposed level of skill in the art for the ‘449 Patent. Paper 10 at 19.

60. For purposes of this Declaration and my analysis, I have been asked to apply Petitioner’s proposed level of skill in the art. Unless otherwise noted, my opinions would not change if the Board were to adopt the level of skill in the art that, to my understanding, Patent Owner proposed in related TI Litigation.

61. I met and exceeded the level of skill articulated by Petitioner and in the TI Litigation and the level of skill articulated and adopted by the Board in the Institution Decision. I am also very familiar with individuals having that articulated level of skill under both definitions.

VI. TECHNOLOGY OVERVIEW

A. Technical Background

62. A system-on-chip (“SoC”) is an integrated circuit in which the components of a system are integrated on the chip, including memories, processors, interfaces, and logic. Each SoC must include an interconnect, which interconnects the components of the system so that they may communicate with each other.

63. In the early years of computers, the components of a system were directly interconnected using point-to-point links. For example, the first computer system was named ENIAC (Electrical Numerical Integrator and Computer) and was developed in the United States during World War II. ENIAC used point-to-point links to connect the components of the systems such as accumulators, central control, and I/O devices.

64. The industry soon thereafter realized a foundational problem with point-to-point link interconnects: all the components in the system must be directly connected with such links. This resulted in increased hardware overhead, especially as the number of components included in the system increased over time.

65. An advancement over the traditional point-to-point link interconnects is what has been termed a “bus” interconnect. The formal concept of a bus, where a single communication pathway could be shared by multiple devices, evolved in the 1950s and 1960s. For example, the UNIVAC 1 (1951) and IBM 7090 (1959) made

great progress towards the goal for managing data flow between the central processor, memory, and peripherals. The development of more standardized bus architectures, such as the S-100 bus (Altair bus) was developed in the 1974. As the S-100 bus gained in popularity, it became necessary to introduce a formal bus specification to ensure compatibility and interoperability among products from different manufacturers. There was also a need to extend the bus capability so that it could support more complex processors. In 1979, Standard Specification for S-100 Bus Interface Devices was introduced. This need for standardization led to the development of the IEEE 696 specification, which was formally adopted by the IEEE in 1983. The IEEE 696 bus specification was a critical early standard in the personal computing world because it provided a foundation for hardware compatibility and expansion during the early years of the microcomputer industry.

66. In modern times, as the number of computational, functional, and memory units on a single chip increased, the need for communication between those units also increased. It is therefore important to choose an appropriate interconnect scheme that is scalable, efficient, reliable, and flexible. A scalable interconnect is an interconnect in which additional or fewer computational, functional, and/or memory units could be included in the SoC without issue. An efficient interconnect is an interconnect that consumes relatively low silicon area and power while offering high bandwidth and low latency. A flexible interconnect

is an interconnect in which it is easy to attach or remove a component or an IP from the interconnect without modifying the interconnect completely.

67. SoC designers have the option of using a point-to-point interconnect, single-bus architecture, hierarchical bus architecture, or a network-on-chip interconnect. Point-to-point interconnects are the least scalable with limited flexibility and are optimal when future design changes are not needed and are usually reserved for high performance applications. For example, a point-to-point connection may exist between two components that are tightly coupled and need a high bandwidth and low latency interconnect to meet power and performance requirements.

68. A bus interconnect is a shared communication interconnect and is used to connect various components or modules within a device. This design approach allows different IPs, cores, memory, and peripheral devices to communicate with each other by transmitting data, addresses, and control signals over the shared bus. Bus-based interconnects have been the dominant form of interconnect prior to the invention described in the '449 Patent and continue to be widely used when the number of integrated components is in the order of tens. A bus is essentially a set of parallel wires on the chip that carry data, address, and control signals between different components. In a bus, one component (i.e., the master) initiates communication while the other component (i.e., the slave)

responds. In bus-based interconnects, only one master can have control of the bus at a time. Thus, when there are multiple master components connected to the bus, arbitration logic must be employed to dictate which master has control of the bus at any given time to avoid conflicts. Each component connected to the bus typically has a bus interface unit that manages the interaction between the device and the bus, ensuring that data is transmitted correctly and provides seamless interaction with the bus communication protocol.

69. While buses solved some of the limitations associated with point-to-point interconnects, a bus is a bottleneck when the number of components connected to the bus increases. This is because all the components share the same bus and there can be contention for bus access, leading to bottlenecks and significant delays in bus response time. The time it takes for data to travel along the bus can introduce delays, particularly in long buses or when multiple devices are trying to communicate simultaneously. The need to drive signals across a shared bus can lead to increased power consumption, particularly in high performance systems.

70. Thus, as the complexity and number of components on a chip have increased, traditional bus-based designs have faced scalability challenges. This led to the development of NoC architectures, where a network of interconnected

switches and routers (and potentially traditional interconnects) replaces the traditional bus, providing better performance and scalability for modern SoCs.

71. NoCs represent an advanced communication architecture for connecting the ever-increasing number of components on a chip. Unlike traditional bus-based designs which rely on a single shared communication highway, NoCs implement a network of interconnected routers and links to facilitate data transfer between the various components on a chip. Routers and switches are the main components in a NoC architecture because they handle the data packets coming from neighboring routers and switches, determine the best path, and forward the packet to their destination. Links are the physical and logical connections between routers and switches and are implemented as wires or interconnects within the chip, thereby facilitating packet transmission for one router or switch to another.

72. Unlike bus-based systems, NoCs can efficiently handle a large number of cores and IP blocks, making NoCs suitable for modern SoCs. NoCs allow multiple data transfers to occur simultaneously across different parts of the network, improving overall system performance and power consumption. However, designing a NoC is more complex than a traditional bus-based interconnect because NoCs require sophisticated routing algorithms, flow control, load balancing, and error handling.

73. NoCs are sophisticated communication architectures that provide an efficient, scalable, and high-performing means of transferring data within a SoC. By using a network of routers, switches, and link, NoCs overcome the limitations of traditional bus-based interconnects, support the growing demand for parallelism, scalability, and energy efficiency in modern computing systems. NoCs are a critical technology in the development of modern electronic devices.

74. The network in a NoC is different from that a traditional computer network such as a local area network (“LAN”) or a wide area network (“WAN”). As I explain below, *infra* § VI.B.3, the ‘449 Patent discusses these differences in great detail. Notwithstanding, the differences provided in the ‘449 Patent, a POSITA would understand there are additional fundamental differences between a NoC and a traditional computer network.

75. The most readily apparent difference between a NoC and a computer network is the size of the components. Modern SoCs are approaching a die area size of 100 square millimeters. In contrast, computer networks are significantly larger. This leads to substantial “design constraints [in] NoCs [that are] less applicable to traditional multicomputer networks.” Ex. 2072 at 39. A POSITA would understand that applying traditional networking architectures to a NoC is impossible due to these size differences. This is one of “a number of basic differences between on- and off-chip communication.” *Id.* at 2.

76. Another difference between NoCs and traditional computer networks is “the cost ratio between wiring and processing resources.” Ex. 2072 at 2. While both NoCs and traditional computer networks use wires, “the differences between on- and off-chip wires make the direct scaling down of traditional multicomputer networks suboptimal for on-chip use.” *Id.* at 3. This is because as the size of the SoC scales down as technology advances, wire resistance and capacitance increase. *Id.*

77. Another difference between NoCs and traditional computer networks is the modules that are communicating through each network. Traditional computer networks connect servers with personal computers or personal computers with other personal computers, for example. Embedded within these computers are specific network adapters that connect the computer to the network. Including network adapters (i.e., network interfaces) in a module on an SoC is highly disfavored for several reasons, one of which being that it prevents module re-use. As background, there was a significant shift to module re-use in SoCs to account for the significant time-to-market demands in the semiconductor industry. For example, “[b]etween 1997 and 2002, the market demand reduced the typical design cycle by 50%.” Ex. 2072 at 4. This all occurred while “design complexity increased 50 times in the same period.” *Id.* Thus, “[t]o keep us with these requirements, IP reuse is pertinent.” *Id.*

78. It is impractical to design a module on a NoC with a dedicated network adapter (i.e., network interface) because, if changes are made to the network, the module would similarly have to be changed. As a solution, SoC designers have decoupled the modules and the network adapters, thereby allowing the modules to merely communicate with a network adapter that is not integrated on the module.

79. The types of network adapters used in NoCs and traditional computer networks also differ. NoCs typically have a hardware component that is separate and distinct from the processing module that aids in connecting the processing module to the network. In contrast, the network adapter functionality in personal computers is typically software based. Ex. 2072 at 43 (“Unlike macronetworks, in NoC, the network adapter and network functionality is often implemented in hardware rather than in software. This is so because NoC-based systems are more tightly bound, and simple, fast, power-efficient solutions are required.”)

80. Other ways that NoCs differ from traditional computer networks include the manner in which they provide service guarantees, their routing schemes, and their architecture. Ex. 2072 at 22 (“In macronetworks, service guarantees are often of a statistical nature. In tightly bound systems such as SoC, hard guarantees are often preferred. GS [i.e., guaranteed service] allows analytical system verification, and hence a true decoupling of subsystems. In order to give hard guarantees, GS communication must be logically independent of other traffic

in the system. This requires connection-oriented routing.”); *id.* at 18 (“While macronetworks usually employ store-and-forward routing, the prevailing scheme for NoC is wormhole routing.”); *id.* at 8 (“The figure also clarifies a basic difference between NoC and networks for more traditional parallel computers; the latter have generally been homogeneous and coarse grained, whereas NoC-based systems implement a much higher degree of variety in composition and in traffic diversity.”)

81. While NoCs share many of the same foundational principles as computer networks, it is understood that there are “significant difference between on-chip and off-chip (on board) applications.” Ex. 2073 at 7. Thus, “it is impossible to incorporate all of these features into the same system,” which is why NoC designers “always have to sacrifice some of the advantages of certain architecture for the sake of gaining another one.” *Id.*

82. In networks, generally, modules communicate with each other through connections, composed of one or more channels. In a simple example, if module A wants to communicate with module B and vis versa, one or more channels would comprise the connection. Channels could be simplex channels, half-duplex channels, or full duplex channels.

83. A simplex channel is a communication channel that sends information in one direction only. Ex. 2074 at 6 (defining “simplex channel” as “A channel

which permits transmission in one direction only”). Thus, in the above example, for module A to send data to module B, one simplex channel is required. *Id.*

However, for module B to send data to module A, a separate and distinct simplex channel is required. Therefore, for a two-way communication (i.e., module A to module B and module B to module A), two different simplex channels would be required. This is commonly referred to as a “dual-simplex” communication. An example of simplex communication channels is television or radio broadcasting where information travels from the transmitter to one or more receivers. The receivers cannot send information back to the transmitter.

84. In contrast, a half-duplex channel is a communication channel that sends information in two directions, but not simultaneously. Ex. 2074 at 5 (defining “half-duplex operation” as “Operation of a telegraph system in either direction over a single channel, but not in both directions simultaneously”); Ex. 2075 at 4 (defining “half-duplex channel” as “A channel of a duplex system arranged to permit operation in either direction but not in both directions simultaneously”). In the above example, for module A to send data to module B, one half-duplex channel is required. Module B can send data to module A on the same half-duplex channel; however, it cannot do so at the same time as module A is sending data to module B. It is commonplace to refer to the transmission of data from module A to module B as a transmission of data in the “forward” direction,

and to refer to the transmission of data from module B to module A as a transmission of data in the “backward” direction. Thus, a half-duplex channel can transmit data in both the “forward” and “backward” directions; however, it cannot transmit data in both directions simultaneously. An example of a half-duplex communication channel is a walkie-talkie or a CB radio, where the user typically says “over,” to indicate that they are done speaking so that the user at the other end of the line knows when they can speak. Half-duplex channels typically conserve bandwidth, making them a popular choice for network designers in applications that do not require simultaneous two-way communication.

85. A full-duplex channel is a communication channel that send information in two directions simultaneously. Ex. 2074 at 4 (defining “duplex channel” as “A communication channel providing simultaneous transmission in both directions”); Ex. 2075 at 3, 6 (defining “full duplex transmission” as “Transmission in which data may be sent simultaneously in both directions on a transmission medium”). In the above example, for module A to send data to module B, one full-duplex channel is required. However, in contrast to the half-duplex channel, module A can send data to module B and module B can send data to module A at the same time. Thus, a full-duplex channel can transmit data in both the “forward” and “backward” directions simultaneously. An example of a full-duplex communication channel is a telephone. Both parties to a phone call can

speak simultaneously, without having to repeat “over,” as with walkie-talkies or CB radios. Full-duplex channels consume more bandwidth compared to half-duplex channels, but are essential certain applications, like a telephone conversation. Many ethernet connections utilize full-duplex communication channels, thus allowing a computer to send and receive data simultaneously.

86. Dual-simplex channels differ from full-duplex channels in their physical implementation. The term “dual-simplex” refers to a specific way of using two separate and distinct simplex channels. One of the two channels would transmit data in a first direction, and the other channel would transmit data in a second direction. In contrast, full-duplex refers to using one single channel to transmit data in both directions.

B. Overview of the ‘449 Patent

1. Exemplary Claims of the ‘449 Patent

87. I understand that Petitioner challenges claims 2, 6, and 9-16 of the ‘449 Patent in this IPR.

88. Independent claim 10 exemplifies the challenged claims and is reproduced below:

10. [10.pre.1] Method for exchanging messages in an integrated circuit comprising a plurality of modules, the messages between the modules being exchanged over connections via a network,

[10.pre.2] wherein said connections comprises [sic] a set of communication channels, each having a set of connection properties, any communication channel being independently configurable,

[10.pre.3] wherein said connection through the network supports transactions comprising at least one of outgoing messages from the first module to the second module and return messages from the second module to the first module

and further comprising the steps of:

[10.a] the first module issuing a request for a connection with the second module to a communication manager, wherein the request comprises desired connection properties associated with the sets of communication channels;

[10.b] the communication manager forwarding the request to a resource manager;

[10.c] the resource manager determining whether a target connection with the desired connection properties is available;

[10.d] the resource manager responding with the availability of the target connection to the communication manager;

[10.e] the target connection between the first and second module being established based on the available properties of said communication channels of said connection.

Ex. 1001 at 19:21-20:6.

2. Technical Summary of the ‘449 Patent

89. The ‘449 Patent explains that systems-on-chip (“SoCs”) “show[ed] a continuous increase in complexity due to the ever increasing need for implementing new features and improvements of existing functions” at the time of the invention. Ex. 1001 at 1:15-17. Conventionally, the modules on the SoC “communicate to each other via a bus.” *Id.* at 1:26-28. However, buses were

proving “no longer practical” because “the large number of modules form[ed] a too high bus load” and “the bus form[ed] a communication bottleneck as it enable[d] only one device to send data to the bus.” *Id.* at 1:28-33.

90. The ‘449 Patent describes a network-on-chip (“NoC”) interconnect which provides “an effective way to overcome these disadvantages” of bus-based SoCs. *Id.* at 1:34-35. NoCs are beneficial for two separate and distinct reasons: (1) NoCs “share wires, lowering their number and increasing their utilization” and “are scalable compared to buses” (*id.* at 1:38-43) and (2) NoCs “decouple computation from communication” by “using protocol stacks, which provide well-defined interfaces separating communication service usage from service implementation” (*id.* at 1:43-49).

91. The NoC described in the ‘449 Patent “abstract[s]” communication services from the network details. Ex. 1001 at 15:61-62. “[T]he services should abstract from the network internals as much as possible.” *Id.* at 17:60-61. “This is a key ingredient in tackling the challenge of decoupling the computation from communication, which allows IPs (the computation part), and the interconnect (the communication part) to be designed independently from each other.” *Id.* at 17:61-65. By abstracting services from the network details, the NoC “decouples computation and communication.” *Id.* at 15:62-63.

92. The '449 Patent expressly defines that its goal is to provide a network-based interconnect that allows existing IP modules, that were designed for communication over a bus-based interconnect, to be re-used. Ex. 1001 at 8:7-12. The NoC includes a “network interface ... associated to each of said modules, for managing the communication between said modules and said network.” *Id.* The inclusion of the network interface allows for “the modules [to] be designed independent from the network and can therefore be re-used.” *Id.* The modules can therefore “be introduced non-disruptively.” *Id.* at 18:2-5.

93. The '449 Patent accomplishes its goals of (1) decoupling computation from communication and (2) creating a NoC that allows bus-based IP modules to be re-used by providing connections between the initiator of a communication and a target of that communication. The connections send data from initiator to target over a “multi-hop” network, “where communication modules are not directly connected, but separated by one or more network nodes.” Ex. 1001 at 3:49-52. “This is in contrast with the prevalent existing interconnects (i.e., buses) where modules are directly connected.” *Id.* at 3:52-54. Data is transmitted over the multi-hop network in the form of a packet. *Id.* at 6:26-28, 6:35-42.

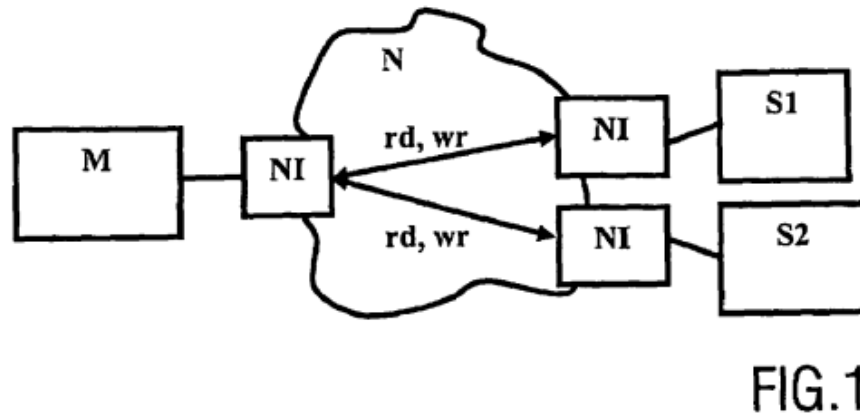
94. A connection comprises a set of channels, each channel in the connection having a set of connection properties. Ex. 1001 at 8:50-52. The connection properties associated with each channel “may include ordering (data

transport in order), flow control (a remote buffer is reserved for a connection, and a data producer will be allowed to send data only when it guaranteed that space is available for the produced data), throughput (a lower bound on throughput is guaranteed), latency (upper bound for latency is guaranteed), the lossiness (dropping of data), transmission termination, transaction completion, data correctness, priority, or data delivery.” *Id.* at 8:62-9:3.

95. “The connections ... must be first created or established with the desired properties before being used,” which “may result in resource reservations inside the network (e.g., buffer space, or percentage of the link usage per time unit).” Ex. 1001 at 10:62-66. “To allow more flexibility in configuring connections, and, hence, better resource allocation per connection, the outgoing and return parts of connections can be configured independently.” *Id.* at 11:4-7. Independently configuring connections allows for “a different amount of buffer space [to] be allocated in the NIPs at the master and slaves, or different bandwidths can be reserved for requests and responses.” *Id.* at 11:7-10.

96. In an exemplary embodiment, the ‘449 Patent discloses “an integrated circuit having a plurality of processing modules and a network arranged for providing connections between modules and a method for exchanging messages in such an integrated circuit.” Ex. 1001 at 1:7-11. As shown in FIG. 1, reproduced below, the integrated circuit “comprises a master module M, two slave modules

S1, S2,” where “[e]ach module is connected to a network N via a network interface NI, respectively.” *Id.* at 9:4-7.



Ex. 1001 at FIG. 1

“The network interfaces NI are provided to manage the communication of the respective modules and the network N, so that the modules can perform their dedicated operation without having to deal with communication with the network or other modules.” Ex. 1001 at 9:9-14.

97. As shown in FIG. 3, reproduced below, the integrated circuit “additionally comprises a communication manager CM and a resource manager RM.” Ex. 1001 at 9:66-10:3.

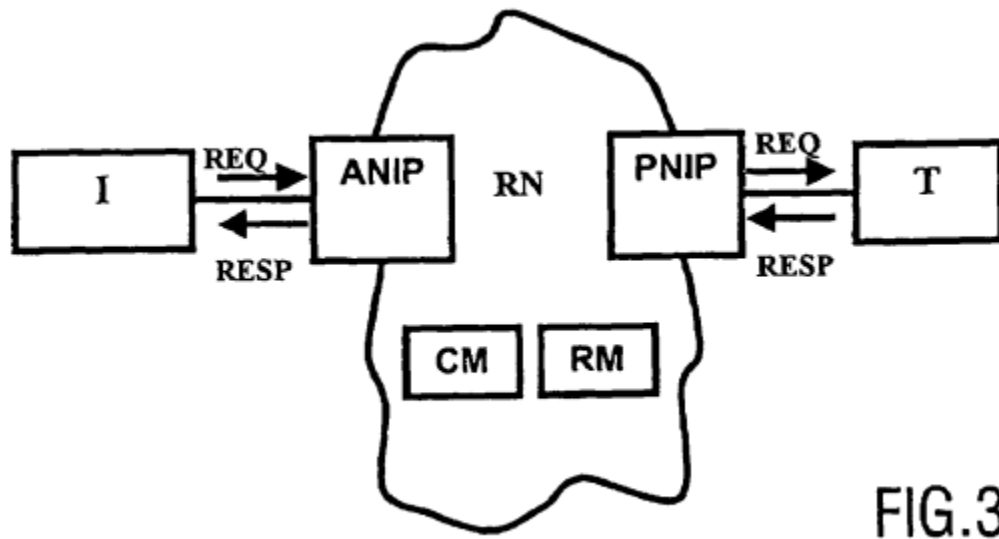


FIG.3

Ex. 1001 at FIG. 3

98. In FIG. 3, the “communication manager CM and the resource manager RM are arranged in the router network RN, but they can also be arranged in one or some of the network interfaces NI.” *Id.* at 10:3-6. The FIG. 3 embodiment also depicts network interface ports ANIP, PNIP “through which the modules communicate with the router network RN or other modules via the router network RN.” *Id.* at 9:18-24. Each network interface “has one or more ports where modules can be connected,” for example, “the active network interface port ANIP, which is connected to the masters, and the passive network interface port PNIP, which is connected to slave[s].” *Id.* at 9:25-29. In an exemplary communication, the “request REQ is delivered to the slave, i.e. the target module T, via the active

network interface port ANIP, the network RN, and the passive network interface port PNIP.” *Id.* at 9:34-36.

99. As another example, the initiator in FIG. 3 (synonymous with the master module of FIG. 1) issues “a request REQ for a connection with the target module T” (synonymous with the slave modules of FIG. 1). *Id.* at 10:7-9. “This request REQ is sen[t] to a request port of the active network interface ports ANIP of the network interface associated to said initiator I.” *Id.* at 10:9-11. “[A]fter receiving the request REQ from the active network interface ports ANIP, i.e. the properties of a connection,” the “communication manager request[s] a connection with a set of properties between two modules from the resource manager RM” and the “resource manager RM allocates the necessary resources and enquires if such a connection based on these resources is possible.” *Id.* at 10:19-26. “After enquiring of the available connection properties, the resource manager RM reserves the available connection, i.e. the required resources, and responds to the communication manager CM which connection is available, i.e. which connection properties or the required resources thereof are available for the desired channels.” *Id.* at 10:41-46. “Optionally, the communication manager CM can accept the connection with the available properties, but on the other hand the communication manager CM may also refuse the offered connection if the available properties or the resources thereof are not acceptable.” *Id.* at 10:46-51.

100. “[M]ore flexibility,” and, thus, “better resource allocation per connection,” is achieved by configuring “the outgoing and return parts of connections ... independently.” Ex. 1001 at 11:4-7. This allows for “different bandwidths [to] be reserved for requests and responses.” *Id.* at 11:7-10. In other words, to prevent “an inefficient bandwidth utilization, the request part of the connection can be set up as best effort (i.e., no throughput guarantees) and guaranteed throughput only for the response part.” *Id.* at 11:47-50.

3. The ‘449 Patent’s Network is Different Than Off-Chip Networks

101. The ‘449 Patent emphasizes that “NoC’s premises are different from off-chip networks, and, therefore, most of the network design choices must be reevaluated” because “[o]n-chip networks have different properties (e.g., tighter link synchronization) and constraints (e.g., higher memory cost) leading to different design choices, which ultimately affect the network services.” Ex. 1001 at 1:66-2:5. One element that is drastically different in an on-chip network compared to an off-chip network is the network interface. For example, the ‘449 Patent explains that “[a]n off-chip network interface usually contains a dedicated processor to implement the protocol stack up to network layer or even higher, to relieve the host processor from the communication processing,” however, “[i]ncluding a dedicated processor in a network interface is not feasible on chip, as

the size of the network interface will become comparable to or larger than the IP to be connected to the network.” *Id.* at 2:16-24. “Moreover, running the protocol stack on the IP itself may also not be feasible, because often these IPs have one dedicated function only, and do not have the capabilities to run a network protocol stack.” *Id.* at 2:24-27.

102. The ‘449 Patent also teaches that in networks, generally, “data sent from a source to a destination may arrive out of order due to reordering in network nodes, following different routes, or retransmission after dropping.” Ex. 1001 at 3:8-11. “For off-chip networks out-of-order data delivery is typical.” *Id.* at 3:11-12. However, this is not the case for on-chip networks (i.e., NoCs) because “for NoCs where no data is dropped, data can be forced to follow the same path between a source and a destination (deterministic router) with no reordering.” *Id.* at 3:12-15. As a result, the design of an off-chip is not applicable to an on-chip network because “reordering modules are no longer necessary.” *Id.* at 3:15-17.

103. The ‘449 Patent also teaches that on-chip networks (i.e., NoCs) differ from off-chip networks with respect to time-related guarantees. For example, “[o]ff-chip networks typically use packet switching and offer best-effort services,” where “[c]ontention can occur at each network node, making latency guarantees very hard to offer.” Ex. 1001 at 3:34-37. On-chip networks can provide “such time-related guarantees ... at a relatively low memory and computation cost.” *Id.*

at 3:39-44. As a result, “[n]etwork resource utilization is increased” by “allow[ing] any left-over guaranteed bandwidth to be used by best-effort communication.” *Id.* at 3:44-46.

104. The ‘449 Patent also explains that on-chip networks (i.e., NoCs) provide more reliable communication compared to off-chip networks. This because on-chip networks use wires as a communication medium. For example, “[a] consequence of the tight on-chip resource constraints is that the network components (i.e., routers and network interfaces) must be fairly simple to minimize computation and memory requirements.” Ex. 1001 at 2:43-46. However, “on-chip wires provide a reliable communication medium, which can help avoid the considerable overhead incurred by off-chip networks for providing reliable communication.” *Id.* at 2:46-49. “Data integrity can be provided at low cost at the data link layer; [h]owever, data loss also depends on the network architecture, as in most computer networks data is simply dropped if congestion occurs in the network.” *Id.* at 2:50-53.

105. The ‘449 Patent also teaches that “resources constraints are tighter on chip than off chip.” Ex. 1001 at 2:7-8. For example, “[s]torage (i.e., memory) and computation resources are relatively more expensive, whereas the number of point-to-point links is larger on chip than off chip.” *Id.* at 2:8-11. “Storage is expensive, because general-purpose on-chip memory, such as RAMs, occupy a large area”

and “[h]aving the memory distributed in the network components in relatively small sizes is even worse, as the overhead area in the memory then becomes dominant.” *Id.* at 2:11-15. To overcome these physical size constraints, on-chip networks use “wires [to] provide a reliable communication medium” that “help[s] avoid the considerable overhead incurred by off-chip networks for providing reliable communication.” Ex. 1001 at 2:46-49.

106. In sum, “NoCs have different properties from both existing off-chip networks and existing on-chip interconnects.” Ex. 1001 at 17:42-44. “As a result, existing protocols and service interfaces cannot be adopted directly to NoCs, but must take the characteristics of NoCs into account.” *Id.* at 17:44-46. “For example, a protocol such as TCP/IP assume the network is lossy, and includes significant complexity to provide reliable communication; [t]herefore, it is not suitable in a NoC where we assume data transfer reliability is already solved at a lower level.” *Id.* at 17:46-51.

VII. OVERVIEW OF PETITIONER’S REFERENCES

A. Goossens2002 (Ex. 1005)

107. Goossens2002 describes a “network on silicon (NOS)” that “implement[s] communication between IP cores in future technologies.” Ex. 1005 at Abstract. The network on silicon includes a “router network based on packet switching” in which a “packet must traverse a number of routers,” this traversal

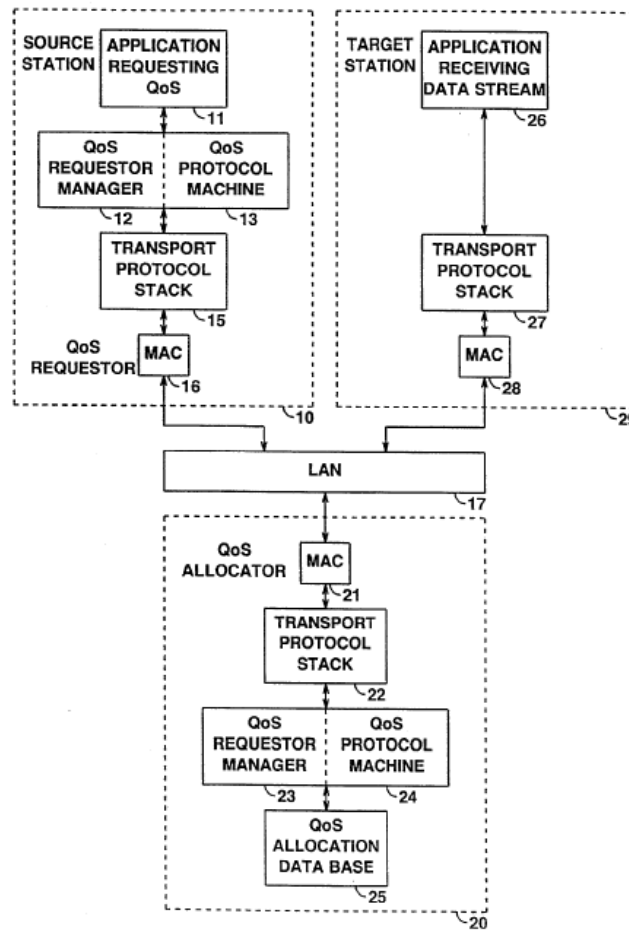
being called a “hop.” *Id.* at 1-2. The router network connects intellectual property blocks so that they may communicate with each other. *Id.* at 1. Communication in the between the intellectual property blocks is performed on a connection. *Id.* at 3. “A connection combines multiple channel and can include flow control and reordering for lossless in-order (multicast) transmission.” *Id.* Each channel is “a simplex point-to-point communication between two network interfaces (possibly with multiple paths).” *Id.* Goossens2002 further discloses that “[a] channel can have a combined throughput and latency guarantee (GT), or be best effort (BE), with an unspecified finite latency upper bound.” *Id.*

108. Goossens2002 also explains that “guaranteed services offer many advantages over *best-effort* services when programming” systems on a chip. Ex. 1005 at 1. For example, “services that are guaranteed to an IP are not affected by other IPs in the network, making reasoning about the IP in isolation possible.” *Id.* at 3. Goossens2002 provides that “[a]t run-time an application or quality-of-service manager reconfigures the SOS,” thus making the network predictable. *Id.* “[P]redictability in the form of guaranteed services, greatly benefits programming a SOS at two levels.” First, IPs with guaranteed services requirements “are more easily integrated,” and second, “the programming of IPs is compositional because their services are independent of each other.” *Id.* Goossens2002 also discloses that

the “[q]uality-of-service managers can effectively observe and setter a NOS because” of its predictable behavior with guaranteed service connections. *Id.*

B. Drake (Ex. 1006)

109. Drake relates to “[a] management system for local area networks.” Ex. 1006 at Abstract. Drake explains that “[m]ost packet based local area networks (LANs), such as token rings (IEEE Standard 802.5), do not offer these sophisticated techniques for quality of service management.” *Id.* at 2:10-13. The “management system of a local area network is almost entirely concentrated in a single QoS management station on the LAN, thereby significantly reducing the complexity of introducing QoS management into existing LAN networks.” *Id.* at 2:65-3:3. The management system is depicted in FIG. 1 as QoS Allocator 20.



Ex. 1006 at FIG. 1

110. Drake describes the quality-of-service management process as follows: first, “an application 11 [] requests a QoS connection to the destination or target station 29;” next, QoS requestor manager 12 and QoS protocol machine 13, “[t]ogether, ... assemble a request to reserve a QoS connection for a multi-media stream on that path through the LAN 17 between source station 10 and target station 29;” and QoS Allocator 20 “receive[s] the QoS request from station 10, examine[s] the resources of LAN 17, and determine[s] if a path exists in LAN 17 between station 10 and station 29 which satisfies the requested level of QoS.” Ex.

1006 at 4:26-54. Drake provides that the “QoS requestor manager 12 interacts with application 11 using internal messages as is well known in the art and utilizes QoS protocol machine 13 to format the QoS request.” *Id.* at 4:62-65. Once the QoS Allocator 20 determines that a path exists in LAN 17 which satisfies the requested level of QoS, “an allocation accepted message” is sent and “received at the source station 10.” *Id.* at 11:22-26. “If the allocation has been accepted, ... the multimedia file is transmitted to the target station 29.” *Id.* at 11:26-28.

C. Goossens2003 (Ex. 1007)

111. Goossens2003 describes that “NOCs provide services through protocol stacks, and introducing *guaranteed* services enables IP re-use and platform-based design.” Ex. 1007 at Abstract. Goossens2003 further describes that the NoC “offers differentiated services with *connections*,” where “[a] connection describes communication between one master and one or more slaves, with an associated service level.” *Id.* at 10. The architecture of the NoC disclosed in Goossens2003 includes a combined guaranteed-throughput and best-effort router (a “GT-BE router”) and a network interface. *Id.* at 16-17. The guaranteed throughput router “offers a fixed end-to-end latency for its traffic, which has the highest priority,” while the best-effort router “uses all the bandwidth (slots) that has not been reserved or is not used by GT traffic.” *Id.* at 16. The network interface “convert[s] the OSI network layer services of the routers to transport layer services

for the user” and implements end-to-end connection properties. *Id.* at 16. The connection properties include: “reordering, transaction completion, and flow control.” *Id.* at 16-17.

112. Goossens2003 teaches that “[t]he combination of best-effort and guaranteed services is advantageous: critical parts of the system are predictable while resources are used more efficiently.” *Id.* at 19.

VIII. CLAIM CONSTRUCTION

113. I understand that the following terms of ’449 Patent have been proposed for construction by either Petitioner or the Patent Owner, or have been construed, either by agreement or by the Court in related district court litigation. For all other claim terms, I have applied the plain and ordinary that a POSITA would understand for such terms at the time of the invention.

A. “First Module” and “Communication Manager” Are Separate and Distinct

114. Independent claim 10 of the ’449 Patent recites “the first module issuing a request for a connection with the second module to a communication manager, wherein the request comprises desired connection properties associated with the sets of communication channels.” Ex. 1001 at 19:32-35. Claim 6 recites similar language regarding the first module issuing a request for a connection to the communication manager. *Id.* at 18:60-63. A POSITA would understand that the

claimed “first module” is separate and distinct from the claimed “communication manager.” This understanding is supported by the language of the claims, the intrinsic record, and the intended purpose of the ‘449 Patent.

115. The claims require that the “first module issu[es] a request for a connection ... **to** a communication manager.” Ex. 1001 at 19:32-35 (emphasis added). A POSITA would understand that the plain and ordinary meaning of this limitation requires that the first module sends a request to a separate component, i.e., to the communication manager. A POSITA would not understand this limitation to encompass the communication manager being positioned within the first module (or vis versa) because that understanding is directly contrary to the claim language. Indeed, if the communication manager were positioned within the first module (i.e., if the communication manager and the first module were not separate and distinct components), a POSITA would expect the claim language to read: “first module issuing a request for a connection ... **from** a communication manager.” In other words, a POSITA would not be able to comprehend how a first module can issue a request **to** a communication manager if the communication manager were within the first module. Thus, a POSITA would understand that the claimed “first module” and “communication manager” are separate and distinct components of the claimed integrated circuit.

116. This understanding is confirmed by the ‘449 Patent’s specification. For example, FIG. 3, the only figure including both the “first module” and the “communication manager,” depicts the “first module” and the “communication manager” as separate and distinct components.

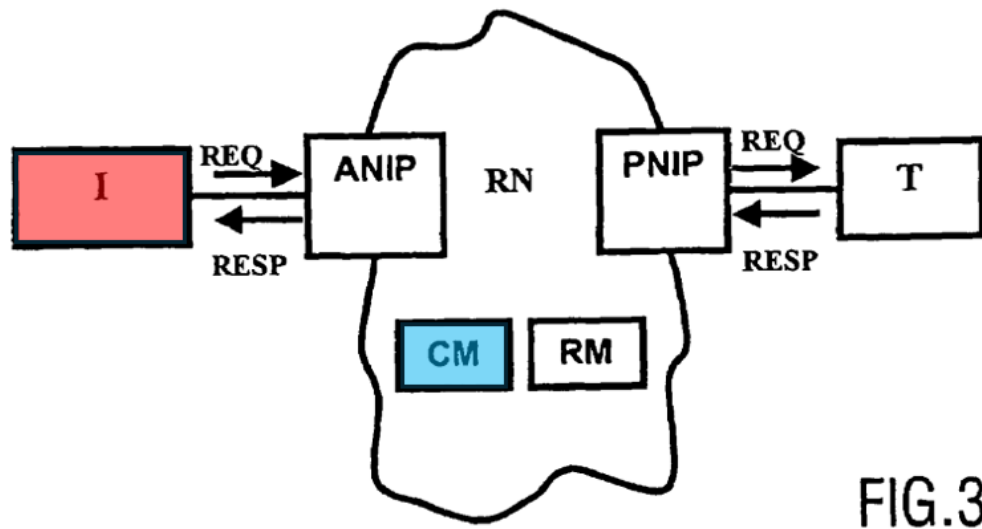


FIG.3

Ex. 1001 at FIG. 3 (annotated)

As shown in FIG. 3, the initiator (i.e., the “first module,” depicted in red) is separate and distinct from the “CM” (i.e., the “communication manager,” depicted in blue). Indeed, the communication manager is shown as being within the network RN, whereas the first module is outside of the network. The specification provides that “the communication manager CM and the resource manager RM are arranged in the router network RN, but they can also be arranged in one or some of the network interfaces NI.” Ex. 1001 at 10:3-6. Thus, a POSITA would understand that the communication manager may be in the network RN (as shown in FIG. 3

above) or within one of the network interfaces ANIP, PNIP. The ‘449 Patent does not contemplate that the communication manager may be arranged within the first module, nor would a POSITA understand that the communication manager could be arranged as such.

117. A POSITA would also understand that the first module must be outside of the network because it communicates with the second module via the network. For example and referring to FIG. 1, the ‘449 Patent provides that “[e]ach module is connected to a network via a network interface NI, respectively. The network interfaces NI are used as interfaces between the master and slave modules M, S1, S2 and network N.” Ex. 1001 at 9:6-9. The “plurality of modules on the same chip communicate with each other via some kind of interconnect” wherein “[t]he interconnect is embodied as a network on chip NOC.” *Id.* at 8:43-46. Therefore, a POSITA would understand that the first module is positioned outside the network, whereas the communication manager may be positioned inside the network or inside the one or more network interfaces.

118. There is no teaching or suggestion in the ‘449 Patent that the communication manager may be integrated within the first module. Indeed, a POSITA would understand that integrating the communication manager within the first module would defeat one of the stated purposes of the ‘449 Patent, which is to “decouple computation from communication.” Ex. 1001 at 1:44-45, 15:61-63,

17:60-65. This allows for “the modules [to] be designed independent from the network” and allows them to “be re-used.” *Id.* at 8:11-12, 17:60-65 (“decoupling [] computation from communications [] allows IPs (the computation part), and the interconnect (the communication part) to be designed independently of each other.”). If the communication manager was integrated into the first module (which is not disclosed in the ‘449 Patent), then the module design would be dependent on the network.

119. The ‘449 Patent discloses using a “request-response transaction model” which “eases the migration of current IPs to NoCs.” *Id.* at 15:63-66. And, as explained above, the “current IPs” at the time of the invention were mainly bus-based IP modules that communicate in a bus-based protocol. *Supra* § VI.A. Thus, integrating the communication manager, which manages network resources, into the first module, is contrary to disclosure of the ‘449 Patent because it does not (1) decouple computation (i.e., the first module) from communication (i.e., the network and the network interfaces); nor (2) allow for existing IP modules to be re-used in a NoC. Indeed, existing IP modules (which communicate in a bus-based protocol), would need to be redesigned to have the claimed communication manager (which manages communication over a network) integrated into them.

120. A POSITA would understand integrating the communication manager into the first module is not only not contemplated by the '449 Patent but is expressly disparaged.

B. “Communication Manager” and “Resource Manager” Are Separate and Distinct

121. For substantially the same reasons that the “first module” and the “communication manager” would be understood as separate and distinct, a POSITA would understand that the claimed “communication manager” and “resource manager” are be separate and distinct.

122. Independent claim 10 of the '449 Patent recites “the communication manager forwarding the request to a resource manager, the resource manager determining whether a target connection with the desired connection properties is available; the resource manager responding with the availability of the target connection to the communication manager.” Ex. 1001 at 19:36-20:6. Claim 6 recites similar language regarding the communication manager forwarding the request to the resource manager and the resource manager responding to the communication manager. *Id.* at 18:60-19:5. A POSITA would understand that the claimed “communication manager” is separate and distinct from the claimed “resource manager.” This understanding comports with the plain and ordinary meaning of the claims and with the specification.

123. The claims requires that the “communication manager forward[s] the request to a resource manager” and that the “resource manager respond[s] with the available of the target connection to the communication manager.” Ex. 1001 at 19:36-20:6 (emphasis added). A POSITA would understand that the plain and ordinary meaning of this limitation requires that the communication manager forwards the request to a separate component, i.e., to the resource manager. A POSITA would not understand this limitation to encompass the communication manager being positioned within the resource manager (or vis versa) because that understanding is directly contrary to the claim language. A POSITA would not be able to comprehend how a communication manager can forward the request to a resource manager if the communication manager were within the resource manager (or vis versa). Thus, a POSITA would understand that the claimed “communication manager” and “resource manager” are separate and distinct components of the claimed integrated circuit.

124. This understanding is confirmed by the ‘449 Patent’s specification. For example, FIG. 3, the only figure including both the “communication manager” and the “resource manager,” depicts the “communication manager” and the “resource manager” as separate and distinct components.

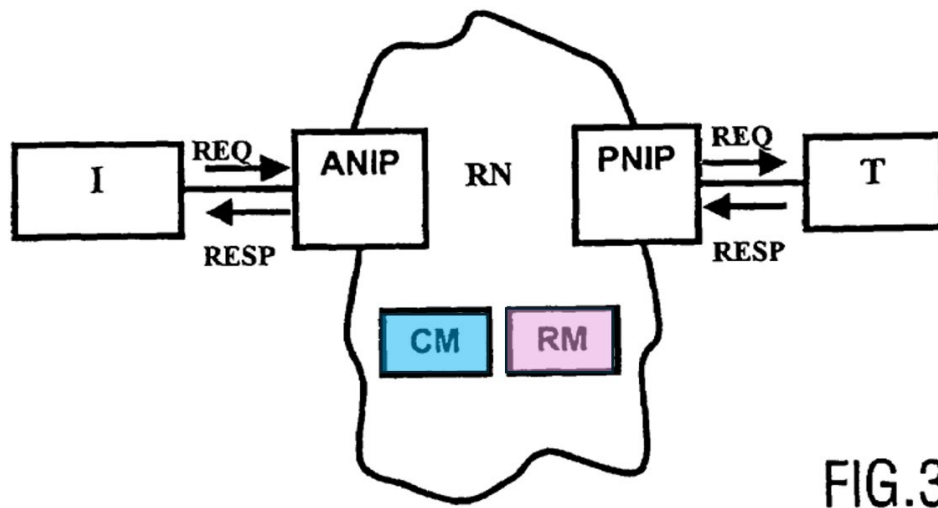


FIG.3

Ex. 1001 at FIG. 3 (annotated)

As shown in FIG. 3, the “CM” (i.e., the “communication manager,” depicted in blue) is separate and distinct from the “RM” (i.e., the “resource manager,” depicted in pink). The specification provides that “the communication manager CM and the resource manager RM are arranged in the router network RN, but they can also be arranged in one or some of the network interfaces NI.” Ex. 1001 at 10:3-6. Thus, a POSITA would understand that the communication manager and the resource manager may be in the network RN (as shown in FIG. 3 above) or within one of the network interfaces ANIP, PNIP. The ‘449 Patent does not contemplate that the communication manager may be arranged within the resource manager, nor would a POSITA understand that the communication manager could be arranged as such.

125. A POSITA would understand integrating the communication manager into the resource manager (or vis versa) is not contemplated by the ‘449 Patent. As

such, a POSITA would understand that the “communication manager” and “resource manager” are separate and distinct.

C. The Preamble of Claim 10

126. A POSITA would understand that the preamble of claim 10, reproduced below, is a limitation of the claim:

Method for exchanging messages in an integrated circuit comprising a plurality of modules, the messages between the modules being exchanged over connections via a network, wherein said connections comprises a set of communication channels each having a set of connection properties, any communication channel being independently configurable, wherein said connection through the network supports transactions comprising at least one of outgoing messages from the first module to the second module and return messages from the second module to the first module and further comprising the steps of:

Ex. 1001 at 19:21-31.

127. I understand that the preamble is often limiting if it provides the antecedent basis for terms in the body of the claim. The preamble of claim 10 does so here. For example, the preamble provides antecedent basis for the following terms: (1) “first module”; (2) “second module”; and (3) “sets of communication channels” recited in the body of claim 10.

128. The body of the claim (i.e., limitation [10.a]) recites “the first module issuing a request for a connection with the second module to a communication manager, wherein the request comprises desired connection properties associated with the sets of communication channels.” Ex. 1001 at 19:32-35. Limitation 10[a]

requires “the first module,” “the second module,” “sets of communication channels,” “connection,” and “connection properties,” which are defined and provided context in the preamble. Without the preamble describing that “connections comprises [sic] a set of communication channels each having a set of connection properties, any communication channel being independently configurable,” a POSITA would not understand what how communication channels relate to connections. Therefore, the preamble is necessary to bring life, vitality, and meaning to claim 10.

129. I also understand that Petitioner in the related district court litigation agreed that the preamble of claim 6 should be construed as limiting. Ex. 2040 at 12-13. I also understand that the same construction was adopted by the district court in the TI Litigation. Ex. 1035 at 19. There is no meaningful difference between the preambles of claims 6 and 10 such that a POSITA would understand that if the preamble of claim 6 is limiting, then the preamble of claim 10 is also limiting.

D. District Court Constructions

1. “connection properties” (claims 2, 6-7, 10, 13-14, 16)

130. In the Qualcomm Litigation, I understand that the parties agreed that “connection properties” should be construed as “properties of a connection, including ordering (data transport in order), flow control (a remote buffer is reserved

for a connection, and a data producer will be allowed to send data only when it is guaranteed that space is available for the produced data), throughput (a lower bound on throughput is guaranteed), latency (upper bound for latency is guaranteed), the lossiness (dropping of data), transmission termination, transaction completion, data correctness, priority, or data delivery.” Ex. 2040 at 13.

131. I understand that the same construction was adopted by the district court in the TI case. Ex. 1035 at 18.

132. None of my opinions would change if this claim construction for “connection properties” was expressly adopted by the Board.

2. “resource manager determining whether a target connection with the desired connection properties is available” (claims 2, 6, and 10)

133. I have applied the plain and ordinary meaning of the term “resource manager” in forming my opinions.

134. I understand that Petitioner and Patent Owner disagreed on the proper construction of this term in District Court and proposed the following claim constructions.

Term	Petitioner’s Proposed District Court Construction	Patent Owner’s Proposed Construction
resource manager determining whether a target connection with	“resource manager determining whether a connection with the desired properties is available to be opened and is not an arbiter	“Resource manager” means “circuit that manages network resources,” and the remaining language should be afforded

the desired connection properties is available	prioritizing which port of a switching device is to be utilized.”	their plain and ordinary meanings.
--	---	------------------------------------

Ex. 2040 at 23. My opinions would not change if either of these constructions was adopted by the Board.

3. “Integrated circuit” (claims 2, 6, 9-16)

135. In the Qualcomm Litigation, I understand that the parties agreed that “integrated circuit” should be construed as “interconnected circuitry on a chip.”

Ex. 2040 at 13.

136. I understand that the parties agreed to the same construction in the Samsung Litigation. Ex. 1036 at Appendix 1. I also understand that the TI Court construed “integrated circuit” as “a combination of interconnected circuit elements inseparably associated on or within a continuous substrate.” Ex. 1035 at 59.

137. None of my opinions would change if any of these claim constructions for “integrated circuit” were adopted by the Board.

4. “connection” (claims 2, 6, 9-16)

138. I am informed and understand that in the Qualcomm Litigation, the parties to that case proposed the following constructions for the term “connection.”

Ex. 2040 at 13.

Term	Qualcomm’s Construction	Patent Owner’s Construction
------	-------------------------	-----------------------------

“connection”	“one or more channels, each having a set of connection properties, between a first module and at least one second module, that are created before use and closed after use”	“one or more communication channels”
--------------	---	--------------------------------------

139. I understand that neither party is proposing a construction for the term “connection” in this proceeding. As such, I have applied the plain and ordinary meaning of this term to a POSITA at the time of the invention, considering the language of the claims, the specification, and prosecution history. However, if either of the parties’ district court construction were adopted by the Board in this proceeding, my opinions would not change.

5. “independently configurable” (claim 10)

140. In the Qualcomm Litigation, I understand that the parties agreed that “independently configurable” should be construed as “able to be configured with connection properties that do not depend on those of another configuration.” Ex. 1032 at 2.

141. I have been asked to apply this construction in my analysis in this Declaration.

IX. ANALYSIS OF THE OBVIOUSNESS GROUNDS

A. The Challenged Claims

142. I understand that Petitioner’s Grounds 1-2 challenge claims 2, 6, and 9-16 of the ’449 Patent. I further understand that claims 2, 6, and 10 are the primary claims at issue.

143. I understand that claim 2 incorporates the limitations of claim 1,
which recites:

- 1[pre] – Integrated circuit comprising
- 1[a] – a plurality of processing modules (M; I; S; T),
- 1[b] – network (N; RN), and
- 1[c] – at least one resource manager (RM) for managing resources of the network (N),
- 1[d] – wherein the modules, network and resource manager are disposed on a chip and arranged for providing at least one connection between a first and at least one second module,
- 1[e] – wherein the at least one connection comprises a set of communication channels each having a set of connection properties, the connection properties of the different communication channels of said connection being adjustable independently,
- 1[f] – wherein said connection supports transactions comprising at least one of outgoing messages from the first module to the second module and return messages from the second module to the first module,
- 1[g] – wherein the resource manager determines whether the at least one connection with said communication channels is available based on the connection properties being available.

144. I understand that claim 2 recites:

- 2 – Integrated circuit according to claim 1, further comprising: at least one communication manager (CM) for managing the communication between different modules.

145. I understand that claim 6 depends from claim 2 and incorporates the limitations of claim 2, including the limitations of claim 1 incorporated into claim

2. I understand that claim 6 recites:

- 6[pre] – Integrated circuit according to claim 2,
- 6[a] – wherein said first module (M; I) is adapted to issue a request (REQ) for a connection with at least one of said second modules to said communication manager (CM),
- 6[b] – said communication manager (CM) is adapted to forward said request (REQ) for a connection with communication channels each having a specific set of connection properties to said resource manager (RM),
- 6[c] – said resource manager (RM) responding with the availability of the requested connection to said communication manager (CM),
- 6[d] – wherein a connection between the first and second module is established based on the available properties of said communication channels of said connection.

146. I understand that independent claim 10 is a method claim with limitations comparable to claim 6. I understand that claim 10 recites:

- 10[pre.1] – Method for exchanging messages in an integrated circuit comprising a plurality of modules, the messages between the modules being exchanged over connections via a network,
- 10[pre.2] – wherein said connections comprises a set of communication channels each having a set of connection properties, any communication channel being independently configurable,
- 10[pre.3] – wherein said connection through the network supports transactions comprising at least one of outgoing messages from the first module to the second module and return messages from the second module to the first module and further comprising the steps of:
 - 10[a] – the first module issuing a request for a connection with the second module to a communication manager, wherein the request comprises desired connection properties associated with the sets of communication channels;
 - 10[b] – the communication manager forwarding the request to a resource manager;

- 10[c] – the resource manager determining whether a target connection with the desired connection properties is available;
- 10[d] – the resource manager responding with the availability of the target connection to the communication manager; and
- 10[e] – the target connection between the first and second module being established based on the available properties of said communication channels of said connection.

B. Petitioner’s Positions are Inconsistent and Unclear

147. Based on my review, Petitioner and Dr. Mowry appear to take inconsistent and/or unclear positions when mapping the teachings of the references to the ’449 Patent’s claim limitations. Specifically, Petitioner and Dr. Mowry appear to take inconsistent, or at least unclear, positions as to whether the claimed “first module” purportedly corresponds to Drake’s source station 10 or only the application 11 therein.

148. Certain portions of the Petition and Dr. Mowry’s declaration, for both Grounds 1-2, clearly rely on Drake’s source station for the claimed “first module,” including because those portions associate Drake’s source station with a starting/master IP in Goossens2002 or Goossens2003 for the claimed “first module” and assert that Drake sets up a connection between source and target stations. Pet., 26-27, 31-32, 43, 67; Ex. 1003 at, ¶¶97, 134, 198.

149. However, other portions of the Petition and Dr. Mowry’s declaration, for both Grounds 1-2, refer to “[the] application in [the] source station (i.e., first

module),” such that it is unclear as to whether the claimed “first module” is mapped to Drake’s source station or the application therein. Pet., 40-41 (including an annotated version of Drake’s Figure 1 that highlights application 11 specifically, not source station 10 as a whole), 59, 65-66; Ex. 1003 at ¶¶129-31, 177, 195.

C. Ground 1: Purported Obviousness over Goossens2002 in view of Drake (Claims 2, 6, 9-16)

150. I understand that in Ground 1, Petitioner and Dr. Mowry assert that claims 2, 6, and 9-16 of the ’449 Patent are obvious over Goossens2002 (Ex. 1005, “Goossens2002”) in view of Drake (Ex. 1006, “Drake”). Pet., 16-50; Ex. 1003 at ¶¶ 71-154. I disagree for at least the reasons provided below.

151. I understand that Petitioner and Dr. Mowry rely on Goossens2002 for the claimed “[i]ntegrated circuit comprising ... [a] network” and further rely on Goossens2002 or Drake for the claimed “set” of: “communication channels” with “connection properties ... being adjustable independently” (claim 2 via incorporation from claim 1) or “independently configurable” “communication channels” (claim 10). Pet., 21-23, 26-32, 45-46; Ex. 1003 at ¶¶84-86, 88-89, 99-110, 138-39.

152. Petitioner and Dr. Mowry recognize that Goossens2002, however, does not teach the claimed “communication manager” or “resource manager,” or

the related limitations, because they rely instead on Drake's QoS requestor manager 12 and QoS allocator 20 for those claim elements, respectively.¹ Pet., 24-26, 32-38, 40-44, 46-47; Ex. 1003 at ¶¶91-94, 113-22, 128-34, 141-45. I understand that Petitioner and Dr. Mowry allege that Drake's QoS requestor manager 12 and QoS allocator 20, including their relationship with Drake's source station 10 (alleged to correspond to Goossens2002's IP as the alleged "first module"), would have been incorporated into Goossens2002. Pet., 16-20, 32-38, 40-44, 46-47; Ex. 1003 at ¶¶71-82, 113-22, 128-134, 141-45.

153. The asserted combination of Goossens2002 and Drake does not render obvious claims 2, 6, and 9-16, including because (i) neither Goossens2002 nor Drake discloses the "independently configurable" or "independently adjustable"

¹ While Petitioner and Dr. Mowry suggest that Goossens2002's quality-of-service manager can constitute the "resource manager" for limitations 1[c]-[d], they rely solely on Drake's QoS allocator as the "resource manager" for limitation 1[g] and all other claims. Pet., 23-24 (limitation 1[c]), 26-27 (limitation 1[d]), 32-34 (limitation 1[g]), 41-43 (relying on Drake's QoS allocator as the "resource manager" for limitations 6[b]-[c]), 47 (relying on analysis of limitations 1[g] and 6[b]-[c] for limitations 10[b]-[d]); Ex. 1003 at ¶¶90, 95-96, 113-16, 131-33, 142-144.

limitations, (ii) Petitioner and Dr. Mowry do not show that a POSITA would have been motivated to combine Goossens2002 and Drake to arrive at the '449 Patent's claimed inventions regarding the "communication manager" and "resource manager" and a POSITA would not have been motivated to do so, and (ii) even if Goossens2002 and Drake are combined as Petitioner asserts, the alleged combination fails to render obvious the claim limitations regarding the "communication manager" and "resource manager."

1. Neither Goossens2002 Nor Drake Discloses "the connection properties of the different communication channels of said connection being adjustable independently" / "any communication channel being independently configurable" (Claims 2, 10)

154. *Goossens2002*—Dr. Mowry opines that Goossens2002 discloses that the connection properties of the different communication channels of said connection are "adjustable independently" because "the different channels described by Goossens2002 can have different connection properties." Ex. 1003 at ¶¶ 103, 139. I disagree.

155. Goossens2002 provides that the "Aethereal NOS intends to support both guaranteed and best-effort services." Ex. 1005 at 3. Goossens2002 also provides that "[a] channel implements a simplex point-to-point communication between two network interfaces (possibly with multiple paths)," and "[a] channel can have a combined throughput and latency guarantee (GT) or best effort (BE),

with an unspecified latency guarantee.” *Id.* Goossens2002 also provides that “[a] connection combines multiple channels.” *Id.* Nothing in Goossens2002 expressly discloses that one channel of a connection can be, for example, GT (i.e., a channel having combined throughput and latency guarantees) while the other channel in the connection could be best effort (i.e., a channel with an unspecified latency guarantee). A POSITA reviewing Goossens2002 would not assume that the channels of one connection are “independently configurable,” under the agreed upon construction in the Qualcomm Litigation. *See* Ex. 1032 at 2 (“able to be configured with connection properties that do not depend on those of another configuration.”).

156. **Drake**—Drake also fails to disclose channels of a connection being independently configurable at least because Drake fails to disclose multiple channels.

157. Dr. Mowry opines that Drake discloses “two different channels: one in the ‘forward direction,’ for communications from source station 10 to target station 29,’ and a second in the ‘backward direction,’ for communications ‘from the target station 29 to the source station 10.’” Ex. 1003 at ¶ 107 (citing Ex. 1006 at 5:30-50). I disagree. A POSITA would understand this passage to mean that Drake’s “forward direction” and “backward direction” are along the same communication channel. This understanding is supported by the use of the term

“forward” and “backward” direction because that signifies that there is one channel in which data is transmitted forwards (i.e., from source to target) and backwards (i.e., from target to source). A POSITA would not take this to mean that there are multiple channels – one channel in the forward direction and another in the backward direction. There would be no reason to call these channels forward/backward; instead, a POSITA would readily recognize that a two-channel connection has a request channel and a response channel. This is consistent with the ‘449 Patent’s disclosure.

158. Drake relates to Token Ring networks. *See* Ex. 1006 at 2:10-13, 4:20-23, 6:66-7:6. Token Ring networks are networks that employ duplex communication, either full duplex or half duplex. Ex. 2076 at 1; Ex. 2077 at 16. As I explained *supra*, § VI.A, the term “duplex” is a term of art that means that there is one channel in the connection. A “full duplex” channel is a channel that can send data in two directions simultaneously, while a “half duplex” channel is a channel that can send data in two directions at differing times (i.e., data is sent in one direction at a first time, and, once that data is fully sent, data can be sent in the opposite direction a second time). Because Drake relates to Token Ring networks, a POSITA would understand that Drake contemplates one channel, which is either a half-duplex or full-duplex channel.

159. Because Drake does not expressly or necessarily disclose two channels, it does not disclose “wherein said connections comprises a set of communication channels each having a set of connection properties, any communication channel being independently configurable” as recited in claim 10. The same is true for claim 2, which recites “the connection properties of the different communication channels of said connection being adjustable independently.” Drake does not expressly or necessarily disclose “a set of communication channels.” As a result, Drake does not expressly a set of channels being independently configurable.

2. A POSITA Would Not Have Combined Goossens2002 and Drake to Meet the Claim Limitations Regarding the “Communication Manager” and “Resource Manager”

160. Based on my review of the Petition, Dr. Mowry’s declaration, and evidence cited therein, a POSITA would not have been motivated to modify Goossens2002 based on Drake to arrive at the claimed inventions of the ’449 Patent. Petitioner and Dr. Mowry argue that select components and functions of Drake’s QoS management system would simply and generically be implemented in Goossens2002, without explanation as to specifically why and how those aspects of Drake’s QoS system would purportedly be incorporated into and work with Goossens2002 for each limitation of the claims.

161. A POSITA would not have combined Goossens2002 and Drake as alleged by Petitioner and Dr. Mowry. There is no motivation for Petitioner and Dr. Mowry's purported combination, including because of redundancy between the references and because the references teach away from the alleged combination, as discussed below.

a. Petition Section VII.A.1 and Mowry Section IX.A Intro

162. I understand that the Petition's Section VII.A.1 (Pet., 16-20, "Petition Section VII.A.1") and corresponding portion of Dr. Mowry's declaration (EX. 1003 AT ¶¶71-82, "Mowry Section IX.A Intro") purport to address motivation to combine Goossens2002 and Drake. For example, based on my review, I understand that Petition Section VII.A.1 and Mowry Section IX.A Intro contain the only express "motivat[ion]" alleged for Ground 1, except for a single mention for claim 2. Pet., 16-20, 38; EX. 1003 AT ¶¶71-82, 122.

163. Petition Section VII.A.1 merely asserts that a POSITA "would have been motivated to combine Goossens2002's disclosures with Drake's disclosures regarding a system for QoS management" and "would have looked to Drake's disclosure to implement a 'QoS requestor manager' to formulate requests for guaranteed services with particular properties and a 'QoS allocator' to determine whether the required network resources are available for the requested services."

Pet., 16-20; *see also* EX. 1003 AT ¶¶71-82 (similar). This fails to explain specifically *how* Drake's QoS system would purportedly be implemented in Goossens2002. For example, Petitioner and Dr. Mowry fail to explain how Drake's QoS requestor manager, QoS allocator, and their related processes would work with respect to any specific existing aspects of Goossens2002 (e.g., IP blocks, NOS components, and Goossens2002's existing service requests).

164. Petitioner and Dr. Mowry suggest that Drake's QoS system simply fills in missing details in Goossens2002, as (i) Petitioner acknowledges that Goossens2002 "does not provide specific details" regarding a "quality-of-service manager" mentioned just twice in Goossens2002 and (ii) Petitioner then proceeds to describe Drake's QoS system. Pet., 17-18; EX. 1003 AT ¶¶75-82 (similar); EX. 1005, 3.

165. The Petition and Dr. Mowry's declaration lack details of how the relied-upon parts of Drake's QoS system (e.g., QoS requestor manager and QoS allocator) would purportedly work with any aspects of Goossens2002 (e.g., IP blocks, NOS components, and Goossens2002's existing service requests) to meet the claim limitations. For example, I understand that the Petition asserts that "Drake provides additional details about ... a system that is consistent with and would have worked with the system of Goossens2002," but Petitioner and Dr. Mowry fail to elaborate on specifically *how* Drake's "additional details"

purportedly “would have worked with the system of Goossens2002.” Pet., 18-19; EX. 1003 AT ¶¶76-82 (similar). As another example, Petitioner and Dr. Mowry assert that the *single* QoS component in Goossens2002 (i.e., quality-of-service manager) would be substituted for *two* QoS components from Drake (i.e., QoS requestor manager and QoS allocator), but based on my review, Petitioner and Dr. Mowry present no explanation for why or how a POSITA can or would substitute Goossens2002’s single QoS component for two. Pet., 16-17; EX. 1003 AT ¶¶75-82.

166. For purposes of efficiency and because of resource and space constraints, a POSITA would not be motivated to modify Goossens2002 to include two QoS components, such as Drake’s QoS requestor manager and QoS allocator, when a single QoS component is sufficient, such as Goossens2002’s quality-of-service manager. A POSITA would need a reason for such modification, and based on my review, the Petition does not present a sufficient reason.

167. Mowry Section IX.A Intro does not explain why a POSITA would have been motivated to combine Drake’s QoS system with Goossens2002 to arrive at the inventions claimed in the ’449 Patent because, for example, it mentions Drake’s QoS requestor manager and QoS allocator each only twice, in paragraphs with no discussion of Goossens2002, and also it does not address the specific claim limitations of the ’449 Patent. Ex. 1003 at ¶¶72-82.

168. Further, regardless of Petitioner and Dr. Mowry’s showing, there was no motivation for the alleged combination because a POSITA would not, and could not, have implemented Drake’s QoS system with Goossens2002’s NOS. Drake emphasizes that its QoS management is specifically directed to local area networks (LANs). EX. 1006, Abstract (describing “[a] management system for [LANs]”), 1:6-11 (“Technical Field,” describing that “[t]his invention” relates to “[LANs]”), 1:13-2:21 (“Background of the Invention,” explaining that while “[e]merging high bandwidth, packet and cell based technologies and architectures ... anticipate th[e] requirement [of QoS management] and thus incorporate techniques to accomplish [QoS] management,” “[m]ost packet based [LANs] ... do not offer these sophisticated techniques for [QoS] management,” and therefore, “[i]t is extremely desirable to provide apparatus and a method to control multimedia data stream entry into a LAN” based on QoS requirements and availability), 2:25-3:29 (“Summary of the Invention,” describing the “present invention” as relating specifically to “LAN[s]”), Fig. 1 and 3:31-4:10 (showing that the Figures relate specifically to “LAN facilities”), 15:39-46 (showing that Drake is intended for “persons skilled in the LAN control and operation arts”), 15:47-18:51 (showing that each claim relates to a “[LAN]”).

169. Drake’s close tie to LAN networks is demonstrated by the fact that the components and processes that Petitioner relies upon in Drake—e.g., QoS

requestor manager 12 and QoS allocator 20—are associated with LAN-related components and processes. EX. 1006, 4:18-26 (describing “a [QoS] management system for [LANs] comprising a prior art [LAN] 17 comprising a plurality of stations 10, 29, ... , attached thereto,” and “[i]n accordance with the present invention, also attached to LAN 17 is a [QoS] allocator 20 which implements a [QoS] management process for LAN 17”), 4:32-47 (“Source station 10 also includes a QoS requestor manager 12 and a QoS protocol machine 13. Together, components 12 and 13 assemble a request to reserve a QoS connection Using a standard LAN transport protocol 15 to format a request packet, the packet is launched on LAN 17 through a medium access control (MAC) entity 16. LAN transport protocol 15 and MAC 16 are standard parts of all stations attached to a LAN”), 4:62-65 (“The QoS requestor manager 12 ... utilizes QoS protocol machine 13 to format the QoS request.”), 4:66-5:4 (“QoS allocator 20 is a station attached to LAN 17 which manages the QoS requests for the entire LAN 17. Like other stations, allocator station 20 includes a [MAC] entity 21 and a LAN transport protocol stack 22”).

170. Because Drake is specifically intended for and directed to LANs and a solution particularly tied to LANs, a POSITA would not have been motivated to modify Goossens2002, which does not contain a LAN, to incorporate Drake’s LAN-related QoS system.

171. I understand that the Board’s preliminarily finding in the Institution Decision states: “Petitioner establishes sufficiently that an ordinarily skilled artisan would have been motivated to combine Drake’s teachings with Goossens2002’s teachings in the way Petitioner proposes, i.e., ‘to create an SoC with improved performance and efficiency.’” *See* Pet. 15–19; Ex. 1003 at ¶¶ 33, 72–82. As Dr. Mowry explains, an ordinarily skilled artisan ‘would have understood that using Drake’s quality of service management process’ with Goossens2002’s NoC would improve the NoC’s performance and efficiency. Ex. 1003 at ¶ 79; *see id.* ¶ 81.” Paper 10 at 64. I disagree.

172. In the sections below, I further discuss the deficiencies in the Petition and Dr. Mowry’s declaration regarding alleged motivation to combine. As discussed below, these deficiencies include that the Petition and Dr. Mowry’s declaration fail to address motivation for the specific claim limitations and fail to explain specifically how Drake’s QoS process would work in Goossens2002, such as how Drake’s relied-upon components would function or be positioned relative to Goossens2002’s IP blocks and NoC components and existing service requests. Also, in the sections below, I further discuss why there was no motivation to combine, including because, as explained below for limitations 2 and 6[a], Drake’s QoS requestor manager (the alleged “communication manager”) is redundant of

Goossens2002's IP, and Goossens2002 also teaches away from incorporating Drake's QoS requestor manager.

b. Claim 2

173. *Limitation 1[c]*²—I understand that limitation 1[c] recites, in part, “at least one resource manager (RM).” I understand that Petitioner and Dr. Mowry rely on Drake's QoS allocator as the claimed “resource manager.” Pet., 24-26; Ex. 1003 at ¶¶91-94. Petitioner and Dr. Mowry do not establish motivation for this limitation. Based on my review, Petitioner's analysis of limitation 1[c] contains no independent analysis of motivation and instead merely refers to Petition Section VII.A.1, asserting: “For the reasons discussed above, a POSITA would have looked to Drake's disclosures regarding a QoS allocator for details regarding the implementation of Goossens2002's quality-of-service manager.” Pet., 26 (citing VII.A.1). Neither this assertion nor Petition Section VII.A.1 explains specifically how Drake's QoS allocator or its related processes would work with any existing aspects of Goossens2002. The same is true in Dr. Mowry's declaration. Ex. 1003 at

² I understand that claim 1 has been statutorily disclaimed by Patent Owner and is no longer at issue in this proceeding. My analysis of limitations 1[c] and 1[g] in this section relates to claim 2, as I understand that claim 2 is dependent from claim 1 and thus incorporates all limitations of claim 1.

¶¶90-94 (containing only separate discussions of Goossens2002 and Drake, and a conclusory assertion of motivation in ¶94 that cites only “Section IX.A,” which I discuss above).

174. **Limitation 1[g]**—I understand that limitation 1[g] relates to the claimed “resource manager” and its capabilities. I understand that Petitioner and Dr. Mowry rely on Drake’s QoS allocator as the claimed “resource manager.” Pet., 32-34; Ex. 1003 at ¶¶113-16. Petitioner and Dr. Mowry do not establish motivation for this limitation. Based on my review, Petitioner’s analysis of limitation 1[g] describes the functionality of Drake’s QoS allocator but contains no discussion of motivation, much less establish why a POSITA would have been motivated to include those functionalities in Goossens2002 or how those functionalities would have worked with existing aspects of Goossens2002. Pet., 32-34. For example, based on my review, Petitioner discusses Drake’s QoS allocator receiving requests for connections but does not explain where such requests would purportedly come from in the alleged combination (e.g., Goossens2002’s IP or somewhere else). Pet., 32-34. Dr. Mowry’s declaration is similarly insufficient. Ex. 1003 at ¶¶ 113-16 (containing no citations to Goossens2002 or discussion of its teachings).

175. **Claim 2**—I understand that claim 2 recites “at least one communication manager (CM) for managing the communication between different modules.” I also understand that Petitioner and Dr. Mowry rely on Drake’s QoS

requestor manager 12 as the claimed “communication manager.” Pet., 35-38, 17; Ex. 1003 at ¶¶117-22.³

176. The Petition and Dr. Mowry’s declaration do not present any motivation for why a POSITA at the time would have or could have implemented Drake’s QoS requestor manager in Goossens2002. Pet., 35-38; Ex. 1003 at ¶¶117-22. Based on my review, the Petition’s only alleged motivation for incorporating Drake’s QoS requestor manager into Goossens2002 states: “For the reasons discussed above, a POSITA would have looked to Drake’s disclosures regarding a QoS requestor manager to obtain the benefits of Drake’s known solution to ensuring the availability of network resources for guaranteed services” Pet., 35-38 (citing Petition Section VII.A.1). However, neither this statement nor Petition Section VII.A.1 explains why Drake’s QoS requestor manager is needed in Goossens2002 or how it would work with any specific aspects of Goossens2002. Indeed, I understand that Petitioner’s claim 2 analysis contains zero cites to Goossens2002, and Petition Section VII.A.1 only mentions Drake’s QoS requestor

³ I understand that Petitioner does not rely on Drake’s QoS requestor manager 23 for the claimed “communication manager.” Paper 10 at 55-56 (finding that Petitioner relies on only QoS requestor manager 12, not QoS requestor manager 23); Pet., 37 n.7 (admitting the same).

manager once. *See* Pet., 35-38, 16-20. Dr. Mowry’s declaration is similarly insufficient. Ex. 1003 at ¶¶117-22 (containing no citations to Goossens2002 and only a conclusory assertion of motivation, which cites only the “background of the technology section” (“Section V.A”)).

177. A POSITA would not have been motivated to incorporate Drake’s QoS requestor manager into Goossens2002 because the QoS requestor manager’s function is redundant of Goossens2002’s IP block. That is, Drake’s QoS requestor manager and Goossens2002’s IP block perform similar functions. I understand that Petitioner and Dr. Mowry assert that Drake’s QoS requestor manager is for requesting a QoS connection: “the QoS requestor managers manage communications ... by ‘assembl[ing] a request to reserve a QoS connection.’” Pet., 35; *see also* Ex. 1003 at ¶118 (same). However, a POSITA would have understood that Goossens2002’s IP block already does this, as Petitioner and Dr. Mowry recognize: “Goossens2002 describes that its IPs ... ‘can set up and remove connections’” and “the IPs do so by making a ‘service request’ that includes information regarding the performance requirements of the connection.” Pet., 40; *see also* Ex. 1003 at ¶128. That is, a POSITA would have understood that both Drake’s QoS requestor manager and Goossens2002’s IP block purportedly make a request for a connection with sufficient properties. EX. 1006, 4:32-37; EX. 1005, 2-3; Pet., 35, 40; Ex. 1003 at ¶¶118, 128.

178. While Petitioner and Dr. Mowry assert that Drake's QoS requestor manager communicates with the alleged "resource manager" (i.e., Drake's QoS allocator, purportedly corresponding to Goossens2002's quality-of-service manager), a POSITA would have understood that this could just be done by Goossens2002's IP block—i.e., Goossens2002's IP block could communicate with the alleged "resource manager." *See* Pet., 35-36, 41-42 (regarding Drake's QoS requestor manager preparing a request sent to the QoS allocator), 23-24, 26, 32 (associating Drake's QoS allocator with Goossens2002's quality-of-service manager), 40-41 (asserting that Goossens2002's IP sends a request similar to the request sent to Drake's QoS allocator); Ex. 1003 at ¶¶118, 131, 90-91, 94-96, 128-30. Thus, a POSITA would have understood that Goossens2002's IP can generate a connection request and send it to the alleged "resource manager" without needing Drake's QoS requestor manager, so adding Drake's QoS requestor manager in Goossens2002 would be redundant and unnecessary.

179. Goossens2002 teaches away from incorporating Drake's QoS requestor manager. A POSITA would have understood that in Drake, QoS requestor manager 12 (the alleged "communication manager") is intentionally *within* source station 10. EX. 1006, Fig. 1, 4:32-47, 4:62-65; Pet., 35 (admitting that "QoS requestor managers [are] associated with source stations"); Ex. 1003 at ¶118 (same). This is further demonstrated by the fact that Drake refers to source

station 10 as the “requestor station 10.” EX. 1006, 14:17. This is also demonstrated by the fact that Drake’s QoS system, including QoS requestor manager 12, is not implemented within “prior art [LAN] 17” but rather in components such as source station 10 attached to that “prior art” network. EX. 1006, 4:18-26, 4:32-47, 4:62-66, Fig. 1.

180. Drake does not suggest that QoS requestor manager 12 can be *outside* of the source station. In fact, a POSITA would have understood that Drake’s QoS requestor manager 12 is a software running on source station 10 and is thus inseparably connected and coupled to the source station, such that QoS requestor manager 12 could not be outside of the source station. However, Drake’s source station 10 corresponds to Goossens2002’s IP block,⁴ and a POSITA would have

⁴ Although Petitioner and Dr. Mowry present unclear and/or inconsistent positions regarding the alleged “first module” in Drake (*supra* § IX.B), for this section (i.e., § IX.C.2), I assume that Petitioner and Dr. Mowry associate Drake’s source station 10 with Goossens2002’s IP block for the claimed “first module,” based on portions of the Petition and Dr. Mowry’s declaration clearly adopting that position and based on my understanding that the Board made an initial finding to that effect. Pet., 26-27, 31-32, 43, 47; Ex. 1003 at ¶¶97, 134; IPR2024-01081, Paper 14 at 23-24; *see also* Pet., 40, 46-47. Indeed, if a POSITA was motivated to combine

understood that Goossens2002 emphasizes that its IP should **not** contain communication components like Drake's QoS requestor manager. EX. 1005, 1 ("Finally, and most importantly, decoupling of computation (IPs) and communication (NOS) enables compositional layout and timing closure. IPs communicate only using the network so that their layout and timing closure are independent of other IPs."), 2 ("For a given user function, computation is mapped to functional IPs ... and communication to the NOS."), 1 ("We believe in the [IP] re-use model."). That is, a POSITA would have understood that the QoS requestor manager is specifically included within Drake's source station that corresponds to Goossens2002's IP, but Goossens2002 would have dissuaded the POSITA from likewise including that QoS requestor manager within Goossens2002's IP, as Goossens2002 is premised on the IP re-use model and the goal of decoupling IPs from communication components such as Drake's QoS requestor manager. Thus, Goossens2002 teaches away from incorporating Drake's QoS requestor manager.

181. Moreover, implementing Drake's QoS requestor manager outside of Drake's source station or the corresponding IP block in Goossens2002 would

Goossens2002 and Drake (although they would not be, as I explain herein), then the POSITA would have understood Goossens2002's IP to correspond to Drake's source station 10, not application 11 therein.

constitute a modification of Drake's teachings, and based on my review, Petitioner and Dr. Mowry present no alleged motivation for such modification. Also, implementing a communication component such as Drake's QoS requestor manager within Goossens2002's IP block would be a modification or destruction of Goossens2002's premise of decoupling or excluding such communication components from Goossens2002's IPs for purposes of IP re-use, and based on my review, Petitioner and Dr. Mowry present no alleged motivation for such modification.

182. I understand that the Institution Decision's preliminary analysis of motivation found that Petitioner's "proposed modification" does not "modify[] Goossens2002's IP block to include Drake's requestor manager 12" because "Petitioner proposes implementing Drake's QoS management process in [Goossens2002's] NOS, not modifying an IP block." Paper 10 at 66 (citing Samsung Pet., 15-19, corresponding to Pet., 16-20, and also citing Ex. 1003 at ¶¶33, 72-82). I disagree with that assessment of Petitioner and Dr. Mowry's proposed modification. Based on my review of the portions of the Petition and Dr. Mowry's declaration that the Board cites, Petitioner and Dr. Mowry do not assert that the alleged combination would implement Drake's QoS system, and particularly its QoS requestor manager, only in Goossens2002's NOS or that the alleged combination would not modify an IP block in Goossens2002. For example,

based on my review, Petitioner merely asserts that a POSITA “would have been motivated to combine Goossens2002’s disclosures with Drake’s disclosures regarding a system for QoS management” and “would have looked to Drake’s disclosure to implement a ‘QoS requestor manager’ ... and a ‘QoS allocator’” Pet., 16-17. Similarly, Dr. Mowry merely asserts that a POSITA “would have been particularly interested in Drake’s disclosure of a ‘QoS requestor manager’ to formulate requests for guaranteed services with particular properties” *See* Ex. 1003 at ¶¶ 76-79. This fails to address if or how Goossens2002’s IP blocks and/or NOS would purportedly be modified to implement Drake’s QoS system, particularly the QoS requestor manager.

183. In fact, based on my review, the entirety of the Petition and Dr. Mowry’s declaration are ambiguous and unclear as to specifically how the relied-upon components and functions of Drake’s QoS system, particularly the QoS requestor manager, would purportedly work with Goossens2002’s IP blocks and NOS. Indeed, Dr. Mowry’s declaration never specifies where Drake’s QoS requestor manager would be implemented in Goossens2002 (e.g., IP, NOC, or elsewhere). Without such explanation, Petitioner and Dr. Mowry do not sufficiently establish that a POSITA would have been motivated to combine the two references.

184. As noted above, I understand that the Institution Decision interpreted Petitioner's modification as implementing Drake's QoS process (including its QoS requestor manager) only in Goossens2002's NOS, without modifying Goossens2002's IP, but this ignores and goes against Drake's teachings, Petitioner and Dr. Mowry's positions, and the understanding of a POSITA. As I discussed above, a POSITA would have understood that Drake's QoS requestor manager 12 is purposefully *within* source station 10, not the "prior art" network to which source station 10 is attached. EX. 1006, Fig. 1, 4:18-26, 4:32-47, 4:62-65; Pet., 35; Ex. 1003 at ¶118. Based on my review, Petitioner and Dr. Mowry do not argue that a POSITA would modify this teaching of Drake when purportedly implementing Drake's QoS system in Goossens2002, and they also does not argue motivation for such a modification. Also, based on my review and understanding, Petitioner and Dr. Mowry associate Drake's source station with Goossens2002's IP (*supra* § IX.C.2,n.4), so if a POSITA was motivated to implement Drake's QoS requestor manager in Goossens2002 (although, they would not be), then based on Petitioner and Dr. Mowry's position, the POSITA would implement Drake's QoS requestor manager in Goossens2002's IP, not in Goossens2002's NOS. Moreover, as explained above, a POSITA would not actually be motivated to implement Drake's QoS requestor manager in Goossens2002's IP because Goossens2002 teaches

away from its IP containing such a communication component. Ex. 1005, 1-2 (regarding “decoupling” computation and communication, and IP “re-use”).

185. I understand that Petitioner and Dr. Mowry further assert that “a POSITA would have been motivated to ... implement[] ... Drake’s QoS requestor manager as a circuit on the same integrated circuit chip as Goossens2002’s IP blocks and NOS,” which I understand is intended to address claim 2’s limitation that the “communication manager” is comprised by the claimed “[i]ntegrated circuit.” Pet., 38; Ex. 1003 at ¶122 (same). First, however, this assertion is still unclear as to specifically how Drake’s QoS requestor manager would purportedly be implemented in Goossens2002—e.g., whether the QoS requestor manager would purportedly be implemented in an IP, the NOS, or somewhere else, and if somewhere else, how it would connect to and function with the IP or NOS. Second, I understand this assertion to suggest that Drake’s QoS requestor manager would not be implemented within Goossens2002’s IP, which, as explained above, goes against Drake’s teachings, Petitioner and Dr. Mowry’s other positions, and the understanding of a POSITA. EX. 1006, Fig. 1, 4:18-26, 4:32-47, 4:62-65; *supra* § IX.C.2,n.4. Also, to the extent that Petitioner and Dr. Mowry suggest implementing Drake’s QoS requestor manager *outside* of Goossens2002’s IP, this would be a modification of Drake’s teaching that QoS requestor manager 12 is *within* the source station 10 that corresponds to Goossens2002’s IP (*see* EX. 1006,

Fig. 1, 4:32-36, 4:62-65; Pet., 35; *supra* § IX.C.2,n.4), and based on my review, Petitioner and Dr. Mowry provide no explanation or motivation for such modification. Pet., 38; Ex. 1003 at ¶122. Third, I understand this assertion to also suggest that Drake's QoS requestor manager would not be implemented in Goossens2002's NOS, which I understand goes against the Board's preliminary finding discussed above. Paper 10 at 66 (finding that "Petitioner proposes implementing Drake's QoS management process in the NOS).

186. I understand that Dr. Mowry stated during his deposition that Drake's QoS requestor manager could go anywhere on Goossens2002's chip as long as the QoS requestor manager is attached or connected to the NOS.

187. However, a POSITA would not have implemented Drake's QoS requestor anywhere on Goossens2002's chip. **First**, a POSITA would not have implemented Drake's QoS requestor manager in either Goossens2002's IP or NOS, as Goossens2002 and Drake teach completely opposite solutions. Drake is premised on its QoS components being implemented in stations attached to prior art networks, where the network stays the same, whereas Goossens2002 is premised on implementing such communication components within the network, so that the IPs stay the same. EX. 1006, Abstract ("management system is attached to the network"), Fig. 1, 4:18-26, 4:32-47, 4:62-67, 14:17; EX. 1005, 1 ("decoupling of computation (IPs) and communication (NOS)"), 2 (mapping

“communication to the NOS”), 1-3 (“[IP] re-use”). Thus, as discussed above, Goossens2002 teaches away from incorporating Drake’s QoS requestor manager within Goossens2002’s IP, but on the other hand, Drake’s QoS requestor manager would also not be incorporated within Goossens2002’s NOS because that would go against Drake’s teachings and require modifications of Drake that Dr. Mowry does not discuss.

188. ***Second***, a POSITA also would not have implemented Drake’s QoS requestor manager anywhere on Goossens2002’s chip other than in the IPs and NOS. To note, a POSITA would have understood Goossens2002’s network interfaces to be at least partially within the NOS. For example, a POSITA would have understood that Goossens2002’s chip, with its on-chip network, would be subject to several constraints, including physical, size, cost, and resource constraints, and that implementing a communication component outside of the IPs and NOS would require space and resources and would introduce issues regarding complexity, efficiency, component count, manufacturing cost, and technical and other issues that arise when adding such peripheral and intermediary components, including protocols and resources necessary for such communication component to interface and communicate with the network. *See, e.g.*, ’449 Patent, 1:50-2:46. Implementing the QoS requestor manager on Goossens2002’s chip would have required integrated the QoS requestor manager as a separate circuit attached to the

network with its own network interface, similar to how an IP has its own network interface. This would result in additional testing, integration, and verification costs, thereby negatively impacting the expected rapid design time to market requirement. It would also introduce additional latency each time an IP block needed to communicate with it.

189. Moreover, a POSITA according to Petitioner and Dr. Mowry's proposed definition of a POSITA, with that relatively low level of skill in the art (e.g., "a Bachelor's degree in computer science ... and two ... years of experience with ... networking technologies"), would not have been capable of implementing Drake's QoS requestor manager on Goossens2002's chip (if at all) somewhere outside of both the IPs and NOS. Pet., 15; Ex. 1003 at ¶61; *infra* § IX.C.2.e.

190. In summary, it is my opinion that Petitioner and Dr. Mowry fail to adequately explain specifically why or how Goossens2002 would be modified to incorporate Drake's QoS requestor manager, and further, there is no motivation for this proposed modification, including because a POSITA would have understood that this proposed modification is redundant and is taught away from by Goossens2002.

c. Claim 6

191. ***Claim 6 (generally)***—Petitioner and Dr. Mowry fail to establish the requisite motivation for claim 6 because in both the Petition and Dr. Mowry's

declaration, the entire analysis for claim 6 contains no references or cites to Petition Section VII.A.1 or Mowry Section IX.A Intro, respectively, and contains only two cites to Goossens2002—both for 6[a] and neither for explaining why or how Goossens2002 would be modified or work with Drake’s teachings. *See* Pet., 39-44; Ex. 1003 at ¶¶127-34. Petitioner and Dr. Mowry’s limited claim 6 analysis does not explain specifically why or how Goossens2002 would incorporate or work with Drake’s teachings.

192. ***Limitation 6[a]***—I understand that limitation 6[a] recites that “said first module” issues a “request (REQ) for a connection” to “said communication manager.” I understand that Petitioner and Dr. Mowry rely on Goossens2002’s IP and Drake’s source station 10 for the claimed “first module,” rely on the requests issued from Goossens2002’s IP and Drake’s application in source station 10 for the claimed “request,” and rely on Drake’s QoS requestor manager 12 as the claimed “communication manager.” Pet., 40-41; Ex. 1003 at ¶¶128-30; *supra* § IX.C.2,n.4. Based on my review, however, the Petition contains zero discussion for why or how Goossens2002 and Drake would purportedly be combined for limitation 6[a], and it thus fails to explain a motivation to combine. *See* Pet., 40-41. Dr. Mowry’s declaration is similarly insufficient. Ex. 1003 at ¶¶128-30 (mentioning Drake’s QoS requestor manager (alleged “communication manager”) only in ¶130, which contains no discussion of Goossens2002 or alleged motivation).

193. Also, as explained above for claim 2, there is no need for Drake’s QoS requestor manager in Goossens2002. For limitation 6[a], I understand that Petitioner and Dr. Mowry assert that both Goossens2002 and Drake “[s]imilarly” describe an alleged first module that requests a connection—i.e., Goossens2002’s IP makes a “service request” to set up a connection and an application in Drake’s source station similarly “requests a ... connection.” Pet., 40; Ex. 1003 at ¶¶128-29. I understand that Petitioner and Dr. Mowry then assert, however, that “Drake *further* describes that the application in the source station ... communicates this request *to a QoS requestor manager ... for subsequent transmission to a QoS allocator.*” Pet., 41 (emphasis added); *see also* Ex. 1003 at ¶130 (similar). Based on my review, Petitioner and Dr. Mowry provide no motivation for incorporating this “further” step into Goossens2002—i.e., to modify Goossens2002 such that its IP issues a request to a QoS requestor manager for subsequent transmission. Pet., 41; Ex. 1003 at ¶130.

194. There was no such motivation for incorporating this “further” step into Goossens2002 because if Drake’s QoS allocator was implemented in Goossens2002 as Petitioner and Dr. Mowry allege, then a POSITA considering the combination would have understood that Goossens2002’s IP would just send its request directly to the QoS allocator, not “to a QoS requestor manager ... for subsequent transmission to [the] QoS allocator” as Petitioner and Dr. Mowry

assert. Pet., 41; Ex. 1003 at ¶130 (same). A POSITA would have understood that it would have been redundant and unnecessary for a request issued by Goossens2002's IP to be sent to and issued *again* by a QoS requestor manager. Thus, there was no motivation for Goossens2002's IP to issue its request *to a QoS requestor manager* (the alleged "communication manager") for limitation 6[a], and based on my review, Petitioner and Dr. Mowry fail to establish otherwise.

195. Moreover, because limitation 6[a] recites that the "first module" issues a "request" to the "communication manager," this implicates the issues I discuss above for claim 2 regarding where and how Drake's QoS requestor manager is purportedly implemented in Goossens2002. As explained for claim 2: (i) based on my review, Petitioner and Dr. Mowry fail to sufficiently explain how Drake's QoS requestor manager is implemented in Goossens2002 (e.g., in Goossens2002's IP, NOS, or elsewhere); (ii) to the extent that Drake's QoS requestor manager would have purportedly been implemented in Goossens2002's IP, Goossens2002 teaches away from such modification; and (iii) to the extent that Drake's QoS requestor manager would have purportedly been implemented outside of Goossens2002's IP that Petitioner and Dr. Mowry associate with Drake's source station (*supra* § IX.C.2,n.4), such as instead in Goossens2002's NOS, then based on my review, neither this modification of Drake's teachings nor any motivation therefor is argued by Petitioner and Dr. Mowry and this modification goes against

the teachings of Drake, Petitioner and Dr. Mowry's positions, and the understanding of a POSITA.

196. **Limitation 6[b]-[d]**—I understand that limitations 6[b]-[d] recite, in part, that “said communication manager (CM) is adapted to forward said request (REQ) ... to said resource manager (RM),” and “said resource manager (RM) responding ... to said communication manager (CM)” “with the availability of the requested connection,” “wherein a connection between the first and second module is established based on the available properties.” I understand that Petitioner and Dr. Mowry rely on Drake's teachings for limitation 6[b]-[d], asserting that Drake's QoS requestor manager (alleged “communication manager”) sends a QoS request (alleged “request”) to the QoS allocator (alleged “resource manager”), the QoS allocator then sends a QoS allocation reply (alleged “respon[se]”), and a connection is established between source and target stations (alleged “first and second module”). Pet., 41-44; Ex. 1003 at ¶¶131-34.

197. Petitioner and Dr. Mowry fail to establish motivation for limitations 6[b]-[d] because their analysis of limitations 6[b]-[d] contains no discussion or citation of Goossens2002, much less an explanation for why and how Goossens2002 would be modified to include the relied-upon teachings of Drake. Pet., 41-44; Ex. 1003 at ¶¶131-34. For example, for limitation 6[b], Petitioner and Dr. Mowry do not establish motivation for why Goossens2002 would have been

modified to include Drake's QoS requestor manager to forward a request to the alleged "resource manager" (i.e., Drake's QoS allocator, purportedly corresponding to Goossens2002's quality-of-service manager), as opposed to Goossens2002's IP block just sending the request directly to the alleged "resource manager," which a POSITA would have understood could be done and would have been more direct and efficient. Pet., 41-42; Ex. 1003 at ¶¶131-32; *see also* Pet., 40 (acknowledging that Goossens2002's IP makes a service request similar to Drake's QoS request); Ex. 1003 at ¶¶128-30 (same). Also, for limitation 6[c], Petitioner and Dr. Mowry do not establish motivation for why Goossens2002 would have been modified such that the alleged "resource manager" sends a response about availability to a QoS requestor manager purportedly incorporated from Drake, as opposed to the alleged "resource manager" sending this response to Goossens2002's IP block that made the request, which a POSITA would have understood could be done and would be more direct and efficient. Pet., 42-43; Ex. 1003 at ¶133. Based on my review, Petitioner and Dr. Mowry's 6[c] analysis does not even mention Drake's QoS requestor manager (alleged "communication manager"), much less that Drake's QoS allocator sends a response to the QoS requestor manager. Pet., 42-43; Ex. 1003 at ¶133.

198. There was no motivation for such modifications for limitations 6[b]-[c] because if a POSITA was looking to implement Drake's QoS system in

Goossens2002 (although, they would not be), then the POSITA would have understood that the alleged “resource manager” (i.e., Drake’s QoS allocator) would have received the request directly from, and provided its response to, Goossens2002’s IP, not a QoS requestor manager. EX. 1006, 4:50-52 (“[QoS] allocator 20 ... receive[s] the QoS request from [source] station 10”), 11:22-38, 14:22-27 (teaching that QoS allocator 20 sends the response to source station 10); *supra* § IX.C.2,n.4 (explaining that Petitioner associates Drake’s source station 10 with Goossens2002’s IP); Pet., 34 (admitting that “a requesting module”—like Goossens2002’s IP—“sends a request to [Drake’s] [QoS] allocator 26”); Ex. 1003 at ¶115 (same). A POSITA would have understood that such direct communication between the alleged “resource manager” (i.e., Drake’s QoS allocator) and Goossens2002’s IP is actually comparable to communication between Drake’s QoS allocator and source station 10. Also, a POSITA would have understood that such direct communication between the alleged “resource manager” (i.e., Drake’s QoS allocator) and Goossens2002’s IP is advantageous, for example, for purposes of timing, efficiency, and conservation of resources.

199. Additionally, as discussed above, Dr. Mowry’s declaration is insufficient for establishing motivation for limitations 6[b]-[d]. Ex. 1003 at ¶¶131-32 (containing no discussion or citations of Goossens2002 and no alleged motivation), 133 (containing no mention of Drake’s QoS requestor manager

(alleged “communication manager”), much less asserting that the alleged “resource manager” sends a response to the QoS requestor manager per limitation 6[c], and containing no discussion or citations of Goossens2002 and no alleged motivation), 134 (containing no discussion or citations of Goossens2002 and no alleged motivation).

d. Claim 10

200. I understand that Petitioner and Dr. Mowry rely on their analysis of limitations 6[a], 6[b], 1[g], 6[c], and 6[d] for limitations 10[a], 10[b], 10[c], 10[d], and 10[e], respectively. Pet., 46-47; Ex. 1003 at ¶¶141-45. Thus, Petitioner and Dr. Mowry fail to establish motivation for those limitations of claim 10 for the same reasons explained above with respect to limitation 1[g], claim 2, claim 6, and Petition Section VII.A.1 and Mowry Section IX.A Intro. Also, I understand that limitation 10[a] contains claim 10’s first recitation of a “communication manager.” Thus, Petitioner and Dr. Mowry fail to establish motivation for limitation 10[] for the same reasons explained above with respect to claim 2. Also, I understand that limitation 10[b] contains claim 10’s first recitation of a “resource manager.” Thus, Petitioner and Dr. Mowry fail to establish motivation for limitation 10[b] for the same reasons explained above with respect to limitation 1[c].

e. A POSITA Would Have No Expectation of Success In Making the Proposed Combination

201. Even if a POSITA would be motivated to make Dr. Mowry's proposed combination (which it would not for the reasons provided above, *supra* § IX.C.2), a POSITA would have had no expectation of success in making the proposed combination. This is especially true where the relevant POSITA in this proceeding is an individual without any specific knowledge regarding the design of a SoC. Below, I reproduce Dr. Mowry's proposed level of skill for this proceeding, and I show why this POSITA would have had no expectation of successfully implementing Drake's LAN-based architecture into a NoC, such as the NoC disclosed in Goossens2002.

202. Dr. Mowry proposed that a POSITA is an individual with: "at least a Bachelor's degree in computer science, electrical engineering, computer engineering, or an equivalent degree, and two or more years of experience with system-on-chip [SoC], interconnect, or networking technologies." Ex. 1003 at ¶ 32. I note that the hypothetical POSITA must have had this level of skill (or greater) in the by October 2003, which is the priority date of the '449 Patent. Ex. 1003 at ¶ 4. Therefore, according to Dr. Mowry, a POSITA would be an individual with, for example, a computer science degree and two years of general experience in networking technologies by October 2003. Such an individual would have no

expectation or likelihood of successfully incorporating Drake's LAN-related components into a NoC. A person with merely a computer science degree that has two years of general experience with "networking technologies" is unlikely to have ever even seen a NoC.

203. Even a hypothetical POSITA having a degree in electrical or computer engineering with two years of general experience in networking technologies would not have had a reasonable expectation or likelihood of success in combining LAN-related architectures to a NoC. An electrical or computer engineering student would have learned about the following topics in the 2003 timeframe.

- Layered OSI and TCP/IP models;
- Error detection and correction techniques;
- Routing protocol, IP addressing;
- Various topics from all seven OSI layers (i.e., network layer, transport layer, etc.);
- Network security;
- Ethernet and LAN; and
- Early Wi-Fi protocols (e.g., 802.11b)

Network-on-chip technology was not included as a subtopic, let alone a main topic, in October 2003 for electrical or computer engineering undergraduate students.

Even VLSI design or computer architecture courses were not covering network-on-chip design or architecture in October 2003. I know this to be true because I personally taught computer architecture and VLSI design in 2003 at the University of California at Irvine.

204. That undergraduate students were not learning about NoCs in October 2003 makes sense given the relevant timeframe. For example, the concept of a NoC, i.e., the concept behind creating a more general on-chip interconnect that routes packets from sources to destinations as opposed to directly wiring the source and destination together via dedicated hardware FIFO buffers and wires, “was described in the influential paper by Bill Dally and Brian Towles,” in June 2001. Ex. 1003 at ¶ 32. By October 2003, NoCs had not even begun to replace busses as the desired interconnect for SoCs. In other words, if the Dally paper (Ex. 1029), published in June of 2001, was the seminal work that first mentioned the concept of a NoC, then NoC was not a topic that would have been covered in electrical or computer engineering classes in October 2003.

205. Without specific education and work experience in NoC technology, a person with merely an undergraduate degree in electrical or computer engineering and two years of general experience in networking technologies would not have possessed the requisite skill to implement Drake’s teachings into the NoC disclosed in Goossens2002. For example, Dr. Mowry’s POSITA would not have

the requisite skill to implement Drake's QoS requestor manager 12 (a LAN-based component located in a computer) onto a SoC, such as the SoC described in Goossens2002. Similarly, this hypothetical POSITA would not have the requisite skill to implement Drake's QoS allocator 20 (a LAN-based component connected to the LAN) onto a SoC, such as the SoC described in Goossens2002. This is because NoC architecture is not equivalent to general network architecture. Designing and implementing a NoC has to do with VLSI design (or SoC design), and a person would have to have a thorough understanding of the constraints that exist when a SoC with hundreds of modules is being implemented on a two-dimensional grid. Notwithstanding the fact that Dr. Mowry's proposed POSITA would have had troubles working around the design constraints, the hypothetical POSITA would have faced additional difficulties in introducing a rather new form of interconnect (i.e., a NoC) in place of the existing form of interconnect (i.e., a bus).

206. Moreover, Drake teaches that it would be complex to implement QoS in the network. *See* Ex. 1006 at 2:57-3:3. It would be even more complex to implement Drake's QoS requestor manager 12 or QoS allocator 20 (i.e., LAN-based components connected to, but not within, a LAN) into a NoC, for the reasons described above.

207. Even a person with a thorough understanding of the OSI model would not have had an expectation or likelihood of success in making the proposed combination. This is because, as taught by Goossens2002 and the '449 Patent, full implementation of the OSI model is disfavored in NoCs. Instead, both references prefer a varied version of the OSI model. This is because of the overhead cost of having a full off-chip OSI model outweighs the benefits of utilizing NoCs with short wires and a parallel path for communication between network nodes. *See e.g.*, Ex. 1001 at 2:16-43; *supra* § VI.A.

208. Moreover, the design of the SoC is exactly the problem faced with Dr. Mowry's proposed combination. For example, to make Dr. Mowry's proposed combination, a POSITA would have to understand how to take at least Drake's QoS requestor manager 12 and QoS allocator 20 (both of which are specifically designed to be used with a LAN), integrate their functionalities on a miniscule piece of hardware, and arrange them within a network or within the network interfaces of Goossens2002's SoC. A person with two years of general experience in networking technologies is incapable of successfully making this proposed combination. Drake offers no guidance on how to implement its components in an integrated circuit because Drake was focused on managing resources of a LAN, such as IBM's token ring network. As such, there is explicit teaching in Drake that

would lend a hand to Dr. Mowry's proposed POSITA to assist with making Dr. Mowry's proposed combination.

209. Finally, obtaining industry experience in NoC technology was not possible in October 2003. In the relevant timeframe, the concept of a NoC was considered too risky and premature for investment in next-generation SoCs. The semiconductor industry had deemed that bus-based interconnects were sufficient for the time being, as the number of processing modules was management with a single or hierarchical bus architecture, while scalability was not yet a significant concern. Indeed, NoCs were not commercially available until 2006.

210. Therefore, a hypothetical person with a Bachelor's degree in electrical engineering, computer engineering, or computer science with two years of general experience in networking technologies, or even SoC and interconnect technologies, would have had no expectation or likelihood of success in incorporating Drake's LAN-based architecture into a SoC, such as the SoC disclosed in Goossens2002.

3. The Alleged Combination of Goossens2002 and Drake Fails to Meet the Claim Limitations Regarding the "Communication Manager" and "Resource Manager"

211. Regardless of motivation to combine, the alleged combination of Goossens2002 and Drake does not disclose or render obvious the limitations of claims 2, 6, and 10 of the '449 Patent.

a. communication manager (Claim 2 and Limitation 10[a])

212. The alleged combination of Goossens2002 and Drake fails to disclose the “communication manager” recited in claim 2 and limitation 10[a]. EX. 1001, 18:49-51, 19:33. I understand that Petitioner and Dr. Mowry rely on Drake’s QoS requestor manager 12 as the claimed “communication manager.” Pet., 35-38, 40-41, 46-47, 17; Ex. 1003 at ¶¶117-22, 130, 141, 76; *supra* § IX.C.2.b, n.3. However, I understand that Petitioner and Dr. Mowry rely on Drake’s source station 10 for the claimed “first module,”⁵ and QoS requestor manager 12 is completely within source station 10. EX. 1006, Fig. 1, 4:32-34, 4:62-65. Thus, QoS requestor manager 12 cannot constitute the “communication manager” because, as established above, *supra* § VIII.A, the “communication manager” is separate from, and cannot be within, the “first module.” That is, the claimed “first module” and “communication module” are separate and distinct, so since Petitioner and Dr. Mowry associate Drake’s source station 10 with the “first module,” the QoS requestor manager 12 therein cannot constitute the “communication manager.”

⁵ For this section (i.e., § IX.C.3), I assume that Petitioner and Dr. Mowry rely on Drake’s source station 10 for the claimed “first module.” *See* Pet., 26-27, 31-32, 43, 47; Ex. 1003 at ¶¶97-134; *supra* § IX.C.2,n.4.

b. first module issues a request for a connection with the second module to a communication manager (Limitations 6[a], 10[a])

213. The alleged combination of Goossens2002 and Drake fails to meet limitations 6[a] and 10[a], which recite that a “first module [...] issue[s] a request [] for a connection with [said] second module[] to [said] communication manager.” EX. 1001, 18:60-63, 19:32-33. I understand that, as explained above, *supra* § IX.C.3.a., Petitioner and Dr. Mowry rely on Drake’s source station 10 and QoS requestor 12 therein for the claimed “first module” and “communication manager,” respectively. Pet., 40-41; Ex. 1003 at ¶¶128-30; *supra* §§ IX.C.3.a, n.5; *supra* § IX.C.2.b, n.3; *see also* Pet., 46-47 (relying on limitation 6[a] analysis for limitation 10[a]); Ex. 1003 at ¶141 (same). Regardless of whether Drake’s QoS requestor manager 12 meets the construction of “communication manager,” Drake does not teach that *source station 10* (alleged “first module”) *issues a request to* QoS requestor manager 12 (alleged “communication manager”) as required for limitations 6[a] and 10[a].

214. A POSITA would have understood that in Drake, the request issued to QoS requestor manager 12 is issued by application 11, not source station 10. EX. 1006, Fig. 1, 4:18-37, 4:62-65. Petitioner and Dr. Mowry do not and cannot show that Drake teaches QoS requestor manager 12 receiving a request from source station 10 as a whole rather than specifically from application 11 therein. Indeed,

based on my review, in Petitioner and Dr. Mowry's only mentions of QoS requestor manager 12 for limitation 6[a], they admit that "*the application [11]* ... communicates this request to a QoS requestor manager" and "[t]he QoS requestor manager 12 interacts with *application [11]*." Pet., 40-41 (quoting EX. 1006, 4:62-65) (emphases added); Ex. 1003 at ¶130 (same). Additionally, based on my review, I understand that Petitioner and Dr. Mowry both rely on an annotated version of Drake's Figure 1 that highlights application 11 in particular, not source station 10 as a whole, and thus, this demonstrates that the request to QoS requestor manager 12 is issued by application 11, not source station 10. Pet., 41; Ex. 1003 at ¶130.

215. Further, a POSITA would not have understood the request issued by application 11 to QoS requestor manager 12 to be issued by source station 10 based on the fact that application 11 and/or QoS requestor manager 12 are within source station 10. A POSITA would not have understood source station 10 to issue a request to an internal component of itself. Rather, based on Drake's teachings discussed above, a POSITA would have understood that the request issued to QoS requestor manager 12 is issued by another internal component—i.e., application 11—not source station 10 as a whole.

216. A POSITA would have at least understood Drake's teachings from the same level for both issuing and receiving the request. That is, to the extent the request is considered to be issued by source station 10 (alleged "first module")

rather than application 11 therein, then the request would likewise be understood to be received by the source station 10, not QoS requestor manager 12 (alleged “communication manager”) therein. On the other hand, to the extent the request is considered to be received by QoS requestor manager 12 (alleged “communication manager”), not source station 10 as a whole, then the request would likewise be understood to be issued by application 11, not source station 10 (alleged “first module”) as a whole.

217. I understand that the Board’s Institution Decision in the Qualcomm IPR found: “As for Patent Owner’s assertion that source station 10 as the claimed ‘first module’ cannot ‘issue a request’ to itself, the challenged claims do not specify what component in the ‘first module’ issues a request to the claimed ‘communication manager.’” IPR2024-01081, Paper 14 at 25. I disagree. The plain language of the claims recites that the request is issued *by the first module itself*, not that a “component in the ‘first module’ issues a request to the claimed ‘communication manager.’” *Id.*; EX. 1001, 18:60-63, 19:32-33. As explained above, *supra* § VIII.A, based on the intrinsic evidence, a POSITA would have understood that the claimed “communication manager” cannot be completely within the “first module,” with no separateness between the two, including because the “first module” would not issue a request to itself.

218. Moreover, based on my review, Petitioner and Dr. Mowry do not rely on Goossens2002 to remedy the deficiency in Drake, as they do not allege any “communication manager” in Goossens2002 and do not mention Goossens2002 when discussing the alleged “communication manager” in Drake. Pet., 40-41; Ex. 1003 at ¶¶128-30.

c. communication manager forwards the request to a resource manager (Limitations 6[b], 10[b])

219. The alleged combination of Goossens2002 and Drake fails to meet limitations 6[b] and 10[b], which recite “[said] communication manager ... forward[s] [said] request ... to [a] resource manager.” EX. 1001, 18:63-67, 19:36-37. I understand that Petitioner and Dr. Mowry rely on Drake’s QoS requestor manager 12 and QoS allocator 20 for the claimed “communication manager” and “resource manager,” respectively. Pet., 41-42; EX. 1003 AT ¶¶131-32; *supra* § IX.C.2.b, n.3; *see also* Pet., 47 (relying on limitation 6[b] analysis for limitation 10[b]); Ex. 1003 at ¶142 (same). Regardless of whether Drake’s QoS requestor manager 12 meets the construction of “communication manager,” Drake does not teach that QoS requestor manager 12 (alleged “communication manager”) forwards the request it receives to QoS allocator 20 (alleged “resource manager”) as required for limitations 6[b] and 10[b].

220. A POSITA would not have understood that Drake's QoS requestor manager 12 forwards a request to QoS allocator 20. A POSITA would have understood that Drake teaches that the request received by QoS allocator 20 is sent from source station 10, not from QoS requestor manager 12 therein. Ex. 1006, Fig. 1, 4:50-54 ("allocator 20 ... receive[s] the QoS request from station 10"), 5:5-8 ("Allocator station 20 ... receives ... the QoS request from source station 10"), 9:52-10:8 ("included in the allocation request message" is "the source address field 52 (Source MAC Address)" "of the source ... station[]"), Fig. 3, 10:41-46 ("source station 10 actually sends a request to the allocator [20], Fig. 4; Paper 10 at 35-36, 39.

221. A POSITA would have understood that Drake teaches that QoS requestor manager 12, along with QoS protocol machine 13, merely "assemble[s]" and "format[s]" a request and sends it to transport protocol stack 15, not that QoS requestor manager 12 sends the request to QoS allocator 20. EX. 1006, 4:32-37 (describing that source station 10 uses "components 12 and 13 assemble a request"), 4:62-65 (describing that "QoS requestor manager 12 ... utilizes QoS protocol machine 13 to format the QoS request"), Fig. 1; Paper 14 at 34-35. A POSITA would have understood that after QoS requestor manager 12 assembles/formats the request, Drake teaches that source station 10 then uses transport protocol stack 15 and MAC entity 16 for formatting and launching on

LAN 17, respectively, a request packet for sending the request to QoS allocator 20. EX. 1006, 4:37-40, Fig. 1; Paper 14 at 35. Thus, if a POSITA were to understand that any particular component(s) of source station 10 send or forward the request to allocator 20, it would be transport protocol stack 15 and/or MAC entity 16, not QoS requestor manager 12.

222. A POSITA would have understood that the mere fact that the request is *eventually* received by QoS allocator 20 does not mean that QoS requestor manager 12 forwards the request to QoS allocator 20. A POSITA would have understood that Drake does not disclose that QoS requestor manager 12 sends the request to QoS allocator 20 or that QoS allocator 20 receives the request from QoS requestor manager 12.

223. Based on my review, Petitioner and Dr. Mowry fail to show that QoS requestor manager 12 in particular sends or forwards the request to QoS allocator 20. Both Petitioner and Dr. Mowry acknowledge that Drake teaches that QoS requestor manager 12 merely *assembles* a request and that QoS allocator receives the request from *source station 10*, not specifically QoS requestor manager 12. Pet., 41-42; Ex. 1003 at ¶131. Based on my review, Petitioner and Dr. Mowry ignore that Drake's source station 10 contains transport protocol stack 15 and MAC entity 16, which receive the request from QoS requestor manager 12 and send the request packet to QoS allocator 20. Pet., 41-42; Ex. 1003 at ¶¶131-32.

224. Moreover, based on my review, Petitioner and Dr. Mowry do not rely on Goossens2002 to remedy the two deficiencies described above in Drake, as their analysis does not discuss any teachings of Goossens2002. Pet., 41-42; Ex. 1003 at ¶¶131-32.

d. resource manager responding to the communication manager (Limitations 6[c], 10[d])

225. The alleged combination of Goossens2002 and Drake fails to meet limitations 6[c] and 10[d], which recite “[said] resource manager [] responding with the availability of the [target] connection to [said] communication manager.” EX. 1001, 18:67-19:2, 20:1-2. I understand that Petitioner and Dr. Mowry rely on Drake’s QoS allocator 20 and QoS requestor manager 12 and for the claimed “resource manager” and “communication manager,” respectively, and rely on Drake’s QoS allocation reply for the claimed “respon[se].” Pet., 42-43; Ex. 1003 at ¶133; *supra* § *supra* § IX.C.2.b, n.3; *see also* Pet., 47 (relying on limitation 6[c] analysis for limitation 10[d]); Ex. 1003 at ¶144 (same). Regardless of whether Drake’s QoS requestor manager 12 meets the construction of “communication manager,” Drake does not teach that QoS allocator 20 (alleged “resource manager”) sends the QoS allocation reply (alleged “respon[se]”) to QoS requestor manager 12 (alleged “communication manager”), as required for limitations 6[c] and 10[d].

226. First, Drake does not disclose that allocator 20 sends the QoS allocation reply to QoS requestor manager 12 (alleged “communication manager”). A POSITA would have understood that Drake instead teaches that QoS allocator 20 sends the QoS allocation reply to source station 10 (alleged “first module”) in general. EX. 1006, 4:54-57 (“station 10 is notified”), 8:20-29 (describing “QoS allocation reply” as a “message[] exchanged between the stations of the [LAN]”), 14:22-27 (“AllocationReply message is ... sent from allocator station 20 ... to source station 10,” and “source station 10 ... receives the AllocationReply message”), 11:22-48 (describing that allocation acceptance/denial messages in Fig. 5 are sent to, and received by, “source station 10”), 9:52-10:2 (describing a “QoS message,” such as QoS allocation reply, as including a “source address field 52 (Source MAC Address)” for the source station). As for QoS requestor manager 12, a POSITA would have understood that Drake just discloses that QoS requestor manager 12 assembles/formats the QoS request, not that it receives any response. EX. 1006, 4:32-37, 4:62-65.

227. Second, it is neither inherent nor obvious that QoS allocator 12 sends the QoS allocation reply to QoS requestor manager 12 within source station 10. A POSITA would have understood that the QoS allocation reply would not have necessarily been sent to QoS requestor manager 12, as the reply could have been sent to application 11 or some component not depicted in Drake’s Figure 1.

Further, to the extent the QoS allocation reply is sent to an internal component of source station 10 depicted in Fig. 1 (Drake includes no such teaching), a POSITA would understand that the reply would be sent to application 11, not QoS requestor manager 12, because application 11 is the original requestor and is the component that sends a multimedia file via the established connection. EX. 1006, 4:27-32 (disclosing “application 11 ... requests a QoS connection to the ... target station 29” and “[a]pplication 11 also is responsible for causing the transmission of the multimedia data stream ... to the target station 29”), 11:22-28 (describing that an “allocation acceptance message” is sent to source station 10 and then “the multimedia file is transmitted to the target station 29”). That is, to the extent that the QoS allocation reply is sent to one of the source station’s components depicted in Figure 1, it would have been understood that application 11, not QoS requestor manager 12, would receive the QoS allocation reply indicating whether the connection is available for such transmission. Also, a POSITA would have understood that even if the QoS allocation reply is sent to application 11 via the path shown by Drake’s Figure 1 within source station 10, which purportedly includes QoS requestor manager 12, this would not constitute QoS allocator 20 “responding ... to” QoS requestor manager 12 (alleged “communication manager”) “with the availability of the [target] connection,” as recited by the claim limitations.

228. Lastly, based on my review, Petitioner and Dr. Mowry fail to establish that this limitation is disclosed or obvious in Drake. Critically, I understand that **there is no mention of QoS requestor manager 12** (alleged “communication manager”) in Petitioner’s 6[c] analysis, the portions of Drake cited therein, or the corresponding portion of Dr. Mowry’s declaration, much less any argument or showing that Drake discloses or even renders obvious that QoS allocator 20 sends the QoS allocation reply to QoS requestor manager 12. Pet., 42-43 (citing EX. 1006, 4:55-57, 8:20-29, 8:50-64, Fig. 5); Ex. 1003 at ¶133 (same). In fact, based on my review, I understand that the portions of Drake cited by Petitioner and Dr. Mowry disclose that the QoS allocation reply is sent to source station 10, as described above. EX. 1006, 4:55-57, 8:20-29. Yet, based on my review, Petitioner and Dr. Mowry ignore this teaching in Drake that the QoS allocation reply is sent to source station 10, without any disclosure regarding the reply being sent to QoS requestor manager 12. *See* Pet., 42-43.

229. Moreover, based on my review, Petitioner and Dr. Mowry do not rely on Goossens2002 to remedy the deficiency in Drake, as their analysis does not discuss any teachings of Goossens2002. Pet., 42-43; Ex. 1003 at ¶133.

e. connection between the first and second module is established (Limitations 6[d], 10[e])

230. I have assumed for my analysis in this section (i.e., § IX.C.3) that Petitioner and Dr. Mowry rely on Drake's source station 10 for the claimed "first module." *Supra* § IX.C.2, n.4. However, to the extent that Petitioner and Dr. Mowry seek to alternatively rely on Drake's application 11 as the claimed "first module," then the alleged combination of Goossens2002 and Drake fails to meet limitations 6[d] and 10[e], which recite, in part, "[the target] connection between the first and second module [is] established." EX. 1001, 19:2-5, 20:4-6. That is because, based on my review, I understand that neither Petitioner's analysis for limitations 6[d]/10[e] nor the corresponding portions of Dr. Mowry's declaration mention Drake's application 11, much less include argument or evidence that a "connection between" application 11 and Drake's target station 29 (alleged "second module") "[is] established," as recited by these limitations. *See* Pet., 43-44; Ex. 1003 at ¶134; *see also* Pet., 47 (relying on limitation 6[d] analysis for limitation 10[e]), 32, 40, 43 (relying on Drake's target station as the claimed "second module"); Ex. 1003 at ¶145 (relying on limitation 6[d] analysis for limitation 10[e]).

231. Moreover, based on my review, Petitioner and Dr. Mowry do not rely on Goossens2002 to remedy such deficiency in Drake, as their analysis does not discuss any teachings of Goossens2002. Pet., 43-44; Ex. 1003 at ¶134.

D. Ground 2: Purported Obviousness over Goossens2003 in view of Drake (Claims 2, 6, 9-16)

232. I understand that in Ground 2, Petitioner and Dr. Mowry assert that claims 2, 6, and 9-16 of the '449 Patent are obvious over Goossens2003 (Ex. 1007, “Goossens2003”) in view of Drake. Pet., 51-71; Ex. 1003 at ¶¶ 155-216. But I disagree for at least the reasons provided below.

233. I understand that Petitioner and Dr. Mowry rely on Goossens2003 for the claimed “[i]ntegrated circuit comprising ... [a] network.” Pet., 54-57, 68-69; EX. 1003 AT ¶¶168-72, 202. Petitioner and Dr. Mowry recognize that Goossens2003, however, does not teach the claimed “communication manager” or “resource manager,” or the related limitations, because they rely instead on Drake’s QoS requestor manager 12 and QoS allocator 20 for those claim elements, respectively. Pet., 57-58, 61-63, 65-67, 69-70; Ex. 1003 at ¶¶173, 182-87, 193-98, 205-09. I understand that Petitioner and Dr. Mowry allege that Drake’s QoS requestor manager 12 and QoS allocator 20, including their relationship with Drake’s source station 10 (alleged to correspond to Goossens2003’s IP as the

alleged “first module”), would have been incorporated into Goossens2003. Pet., 57-58, 61-63, 65-67, 69-70; EX. 1003 AT ¶¶155-66, 173, 182-87, 193-98, 205-09.

234. The asserted combination of Goossens2003 and Drake does not render obvious claims 2, 6, and 9-16, including because (i) Petitioner and Dr. Mowry do not show that a POSITA would have been motivated to combine Goossens2003 and Drake to arrive at the ’449 Patent’s claimed inventions regarding the “communication manager” and “resource manager” and, in fact, a POSITA would not have been motivated to do so, and (ii) even if Goossens2003 and Drake are combined as Petitioner asserts, the alleged combination fails to render obvious the claim limitations regarding the “communication manager” and “resource manager.”

235. I understand that Petitioner’s Ground 2 includes similarities to Ground 1. Thus, I incorporate by reference here into Ground 2 my analysis of Ground 1 in section IX.C above.

1. A POSITA Would Not Have Combined Goossens2003 and Drake to Meet the Claim Limitations Regarding the “Communication Manager” and “Resource Manager”

236. Based on my review of the Petition, Dr. Mowry’s declaration, and evidence cited therein, Petitioner and Dr. Mowry fail to show that a POSITA would have been motivated to modify Goossens2003 based on Drake to arrive at the claimed inventions of the ’449 Patent’s claims 1, 2, 6, and 10. Petitioner and

Dr. Mowry argue that select components and functions of Drake's QoS management system would simply and generically be implemented in Goossens2003, without explanation as to specifically why and how those aspects of Drake's QoS system would purportedly be incorporated into and work with Goossens2003 for each limitation of the claims.

237. Further, regardless of the showing in the Petition and Dr. Mowry's declaration, a POSITA would not have combined Goossens2003 and Drake as they allege. There is no motivation for Petitioner and Dr. Mowry's purported combination, including because of redundancy between the references and because the references teach away from the alleged combination, as discussed below.

a. Petition Section VII.B.1 and Mowry Section IX.B Intro

238. I understand that the Petition's Section VII.B.1 (Pet., 51-54, "Petition Section VII.B.1") and corresponding portion of Dr. Mowry's declaration (Ex. 1003 at ¶¶155-66, "Mowry Section IX.B Intro") purport to address motivation to combine Goossens2003 and Drake. For example, based on my review, I understand that Petition Section VII.B.1 and Mowry Section IX.B Intro contain the only express "motivat[ion]" alleged for Ground 2, except for a single mention for each of limitations 1[c] and 1[d]. Pet., 51-54, 58; Ex. 1003 at ¶¶155-66, 173, 175. However, based on my review, Petition Section VII.B.1 merely asserts that a

POSITA “would have been motivated to combine Goossens2003’s disclosures with Drake’s disclosures regarding a system for QoS management” and “would have looked to Drake’s disclosure of a ‘QoS requestor manager’ to formulate requests for guaranteed services with particular properties and a ‘QoS allocator’ to determine whether the network resources required for the requested services are available.” Pet., 51-52; *see also* Ex. 1003 at ¶¶155-66 (similar). This fails to explain specifically *how* Drake’s QoS system would purportedly be implemented in Goossens2003. For example, Petitioner and Dr. Mowry fail to explain how Drake’s QoS requestor manager, QoS allocator, and their related processes would work with respect to any specific existing aspects of Goossens2003 (e.g., IP blocks, NOC components, and Goossens2003’s existing service requests).

239. Based on my review, Petitioner and Dr. Mowry suggest that Drake’s QoS system simply fills in missing details in Goossens2003, as (i) Petitioner acknowledges that Goossens2003 “does not describe a component or mechanism for managing resource usage within the NOC or for determining the availability of the resources” and (ii) Petitioner then proceeds to describe Drake’s QoS system. Pet., 51-52; Ex. 1003 at ¶¶159-66 (similar). However, the Petition and Dr. Mowry’s declaration lack details of how the relied-upon parts of Drake’s QoS system (e.g., QoS requestor manager and QoS allocator) would purportedly work

with any aspects of Goossens2003 (e.g., IP blocks, NOC components, and Goossens2003's existing service requests) to meet the claim limitations.

240. For example, I understand that the Petition asserts that “Drake provides additional details about such a system that is consistent with and would have worked with the system of Goossens2003,” but Petitioner and Dr. Mowry fail to elaborate on specifically *how* Drake’s “additional details” purportedly “would have worked with the system of Goossens2003.” Pet., 52-53; Ex. 1003 at ¶¶160-66 (similar). As another example, Petitioner and Dr. Mowry do not explain why *two* QoS components from Drake (i.e., QoS requestor manager and QoS allocator) are purportedly needed for resource management in Goossens2003 rather than a single component, which would be preferable for purposes of efficiency and because of resource and space constraints. Also, Petitioner and Dr. Mowry do not explain why a POSITA would have purportedly “looked to Drake’s disclosure of a ‘QoS requestor manager’ to formulate requests for guaranteed services with particular properties” when, as Petitioner and Dr. Mowry assert and a POSITA would have understood, Goossens2003 already teaches requests for connections with particular properties. Pet., 51-52, 65; *see also* Ex. 1003 at ¶¶160, 193-94 (similar).

241. Based on my review, Mowry Section IX.B Intro does not explain why a POSITA would have been motivated to combine Drake’s QoS system with Goossens2003 to arrive at the inventions claimed in the ’449 Patent because, for

example, it mentions Drake's QoS requestor manager and QoS allocator each only twice, in paragraphs with no discussion of Goossens2003, and also it does not address the claim limitations of the '449 Patent. Ex. 1003 at ¶¶156-166.

242. Further, regardless of Petitioner and Dr. Mowry's showing, there was no motivation for the alleged combination because a POSITA would not, and could not, have implemented Drake's QoS system with Goossens2003's NOC. Drake emphasizes that it's QoS management is specifically directed to local area networks (LANs). EX. 1006, Abstract (describing "[a] management system for [LANs]"), 1:6-11 ("Technical Field," describing that "[t]his invention" relates to "[LANs]"), 1:13-2:21 ("Background of the Invention," explaining that while "[e]merging high bandwidth, packet and cell based technologies and architectures ... anticipate th[e] requirement [of QoS management] and thus incorporate techniques to accomplish [QoS] management," "[m]ost packet based [LANs] ... do not offer these sophisticated techniques for [QoS] management," and therefore, "[i]t is extremely desirable to provide apparatus and a method to control multimedia data stream entry into a LAN" based on QoS requirements and availability), 2:25-3:29 ("Summary of the Invention," describing the "present invention" as relating specifically to "LAN[s]"), Fig. 1 and 3:31-4:10 (showing that the Figures relate specifically to "LAN facilities"), 15:39-46 (showing that

Drake is intended for “persons skilled in the LAN control and operation arts”), 15:47-18:51 (showing that each claim relates to a “[LAN]”).

243. Drake’s close tie to LAN networks is demonstrated by the fact that the components and processes that Petitioner relies upon in Drake—e.g., QoS requestor manager 12 and QoS allocator 20—are associated with LAN-related components and processes. EX. 1006, 4:18-26 (describing “a [QoS] management system for [LANs] comprising a prior art [LAN] 17 comprising a plurality of stations 10, 29, ... , attached thereto,” and “[i]n accordance with the present invention, also attached to LAN 17 is a [QoS] allocator 20 which implements a [QoS] management process for LAN 17”), 4:32-47 (“Source station 10 also includes a QoS requestor manager 12 and a QoS protocol machine 13. Together, components 12 and 13 assemble a request to reserve a QoS connection Using a standard LAN transport protocol 15 to format a request packet, the packet is launched on LAN 17 through a medium access control (MAC) entity 16. LAN transport protocol 15 and MAC 16 are standard parts of all stations attached to a LAN”), 4:62-65 (“The QoS requestor manager 12 ... utilizes QoS protocol machine 13 to format the QoS request.”), 4:66-5:4 (“QoS allocator 20 is a station attached to LAN 17 which manages the QoS requests for the entire LAN 17. Like other stations, allocator station 20 includes a [MAC] entity 21 and a LAN transport protocol stack 22”). Because Drake is specifically intended for and directed to

LANs and a solution particularly tied to LANs, a POSITA would not have been motivated to modify Goossens2003, which does not contain a LAN, to incorporate Drake's LAN-related QoS system.

244. I understand that the Board's preliminarily finding in the Institution Decision states: "Petitioner establishes sufficiently that an ordinarily skilled artisan would have been motivated to combine Drake's teachings with Goossens2003's teachings in the way Petitioner proposes, i.e., "to create an SoC with improved performance and efficiency." See Pet. 48–51; Ex. 1003 at ¶¶ 33, 156–166, 173. As Dr. Mowry explains, an ordinarily skilled artisan "would have understood that using Drake's quality of service management process" with Goossens2003's NoC would improve the NoC's efficiency and performance. Ex. 1003 at ¶ 163; see id. ¶ 165." Paper 10 at 84.

245. I disagree with that preliminary finding. Based on my review, this preliminary finding was based on testimony by Dr. Mowry that Drake's QoS management process would have purportedly improved the "performance and efficiency" of Goossens2003's NOC, without explanation as to specifically how the references would have worked together. Paper 10 at 84 (citing Ex. 1003 at ¶¶33, 156-66, 173). I understand that Ex. 1003 at ¶¶156-66 is Mowry Section IX.B Intro, which corresponds to Petition Section VII.B.1. As discussed above, those sections of the Petition and Dr. Mowry's declaration do not establish motivation to

combine the references to arrive at the claims, including because they do not address the specific claim limitations and do not explain specifically how Drake's relied-upon teachings would work in with Goossens2003's existing teachings (e.g., IP block, NOC, and existing service request). *See* Pet., 51-54; Ex. 1003 at ¶¶156-66.

246. In the sections below, I further discuss the deficiencies in the Petition and Dr. Mowry's declaration regarding alleged motivation to combine. As discussed below, these deficiencies include that the Petition and Dr. Mowry's declaration fail to address motivation for the specific claim limitations and fail to explain specifically how Drake's QoS process would work in Goossens2003, such as how Drake's relied-upon components would function or be positioned relative to Goossens2003's IP blocks and NOC components, and existing service requests. Also, in the sections below, I further discuss why there was no motivation to combine, including because, as explained below for limitations 2 and 6[a], Drake's QoS requestor manager (the alleged "communication manager") is redundant of Goossens2003's IP, and Goossens2003 also teaches away from incorporating Drake's QoS requestor manager.

b. A POSITA Would Have No Expectation of Success In Making the Proposed Combination

247. For the reasons provided above, *supra* § IX.C.3.e, the hypothetical POSITA, as proposed by Dr. Mowry, would have no expectation or likelihood of success in incorporating Drake’s LAN-based architecture into a NoC, such as the NoC disclosed in Goossens2003. All of my opinions above are directly applicable to this combination because Goossens2003 does not provide additional information that would aid this hypothetical POSITA in successfully making Dr. Mowry’s proposed combination. *Supra* § IX.C.3.e.

c. Claim 2

248. **Limitation 1[c]**⁶—I understand that limitation 1[c] recites, in part, “at least one resource manager (RM).” I understand that Petitioner and Dr. Mowry rely on Drake’s QoS allocator as the claimed “resource manager.” Pet., 57-58; Ex. 1003 at ¶173. Petitioner and Dr. Mowry do not establish motivation for this limitation. Based on my review, Petitioner’s analysis of limitation 1[c] contains no

⁶ I understand that claim 1 has been statutorily disclaimed by Patent Owner and is no longer at issue in this proceeding. My analysis of limitations 1[c] and 1[g] in this section relates to claim 2, as I understand that claim 2 is dependent from claim 1 and thus incorporates all limitations of claim 1.

independent analysis of motivation and instead merely refers to Petition Section VII.B.1, asserting: “For the reasons discussed above, a POSITA would have looked to Drake’s disclosures regarding a QoS allocator for details regarding the implementation of resource management in Goossens2003’s NOC” Pet., 58 (citing VII.B.1). Neither this assertion nor Petition Section VII.B.1 explains specifically how Drake’s QoS allocator or its related processes would work with any existing aspects of Goossens2003. Dr. Mowry’s declaration is similarly insufficient. EX. 1003 AT ¶173 (relying completely on “discuss[ion] above,” with a lone cite to “Section V.A” (which is his “Overview of the Technology” section on SoCs) and no independent analysis or citations of Drake).

249. **Limitation 1[g]**—I understand that limitation 1[g] relates to the claimed “resource manager” and its capabilities. I understand that Petitioner and Dr. Mowry rely on Drake’s QoS allocator as the claimed “resource manager.” Pet., 61-62; Ex. 1003 at ¶¶182-83. Petitioner and Dr. Mowry do not establish motivation for this limitation. Based on my review, for alleged motivation, Petitioner’s analysis of limitation 1[g] just refers to Petition Section VII.B.1, and as discussed above, Petition Section VII.B.1 fails to establish specifically how Drake’s QoS allocator would work with existing aspects of Goossens2003. Pet., 61-62. For example, Petitioner’s analysis of limitation 1[g] discusses Drake’s QoS allocator receiving requests for connections, but based on my review, neither that 1[g]

analysis nor Petition Section VII.B.1 explains where such requests would purportedly come from in the alleged combination (e.g., Goossens2003's IP or somewhere else). Pet., 61-62, 51-54. Dr. Mowry's declaration is similarly insufficient. Ex. 1003 at ¶¶182-83 (containing a conclusory assertion of motivation, with no citations or independent analysis).

250. **Claim 2**—I understand that claim 2 recites “at least one communication manager (CM) for managing the communication between different modules.” Based on my review, however, it is unclear whether Petitioner and Dr. Mowry map the “communication manager” to Goossens2003's NI, Drake's QoS requestor manager 12, or some combination of both. Pet., 62-63; Ex. 1003 at ¶¶185-87, 193-95, 205.⁷ Because Petitioner and Dr. Mowry do not clearly identify what element(s) of Goossens2003 and/or Drake that they rely on, Petitioner and Dr. Mowry do not and cannot establish the requisite motivation to combine. Pet.,

⁷ I understand that Petitioner does not rely on Drake's QoS requestor manager 23 for the claimed “communication manager.” Paper 10 at 55-56 (finding that Petitioner does not rely on QoS requestor manager 23), 78-79 (referring to that finding for Ground 2); Pet., 37 n.7 (admitting no reliance on QoS requestor manager 23), 63 (relying on that discussion (VII.A.3) for Ground 2).

62-63. Additionally, there is no motivation with respect to either Goossens2003's NI or Drake's QoS requestor 12 for the reasons I discuss below.

251. **Goossens2003's NI**—To the extent that Petitioner and Dr. Mowry rely on Goossens2003's NI—either alone or in combination with Drake's QoS requestor manager—for the “communication manager,” it is my opinion that Petitioner and Dr. Mowry fail to establish motivation. While Petitioner and Dr. Mowry relies on “Goossens2003 in view of Drake” for claim 2, Petitioner and Dr. Mowry provide no explanation for why or how Goossens2003's NI would work together with any aspects of Drake, such as QoS requestor manager or QoS allocator. Pet., 62-63; Ex. 1003 at ¶¶184-87. Based on my review, Dr. Mowry's claim 2 analysis contains only separate discussions of each reference and refers to the claim 2 analysis for Ground 1, which does not involve or mention Goossens2003's NI. Ex. 1003 at ¶¶184-87. Also, based on my review, Petitioner's claim 2 analysis similarly contains only separate discussions of each reference and refers to the claim 2 analysis for Ground 1 and to Petition Section VII.B.1, neither of which mentions Goossens2003's NI. Pet., 62-63 (citing Pet. 35-38 (VII.A.3), 51-54 (VII.B.1)). In fact, based on my review, Petition Section VII.B.1 suggests that Goossens2003 does **not** include the claimed “communication manager” and that a POSITA would incorporate Drake's QoS requestor manager instead. Pet., 51-52 (“Goossens2003, however, does not describe a component or mechanism for

managing resource usage within the NOC,” and “[a] POSITA would have looked to Drake’s ... ‘QoS requestor manager’ to formulate requests for guaranteed services with particular properties”).

252. *Drake’s QoS requestor manager 12*— To the extent that Petitioner and Dr. Mowry rely on incorporating Drake’s QoS requestor 12 into Goossens2003 for the “communication manager,” this is based on hindsight.

253. The Petition and Dr. Mowry’s declaration do not present any motivation for why a POSITA at the time would have or could have implemented Drake’s QoS requestor manager in Goossens2003. Pet., 62-63; Ex. 1003 at ¶¶184-87. Based on my review, the Petition’s only alleged motivation for incorporating Drake’s QoS requestor manager into Goossens2003 states: “For the reasons discussed above, a POSITA would have looked to Drake’s disclosures regarding a QoS requestor manager to obtain the benefits of Drake’s known solution to ensuring the availability of network resources for guaranteed services” Pet., 62-63 (citing Petition Section VII.B.1). However, neither this statement nor Petition Section VII.B.1 cited therefor explains why Drake’s QoS requestor manager is needed in Goossens2003 or how it would work with any specific aspects of Goossens2003. Indeed, I understand that Petitioner’s claim 2 analysis contains no mention of Goossens2003 in its discussion of Drake’s QoS requestor manager, and Petition Section VII.A.1 only mentions Drake’s QoS requestor

manager once. *See* Pet., 62-63, 51-54. Dr. Mowry's declaration is similarly insufficient. Ex. 1003 at ¶¶184-87 (containing only separate discussions of Goossens2003 and Drake, and a conclusory assertion of motivation, with no citations or independent analysis).

254. A POSITA would not have been motivated to incorporate Drake's QoS requestor manager into Goossens2003 because the QoS requestor manager's function is redundant of Goossens2003's IP block. That is, Drake's QoS requestor manager and Goossens2003's IP block perform similar functions. I understand that Petitioner and Dr. Mowry each refer to their Ground 1 analysis, which asserts that Drake's QoS requestor manager is for requesting a QoS connection: "the QoS requestor managers manage communications ... by 'assembl[ing] a request to reserve a QoS connection.'" Pet., 35, 63; *see also* Ex. 1003 at ¶¶ 118 (same), 187. However, a POSITA would have understood that Goossens2003's IP block already does this, as Petitioner and Dr. Mowry recognize: "Goossens2003's master IPs ... issue requests for connections" and "the requests issued by the IPs comprise desired connection properties." Pet., 65; *see also* Ex. 1003 at ¶194. That is, a POSITA would have understood that both Drake's QoS requestor manager and Goossens2003's IP block purportedly make a request for a connection with sufficient properties. EX. 1006, 4:32-37; EX. 1007, 77, 67, 71; Pet., 35, 63, 65; Ex. 1003 at ¶¶118, 187, 194. Also, while Petitioner and Dr. Mowry assert that Drake's

QoS requestor manager communicates with the alleged “resource manager” (i.e., Drake’s QoS allocator, purportedly incorporated into Goossens2003), a POSITA would have understood that this could just be done by Goossens2003’s IP block—i.e., Goossens2003’s IP block could communicate with the alleged “resource manager.” *See* Pet., 35-36, 63, 66 (regarding Drake’s QoS requestor manager preparing a request sent to the QoS allocator), 65-66 (asserting that Goossens2003’s IP sends a request similar to the request in Drake); Ex. 1003 at ¶¶118, 187, 196, 193-95. Thus, a POSITA would have understood that Goossens2003’s IP can generate a connection request and send it to the alleged “resource manager” without needing Drake’s QoS requestor manager, so adding Drake’s QoS requestor manager in Goossens2003 would be redundant and unnecessary.

255. Goossens2003 teaches away from incorporating Drake’s QoS requestor manager. A POSITA would have understood that in Drake, QoS requestor manager 12 (the alleged “communication manager”) is intentionally *within* source station 10. EX. 1006, Fig. 1, 4:32-47, 4:62-65; Pet., 35 (admitting that “QoS requestor managers [are] associated with source stations”); Ex. 1003 at ¶118 (same). This is further demonstrated by the fact that Drake refers to source station 10 as the “requestor station 10.” EX. 1006, 14:17. This is also demonstrated by the fact that Drake’s QoS system, including QoS requestor manager 12, is not

implemented within “prior art [LAN] 17” but rather in components such as source station 10 attached to that “prior art” network. EX. 1006, 4:18-26, 4:32-47, 4:62-66, Fig. 1. Based on my review, Drake does not suggest that QoS requestor manager 12 can be *outside* of the source station. In fact, a POSITA would have understood that Drake’s QoS requestor manager 12 is a software running on source station 10 and is thus inseparably connected and coupled to the source station, such that QoS requestor manager 12 could not be outside of the source station.

However, Drake’s source station 10 corresponds to Goossens2003’s IP block,⁸ and

⁸ Although Petitioner and Dr. Mowry present unclear and/or inconsistent positions regarding the alleged “first module” in Drake (*supra* § IX.B), for this section (i.e., § IX.D), I assume that Petitioner and Dr. Mowry associate Drake’s source station 10 with Goossens2003’s IP block for the claimed “first module,” based on portions of the Petition and Dr. Mowry’s declaration adopting or suggesting that position and based on my understanding that the Board made an initial finding to that effect. Pet., 59, 26-27, 61, 31-32, 67, 43, 70; Ex. 1003 at ¶198; IPR2024-01081, Paper 14 at 23-24; *see also* Pet., 65-66, 40, 69. Indeed, if a POSITA was motivated to combine Goossens2003 and Drake (although, they would not be, as I explain herein), then the POSITA would have understood Goossens2003’s IP to correspond to Drake’s source station 10, not application 11 therein.

a POSITA would have understood that Goossens2003 emphasizes that its IP should **not** contain communication components like Drake's QoS requestor manager. EX. 1007, 65 ("We advocate system design centered on NOCs and QoS" because: "IP re-use and platform-based design aim to re-use applications and architectures by decoupling them. The use of NOCs and their associated network protocol stacks are a way to achieve this."), 66 ("NOCs help IP re-use and platform-based design to combine IPs, and NOC services aid in decoupling applications and architectures."), 78. That is, a POSITA would have understood that the QoS requestor manager is specifically included within Drake's source station that corresponds to Goossens2003's IP, but Goossens2003 would have dissuaded the POSITA from likewise including that QoS requestor manager within Goossens2003's IP, as Goossens2003 is premised on IP re-use and decoupling IPs from communication components such as Drake's QoS requestor manager. Thus, Goossens2003 teaches away from incorporating Drake's QoS requestor manager.

256. Moreover, implementing Drake's QoS requestor manager outside of Drake's source station or the corresponding IP block in Goossens2003 would constitute a modification of Drake's teachings, and based on my review, Petitioner and Dr. Mowry present no alleged motivation for such modification. Also, implementing a communication component such as Drake's QoS requestor manager within Goossens2003's IP block would be a modification or destruction

of Goossens2003's premise of decoupling or excluding such communication components from Goossens2003's IPs for purposes of IP re-use, and based on my review, Petitioner and Dr. Mowry present no alleged motivation for such modification.

257. I understand that the Institution Decision's preliminary analysis of motivation found that Petitioner's "proposed modification" does not "modify[] Goossens2003's IP block to include Drake's requestor manager 12" because "Petitioner proposes implementing Drake's QoS management process in [Goossens2003's] NoC, not modifying an IP block." Paper 10 at 85 (citing Samsung Pet., 48-51, corresponding to Pet., 51-54, and also citing Ex. 1003 at ¶¶162-63, 173). I disagree with that assessment of Petitioner and Dr. Mowry's proposed modification. Based on my review of the portions of the Petition and Dr. Mowry's declaration that the Board cites, Petitioner and Dr. Mowry do not assert that the alleged combination would implement Drake's QoS system, and particularly its QoS requestor manager, only in Goossens2003's NOC or that the alleged combination would not modify an IP block in Goossens2003. For example, based on my review, Petitioner merely asserts that a POSITA "would have been motivated to combine Goossens2003's disclosures with Drake's disclosures regarding a system for QoS management" and "would have looked to Drake's disclosure of a 'QoS requestor manager' ... and a 'QoS allocator'" Pet., 51-52.

Similarly, Dr. Mowry merely asserts that a POSITA “would have been particularly interested in Drake’s disclosure of a ‘QoS requestor manager’ to formulate requests for guaranteed services with particular properties” See Ex. 1003 at ¶¶ 76-79. This fails to address if or how Goossens2003’s IP blocks and/or NOC would purportedly be modified to implement Drake’s QoS system, particularly the QoS requestor manager.

258. The Petition and Dr. Mowry’s declaration are ambiguous and unclear as to specifically how the relied-upon components and functions of Drake’s QoS system, particularly the QoS requestor manager, would purportedly work with Goossens2003’s IP blocks and NOC. Indeed, Dr. Mowry’s declaration never specifies where Drake’s QoS requestor manager would be implemented in Goossens2003 (e.g., IP, NOC, or elsewhere).

259. As noted above, I understand that the Institution Decision interpreted Petitioner’s modification as implementing Drake’s QoS process (including its QoS requestor manager) only in Goossens2003’s NOC, without modifying Goossens2003’s IP, but this ignores and goes against Drake’s teachings, Petitioner and Dr. Mowry’s positions, and the understanding of a POSITA. As I discussed above, a POSITA would have understood that Drake’s QoS requestor manager 12 is purposefully *within* source station 10, not the “prior art” network to which source station 10 is attached. EX. 1006, Fig. 1, 4:18-26, 4:32-47, 4:62-65; Pet., 35;

Ex. 1003 at ¶118. Based on my review, Petitioner and Dr. Mowry do not argue that a POSITA would modify this teaching of Drake when purportedly implementing Drake's QoS system in Goossens2003, and they also does not argue motivation for such a modification. Also, based on my review and understanding, Petitioner and Dr. Mowry associates Drake's source station with Goossens2003's IP (*supra* § IX.D.1.c, n.8), so if a POSITA was motivated to implement Drake's QoS requestor manager in Goossens2003 (although, they would not be), then based on Petitioner and Dr. Mowry's position, the POSITA would implement Drake's QoS requestor manager in Goossens2003's IP, not in Goossens2003's NOC. Moreover, as explained above, a POSITA would not actually be motivated to implement Drake's QoS requestor manager in Goossens2003's IP because Goossens2003 teaches away from its IP containing such a communication component. EX. 1007, 65-66, 78 (regarding "decoupling" and IP "re-use").

260. I understand that Petitioner and Dr. Mowry each refer to their claim 2 analysis in Ground 1, which asserts that "a POSITA would have been motivated to ... implement[] ... Drake's QoS requestor manager as a circuit on the same integrated circuit chip as Goossens2002's IP blocks and NOS." Pet., 38, 63; *see also* Ex. 1003 at ¶¶122 (same), 187. Based on my review, Petitioner and Dr. Mowry do not make that assertion with respect to Goossens2003 for Ground 2. Pet., 62-63; Ex. 1003 at ¶¶184-87. Regardless, even if such assertion is applied to

Ground 2, it fails with respect to Goossens2003 for the same reasons discussed above with respect to Goossens2002 for Ground 1. *Supra* § IX.C.2.b.

261. I also understand that Dr. Mowry stated during his deposition that Drake's QoS requestor manager could go anywhere on Goossens2003's chip as long as the QoS requestor manager is attached or connected to the NOC.

262. However, a POSITA would not have implemented Drake's QoS requestor anywhere on Goossens2003's chip. **First**, a POSITA would not have implemented Drake's QoS requestor manager in either Goossens2003's IP or NOC, as Goossens2003 and Drake teach completely opposite solutions. Drake is premised on its QoS components being implemented in stations attached to prior art networks, where the network stays the same, whereas Goossens2003 is premised on implementing such communication components within the network, so that the IPs stay the same. EX. 1006, Abstract ("management system is attached to the network"), Fig. 1, 4:18-26, 4:32-47, 4:62-67, 14:17; EX. 1007, 65-66, 78 (regarding "decoupling" and IP "re-use"). Thus, as discussed above, Goossens2003 teaches away from incorporating Drake's QoS requestor manager within Goossens2003's IP, but on the other hand, Drake's QoS requestor manager would also not be incorporated within Goossens2002's NOC because that would go against Drake's teachings and require modifications of Drake that Dr. Mowry does not discuss.

263. ***Second***, a POSITA also would not have been implemented Drake's QoS requestor manager somewhere on Goossens2003's chip other than in the IPs and NOC. To note, a POSITA would have understood Goossens2003's network interfaces to be part of its NOC. For example, a POSITA would have understood that Goossens2003's chip, with its on-chip network, would be subject to several constraints, including physical, size, cost, and resource constraints, and that implementing a communication component outside of the IPs and NOS would require space and resources and would introduce issues regarding complexity, efficiency, component count, manufacturing cost, and technical and other issues that arise when adding such peripheral and intermediary components, including protocols and resources necessary for such communication component to interface and communicate with the network. *See, e.g.*, '449 Patent, 1:50-2:46. I incorporate my discussion above in Ground 1 regarding these issues and Goossens2002, which apply equally to Goossens2003. *Supra* § IX.C.2b.

264. Moreover, a POSITA according to Petitioner and Dr. Mowry's proposed definition of a POSITA, with that relatively low level of skill in the art (e.g., "a Bachelor's degree in computer science ... and two ... years of experience with ... networking technologies"), would not have been capable of implementing Drake's QoS requestor manager on Goossens2003's chip (if at all) somewhere outside of both the IPs and NOS. Pet., 15; Ex. 1003 at ¶61. *Supra* § IX.C.2.e.

265. In summary, it is my opinion that Petitioner and Dr. Mowry fail to adequately explain specifically why or how Goossens2003 would be modified to incorporate Drake's QoS requestor manager, and further, there is no motivation for this proposed modification, including because a POSITA would have understood that this proposed modification is redundant and is taught away from by Goossens2003.

d. Claim 6

266. **Claim 6 (generally)**—Petitioner and Dr. Mowry fail to establish the requisite motivation for claim 6 because in both the Petition and Dr. Mowry's declaration, the entire analysis for claim 6 contains no references or cites to Petition Section VII.B.1 or Mowry Section IX.B Intro, respectively, and contains only four cites to Goossens2003—three for 6[a] and one for 6[d]—none of which explain why or how Goossens2003 would be modified or work with Drake's teachings. *See* Pet., 65-67; Ex. 1003 at ¶¶193-98.

267. **Limitation 6[a]**—I understand that limitation 6[a] recites that “said first module” issues a “request (REQ) for a connection” to “said communication manager.” I understand that Petitioner and Dr. Mowry rely on Goossens2003's IP and Drake's source station 10 for the claimed “first module,” rely on the requests issued from Goossens2003's IP and Drake's application in source station 10 for the claimed “request,” and rely on Drake's QoS requestor manager 12 as the claimed

“communication manager.”⁹ Pet., 65-66; Ex. 1003 at ¶¶193-95, 129-30; *supra* § IX.D.1.c, n.8. Based on my review, however, the Petition contains zero discussion for why or how Goossens2003 and Drake would purportedly be combined for limitation 6[a], and it thus fails to explain a motivation to combine. *See* Pet., 65-66. Dr. Mowry’s declaration is similarly insufficient. Ex. 1003 at ¶¶193-95 (mentioning Drake in only ¶195, which contains no citations and no discussion of Goossens2003 or alleged motivation).

268. Also, as explained above for claim 2, there is no need for Drake’s QoS requestor manager in Goossens2003. For limitation 6[a], I understand that Petitioner and Dr. Mowry assert that both Goossens2003 and Drake “[s]imilarly” describe an alleged first module that requests a connection—i.e., Goossens2003’s master IP “issue[s] requests for connections” and an application in Drake’s source

⁹ Since Petitioner relies solely on Drake’s QoS requestor manager for the “communication manager” in limitations 6[b]-6[c], 10[b], and 10[d], I assume in sections IX.D.1.d and IX.D.1.e that this position applies to the entirety of claims 6 and 10, including limitations 6[a] and 10[a], even though, as explained above in section IX.B, it is unclear whether Petitioner relies on Goossens2003’s NI, Drake’s QoS requestor manager, or both for the “communication manager” in limitations 6[a] and 10[a] and underlying claim 2.

station similarly “requests a ... connection.” Pet., 65; Ex. 1003 at ¶¶193-95. I understand that Petitioner and Dr. Mowry further note, however, that Drake’s source station “directs these requests *to a ‘QoS requestor manager.’*” Pet., 65-66 (emphasis added); *see also* Ex. 1003 at ¶195 (similar). Based on my review, Petitioner and Dr. Mowry provide no motivation for incorporating this further step into Goossens2003—i.e., to modify Goossens2003 such that its IP issues a request to a QoS requestor manager. Pet., 65-66; Ex. 1003 at ¶195. Based on my review, their failure is demonstrated by the fact that the discussion of this further step in the Petition and Dr. Mowry’s declaration contains no mention or citation of Goossens2003. Pet., 65-66; Ex. 1003 at ¶195.

269. There was no such motivation for incorporating this further step into Goossens2003. The Petition and Dr. Mowry’s declaration reference their description of Drake for limitation 6[a] in Ground 1, which describes that Drake’s “application in the source station ... communicates th[e] request to a QoS requestor manager ... *for subsequent transmission to a QoS allocator.*” Pet., 41 (emphasis added), 65-66; *see also* Ex. 1003 at ¶130 (similar), 195. However, if Drake’s QoS allocator was implemented in Goossens2003 as Petitioner alleges, then a POSITA considering the combination would have understood that Goossens2003’s IP would just send its request directly to the QoS allocator, not to a QoS requestor manager “for subsequent transmission to [the] QoS allocator” as

Petitioner and Dr. Mowry suggest. Pet., 41, 65-66; Ex. 1003 at ¶¶130, 195. A POSITA would have understood that it would have been redundant and unnecessary for a request issued by Goossens2003's IP to be sent to and issued *again* by a QoS requestor manager. Thus, there was no motivation for Goossens2003's IP to issue its request *to a QoS requestor manager* (the alleged "communication manager") for limitation 6[a].

270. Moreover, because limitation 6[a] recites that the "first module" issues a "request" to the "communication manager," this implicates the issues I discuss above for claim 2 regarding where and how Drake's QoS requestor manager is purportedly implemented in Goossens2003. As explained for claim 2: (i) based on my review, Petitioner and Dr. Mowry fail to sufficiently explain how Drake's QoS requestor manager is implemented in Goossens2003 (e.g., in Goossens2003's IP, NOC, or elsewhere); (ii) to the extent that Drake's QoS requestor manager would have purportedly been implemented in Goossens2003's IP, Goossens2003 teaches away from such modification; and (iii) to the extent that Drake's QoS requestor manager would have purportedly been implemented outside of Goossens2003's IP that Petitioner and Dr. Mowry associate with Drake's source station (*supra* § IX.D.1.c, n.8), such as instead in Goossens2003's NOC, then based on my review, neither this modification of Drake's teachings nor any motivation therefor is argued by Petitioner and Dr. Mowry, and this modification

goes against the teachings of Drake, Petitioner and Dr. Mowry's positions, and the understanding of a POSITA.

271. **Limitation 6[b]-[d]**—I understand that limitations 6[b]-[d] recite, in part, that “said communication manager (CM) is adapted to forward said request (REQ) ... to said resource manager (RM),” and “said resource manager (RM) responding ... to said communication manager (CM)” “with the availability of the requested connection,” “wherein a connection between the first and second module is established based on the available properties.” I understand that Petitioner and Dr. Mowry rely on Drake's teachings for limitation 6[b]-[d], asserting that Drake's QoS requestor manager (alleged “communication manager”) sends a QoS request (alleged “request”) to the QoS allocator (alleged “resource manager”), the QoS allocator then sends a QoS allocation reply (alleged “respon[se]”), and a connection is established between source and target stations (alleged “first and second module”). Pet., 66-67 (referencing Pet., 41-44); Ex. 1003 at ¶¶196-98 (referencing EX. 1003 AT ¶¶131-34).

272. However, Petitioner and Dr. Mowry fail to establish motivation for limitations 6[b]-[d] because their analysis of limitations 6[b]-[d] contains no explanation for why and how Goossens2003 would be modified to include the relied-upon teachings of Drake. Pet., 66-67; Ex. 1003 at ¶¶196-98. For example, for limitation 6[b], Petitioner and Dr. Mowry merely assert that Goossens2003 and

Drake both describe requested connections with specific connection properties. Pet., 66; Ex. 1003 at ¶196. Petitioner and Dr. Mowry's 6[b] analysis contains no explanation for why or how Goossens2003 would be modified to include Drake's QoS requestor manager to forward a request to the alleged "resource manager" (i.e., Drake's QoS allocator), as opposed to Goossens2003's IP block just sending the request directly to the alleged "resource manager," which a POSITA would have understood could be done and would have been more direct and efficient. Pet., 66; Ex. 1003 at ¶196; *see also* Pet., 65 (acknowledging that Goossens2003's IP makes a service request similar to Drake's QoS request); Ex. 1003 at ¶¶193-95 (same). Also, for limitation 6[c], Petitioner and Dr. Mowry provide no discussion or citation of Goossens2003 at all, much less explanation for why or how Goossens2003 would have been modified such that the alleged "resource manager" sends a response about availability to a QoS requestor manager purportedly incorporated from Drake, as opposed to the alleged "resource manager" sending this response to Goossens2003's IP block that made the request, which a POSITA would have understood could be done and would be more direct and efficient. Pet., 66; Ex. 1003 at ¶197. Based on my review, Petitioner and Dr. Mowry's 6[c] analysis does not even establish that Drake's QoS allocation reply (alleged "respon[se]") is sent to the QoS requestor manager (alleged "communication manager") in Drake itself, and as explained, *infra* § IX.D.2.d, Drake does not teach

this. Pet., 66 (citing only Ex. 1003 at ¶197, which cites no support, and Petition section VII.A.7.d, which does not even mention Drake’s QoS requestor manager); Ex. 1003 at ¶197 (citing no support).

273. There was no motivation for such modifications for limitations 6[b]-[c] because if a POSITA was looking to implement Drake’s QoS system in Goossens2003 (although, they would not be), then the POSITA would have understood that the alleged “resource manager” (i.e., Drake’s QoS allocator) would have received the request directly from, and provided its response to, Goossens2003’s IP, not a QoS requestor manager. EX. 1006, 4:50-52 (“[QoS] allocator 20 ... receive[s] the QoS request from [source] station 10”), 11:22-38, 14:22-27 (teaching that QoS allocator 20 sends the response to source station 10); *supra* § IX.D.1.c, n.8 (explaining that Petitioner associates Drake’s source station 10 with Goossens2003’s IP); Pet., 34 (admitting that “a requesting module”—like Goossens2003’s IP—“sends a request to [Drake’s] [QoS] allocator 26”); Ex. 1003 at ¶115 (same). A POSITA would have understood that such direct communication between the alleged “resource manager” (i.e., Drake’s QoS allocator) and Goossens2003’s IP is actually comparable to communication between Drake’s QoS allocator and source station 10. Also, a POSITA would have understood that such direct communication between the alleged “resource

manager” (i.e., Drake’s QoS allocator) and Goossens2003’s IP is advantageous, for example, for purposes of timing, efficiency, and conservation of resources.

274. Also, for limitation 6[d], based on my review, Petitioner and Dr. Mowry merely assert that Goossens2003 and Drake both describe establishing the requested connection if resources are available, and Petitioner and Dr. Mowry provide no explanation for why or how Goossens2003 would be modified based on Drake when, according to Petitioner, both already allegedly perform similarly. Pet., 67; Ex. 1003 at ¶115.

275. Additionally, as discussed above, Dr. Mowry’s declaration is insufficient for establishing motivation for limitations 6[b]-[d]. Ex. 1003 at ¶¶196 (relying completely on “discuss[ion] above,” with a lone cite to his limitation 1[e] analysis, no citations or independent analyses of the asserted references, and no alleged motivation), 197 (relying completely on “discuss[ion] above,” with no independent analysis, discussion of Goossens2003, alleged motivation, or citations—including no support for the assertion that Drake discloses sending “a ‘QoS allocation reply’ to the QoS requestor manager” (it does not)), 198 (containing only separate discussions of Goossens2003 and Drake, with no alleged motivation).

e. Claim 10

276. I understand that Petitioner and Dr. Mowry rely on their analysis of limitations 6[a], 6[b], 1[g], 6[c], and 6[d] for limitations 10[a], 10[b], 10[c], 10[d], and 10[e], respectively. Pet., 69-70; Ex. 1003 at ¶¶205-09. Thus, Petitioner and Dr. Mowry fail to establish motivation for those limitations of claim 10 for the same reasons explained above with respect to limitation 1[g], claim 2, claim 6, and Petition Section VII.B.1 and Mowry Section IX.B Intro. Also, I understand that limitation 10[a] contains claim 10's first recitation of a "communication manager." Thus, Petitioner and Dr. Mowry fail to establish motivation for limitation 10[a] for the same reasons explained above with respect to claim 2. Also, I understand that limitation 10[b] contains claim 10's first recitation of a "resource manager." Thus, Petitioner and Dr. Mowry fail to establish motivation for limitation 10[b] for the same reasons explained above with respect to limitation 1[c].

2. The Alleged Combination of Goossens2003 and Drake Fails to Meet the Claim Limitations Regarding the "Communication Manager" and "Resource Manager"

277. Regardless of motivation to combine, the alleged combination of Goossens2003 and Drake does not disclose or render obvious the limitations of claims 2, 6, and 10 of the '449 Patent.

a. communication manager (Claim 2 and Limitation 10[a])

278. The alleged combination of Goossens2003 and Drake fails to teach the “communication manager” recited first in claim 2 and limitation 10[a]. Ex. 1001, 18:49-51, 19:33. For claims 6 and 10 and maybe claim 2, I understand that Petitioner and Dr. Mowry rely on Drake’s QoS requestor manager 12 as the claimed “communication manager.” Pet., 62-63, 65-66, 69, 52; Ex. 1003 at ¶¶187, 195-97, 205-06, 208; *supra* § IX.D.1.c, n. 7; *supra* § IX.D.1.d, n.9. However, I understand that Petitioner and Dr. Mowry rely on Drake’s source station 10 for the claimed “first module,”¹⁰ and QoS requestor manager 12 is completely within source station 10. EX. 1006, Fig. 1, 4:32-34, 4:62-65. Thus, QoS requestor manager 12 cannot constitute the “communication manager” because, as established *supra* § VIII.A, the “communication manager” is separate from, and cannot be within, the “first module.” That is, the claimed “first module” and “communication module” are separate and distinct, so since Petitioner and Dr.

¹⁰ For this section (i.e., § IX.D.2), I assume that Petitioner and Dr. Mowry rely on Drake’s source station 10 for the claimed “first module.” See Pet., 59, 26-27, 61, 31-32, 67, 43, 70; Ex. 1003 at ¶198; *supra* § IX.D.1.c, n.8.

Mowry associate Drake's source station 10 with the "first module," the QoS requestor manager 12 therein cannot constitute the "communication manager."

279. For claim 2, based on my review, Petitioner and Dr. Mowry may additionally or alternatively rely on Goossens2003's NI as the claimed "communication manager." Pet., 62-63; Ex. 1003 at ¶¶185-86; *supra* §§ IX.D.1.c, IX.B. As discussed above, *supra* § IX.B, this unclear and/or inconsistent position fails to clearly specify where the claimed "communication manager" is purportedly found in the prior art. Additionally, a POSITA would not have understood Goossens2003's NI to constitute the claimed "communication manager" because the '449 Patent teaches that the "communication manager" is different from such NIs. *See* EX. 1001, Figs. 1-3, 9:4-10:61; 18:49-51, 19:17-20. For example, the '449 Patent claims recite the "communication manager" and "network interface means" as separate elements, showing that they are distinct components. EX. 1001, 18:49-51, 19:17-20.

b. first module issues a request for a connection with the second module to a communication manager (Limitations 6[a], 10[a])

280. The alleged combination of Goossens2003 and Drake fails to meet limitations 6[a] and 10[a], which recite that a "first module [...] issue[s] a request [] for a connection with [said] second module[] to [said] communication manager." EX. 1001, 18:60-63, 19:32-33. I understand that, as explained above, *supra* §

IX.D.2.a, for claims 6 and 10, Petitioner and Dr. Mowry rely on Drake's source station 10 and QoS requestor 12 therein for the claimed "first module" and "communication manager," respectively. Pet., 65-66 (citing Petition section VII.A.7.b regarding limitation 6[a] in Ground 1), 40-41 (Petition section VII.A.7.b); Ex. 1003 at ¶¶195, 128-30; *supra* § IX.D.2.a, n.10; *supra* § IX.D.2.c, n.7; *supra* § IX.D.2.c, n.8; *see also* Pet., 69 (relying on limitation 6[a] analysis for limitation 10[a]); Ex. 1003 at ¶205 (same). Regardless of whether Drake's QoS requestor manager 12 meets the construction of "communication manager," Drake does not teach that ***source station 10*** (alleged "first module") ***issues a request to*** QoS requestor manager 12 (alleged "communication manager") as required for limitations 6[a] and 10[a].

281. A POSITA would have understood that in Drake, the request issued to QoS requestor manager 12 is issued by application 11, not source station 10. EX. 1006, Fig. 1, 4:18-37, 4:62-65. Petitioner and Dr. Mowry do not and cannot show that Drake teaches QoS requestor manager 12 receiving a request from source station 10 as a whole rather than specifically from application 11 therein. Indeed, based on my review, Petitioner and Dr. Mowry reference their 6[a] analysis for Ground 1, in which their only mentions of QoS requestor manager 12 admit that "*the application [11]* ... communicates this request to a QoS requestor manager" and "[t]he QoS requestor manager 12 interacts with *application [11]*." Pet., 40-

41 (quoting EX. 1006, 4:62-65) (emphases added), 65-66; Ex. 1003 at ¶¶130 (same), 195. Additionally, based on my review, I understand that Petitioner and Dr. Mowry both rely on their analysis for Ground 1 containing an annotated version of Drake's Figure 1 that highlights application 11 in particular, not source station 10 as a whole, and thus their own showing demonstrates that the request to QoS requestor manager 12 is issued by application 11, not source station 10. Pet., 41, 65-66; Ex. 1003 at ¶¶130, 195. Petitioner and Dr. Mowry therefore fail to show that source station 10 issues a request to QoS requestor manager 12.

282. Further, a POSITA would not have understood the request issued by application 11 to QoS requestor manager 12 to be issued by source station 10 based on the fact that application 11 and/or QoS requestor manager 12 are within source station 10. Also, a POSITA would not have understood source station 10 to issue a request to an internal component of itself. Rather, based on Drake's teachings discussed above, a POSITA would have understood that the request issued to QoS requestor manager 12 is issued by another internal component—i.e., application 11—not source station 10 as a whole.

283. A POSITA would have at least understood Drake's teachings from the same level for both issuing and receiving the request. That is, to the extent the request is considered to be issued by source station 10 (alleged "first module") rather than application 11 therein, then the request would likewise be understood to

be received by the source station 10, not QoS requestor manager 12 (alleged “communication manager”) therein. On the other hand, to the extent the request is considered to be received by QoS requestor manager 12 (alleged “communication manager”), not source station 10 as a whole, then the request would likewise be understood to be issued by application 11, not source station 10 (alleged “first module”) as a whole. Based on my review, Petitioner and Dr. Mowry rely on a warped reading of Drake by asserting that the request is issued by the entire source station but received by a particular component thereof.

284. I understand that the Board’s Institution Decision in the Qualcomm IPR found: “As for Patent Owner’s assertion that source station 10 as the claimed ‘first module’ cannot ‘issue a request’ to itself, the challenged claims do not specify what component in the ‘first module’ issues a request to the claimed ‘communication manager.’” IPR2024-01081, Paper 14 at 25. First, however, this finding ignores the plain language of the claims, which recite that the request is issued *by the first module itself*, not that some “component in the ‘first module’ issues a request to the claimed ‘communication manager’” as the Board hypothesizes. *Id.*; EX. 1001, 18:60-63, 19:32-33. Second, I understand that the Board relied only on the claims, without evidence of how a POSITA would have understood the claims or consideration of other intrinsic evidence. IPR2024-01081, Paper 14 at 25 (citing only the ’449 Patent’s claims). As explained above, *supra* §

VIII.A, based on the intrinsic evidence, a POSITA would have understood that the claimed “communication manager” cannot be completely within the “first module,” with no separateness between the two, including because the “first module” would not issue a request to itself. Third, based on my review, the Board’s finding addresses just the claims and not how a POSITA would have understood the teachings of Drake, as explained above.

285. Moreover, based on my review, Petitioner and Dr. Mowry do not rely on Goossens2003 to remedy the deficiency in Drake, including because their analysis contains only separate discussions of each reference. Pet., 65-66; Ex. 1003 at ¶¶193-95.

c. communication manager forwards the request to a resource manager (Limitations 6[b], 10[b])

286. The alleged combination of Goossens2003 and Drake fails to meet limitations 6[b] and 10[b], which recite “[said] communication manager ... forward[s] [said] request ... to [a] resource manager.” EX. 1001, 18:63-67, 19:36-37. For claims 6 and 10, I understand that Petitioner and Dr. Mowry rely on Drake’s QoS requestor manager 12 and QoS allocator 20 for the claimed “communication manager” and “resource manager,” respectively. Pet., 66 (citing Petition section VII.A.7.c regarding limitation 6[b] in Ground 1), 41-42 (Petition section VII.A.7.c); Ex. 1003 at ¶¶196, 131-32; *supra* § IX.D.2.a, n.10; *supra* §

IX.D.2.c, n.7; *see also* Pet., 69 (relying on limitation 6[b] analysis for limitation 10[b]); Ex. 1003 at ¶206 (same). Regardless of whether Drake's QoS requestor manager 12 meets the construction of "communication manager," Drake does not teach that QoS requestor manager 12 (alleged "communication manager") forwards the request it receives to QoS allocator 20 (alleged "resource manager") as required for limitations 6[b] and 10[b].

287. A POSITA would not have understood that Drake's QoS requestor manager 12 forwards a request to QoS allocator 20. A POSITA would have understood that Drake teaches that the request received by QoS allocator 20 is sent from source station 10, not from QoS requestor manager 12 therein. EX. 1006, Fig. 1, 4:50-54 ("allocator 20 ... receive[s] the QoS request from station 10"), 5:5-8 ("Allocator station 20 ... receives ... the QoS request from source station 10"), 9:52-10:8 ("included in the allocation request message" is "the source address field 52 (Source MAC Address)" "of the source ... station[]"), Fig. 3, 10:41-46 ("source station 10 actually sends a request to the allocator [20], Fig. 4; Paper 10 at 35-36, 39.

288. A POSITA would have understood that Drake teaches that QoS requestor manager 12, along with QoS protocol machine 13, merely "assemble[s]" and "format[s]" a request and sends it to transport protocol stack 15, not that QoS requestor manager 12 sends the request to QoS allocator 20. EX. 1006, 4:32-37

(describing that source station 10 uses “components 12 and 13 assemble a request”), 4:62-65 (describing that “QoS requestor manager 12 ... utilizes QoS protocol machine 13 to format the QoS request”), Fig. 1; Paper 14 at 34-35. A POSITA would have understood that after QoS requestor manager 12 assembles/formats the request, Drake teaches that source station 10 then uses transport protocol stack 15 and MAC entity 16 for formatting and launching on LAN 17, respectively, a request packet for sending the request to QoS allocator 20. EX. 1006, 4:37-40, Fig. 1; Paper 14 at 35. Thus, if a POSITA were to understand that any particular component(s) of source station 10 send or forward the request to allocator 20, it would be transport protocol stack 15 and/or MAC entity 16, not QoS requestor manager 12.

289. A POSITA would have understood that the mere fact that the request is *eventually* received by QoS allocator 20 does not mean that QoS requestor manager 12 forwards the request to QoS allocator 20. A POSITA would have understood that Drake does not disclose that QoS requestor manager 12 sends the request to QoS allocator 20 or that QoS allocator 20 receives the request from QoS requestor manager 12.

290. Indeed, based on my review, Petitioner and Dr. Mowry fail to show that QoS requestor manager 12 in particular sends or forwards the request to QoS allocator 20. Based on my review, both Petitioner and Dr. Mowry acknowledge

that Drake teaches that QoS requestor manager 12 merely *assembles* a request and that QoS allocator receives the request from *source station 10*, not specifically QoS requestor manager 12. Pet., 41-42, 66; Ex. 1003 at ¶¶131, 196. Based on my review, Petitioner and Dr. Mowry ignore that Drake’s source station 10 contains transport protocol stack 15 and MAC entity 16, which receive the request from QoS requestor manager 12 and send the request packet to QoS allocator 20. Pet., 41-42, 66; Ex. 1003 at ¶¶131-32, 196.

291. Moreover, based on my review, Petitioner and Dr. Mowry do not rely on Goossens2003 to remedy the two deficiencies described above in Drake, as their analysis does not allege a “communication manager” in Goossens2003. Pet., 66; Ex. 1003 at ¶196.

d. resource manager responding to the communication manager (Limitations 6[c], 10[d])

292. The alleged combination of Goossens2003 and Drake fails to meet limitations 6[c] and 10[d], which recite “[said] resource manager [] responding with the availability of the [target] connection to [said] communication manager.” EX. 1001, 18:67-19:2, 20:1-2. For claims 6 and 10, I understand that Petitioner and Dr. Mowry rely on Drake’s QoS allocator 20 and QoS requestor manager 12 and for the claimed “resource manager” and “communication manager,” respectively, and rely on Drake’s QoS allocation reply for the claimed “respon[se].” Pet., 66

(citing Petition section VII.A.7.d regarding limitation 6[c] in Ground 1), 42-43 (Petition section VII.A.7.d); Ex. 1003 at ¶¶197, 133; *supra* § IX.D.2.a, n.10; *supra* § IX.D.2.c, n.7; *see also* Pet., 69 (relying on limitation 6[c] analysis for limitation 10[d]); Ex. 1003 at ¶208. Regardless of whether Drake’s QoS requestor manager 12 meets the construction of “communication manager,” Drake does not teach that QoS allocator 20 (alleged “resource manager”) sends the QoS allocation reply (alleged “respon[se]”) to QoS requestor manager 12 (alleged “communication manager”), as required for limitations 6[c] and 10[d].

293. First, Drake does not disclose that allocator 20 sends the QoS allocation reply to QoS requestor manager 12 (alleged “communication manager”). A POSITA would have understood that Drake instead teaches that QoS allocator 20 sends the QoS allocation reply to source station 10 (alleged “first module”) in general. Ex. 1006, 4:54-57 (“station 10 is notified”), 8:20-29 (describing “QoS allocation reply” as a “message[] exchanged between the stations of the [LAN]”), 14:22-27 (“AllocationReply message is ... sent from allocator station 20 ... to source station 10,” and “source station 10 ... receives the AllocationReply message”), 11:22-48 (describing that allocation acceptance/denial messages in Fig. 5 are sent to, and received by, “source station 10”), 9:52-10:2 (describing a “QoS message,” such as QoS allocation reply, as including a “source address field 52 (Source MAC Address)” for the source station). As for QoS requestor manager 12,

a POSITA would have understood that Drake just discloses that QoS requestor manager 12 assembles/formats the QoS request, not that it receives any response. Ex. 1006, 4:32-37, 4:62-65.

294. Second, it is neither inherent nor obvious that QoS allocator 12 sends the QoS allocation reply to QoS requestor manager 12 within source station 10. A POSITA would have understood that the QoS allocation reply would not have necessarily been sent to QoS requestor manager 12, as the reply could have been sent to application 11 or some component not depicted in Drake's Figure 1. Further, to the extent the QoS allocation reply is sent to an internal component of source station 10 depicted in Fig. 1 (Drake includes no such teaching), in it would have been understood by a POSITA that the reply would be sent to application 11, not QoS requestor manager 12, because application 11 is the original requestor and is the component that sends a multimedia file via the established connection. Ex. 1006, 4:27-32 (disclosing "application 11 ... requests a QoS connection to the ... target station 29" and "[a]pplication 11 also is responsible for causing the transmission of the multimedia data stream ... to the target station 29"), 11:22-28 (describing that an "allocation acceptance message" is sent to source station 10 and then "the multimedia file is transmitted to the target station 29"). That is, in my opinion, to the extent that the QoS allocation reply is sent to one of the source station's components depicted in Figure 1, it would have been understood that

application 11 would receive the QoS allocation reply indicating whether the connection is available for such transmission. Also, a POSITA would have understood that even if the QoS allocation reply is sent to application 11 via the path shown by Drake's Figure 1 within source station 10, which purportedly includes QoS requestor manager 12, this would not constitute QoS allocator 20 "responding ... to" QoS requestor manager 12 (alleged "communication manager") "with the availability of the [target] connection," as recited by the claim limitations.

295. Lastly, based on my review, Petitioner and Dr. Mowry fail to establish that this limitation is disclosed or obvious in Drake. While Petitioner and Dr. Mowry's Ground 2 analysis asserts that "the QoS allocator ... sends a 'QoS allocation reply' to the QoS requestor manager," based on my review, the only cited support is their Ground 1 analysis. Pet., 66; Ex. 1003 at ¶197. And critically, I understand that **there is no mention of QoS requestor manager 12** (alleged "communication manager") in Petitioner's cited 6[c] analysis for Ground 1, the portions of Drake cited therein, or the corresponding portion of Dr. Mowry's declaration, much less any argument or showing that Drake discloses or even renders obvious that QoS allocator 20 sends the QoS allocation reply to QoS requestor manager 12. Pet., 42-43 (citing EX. 1006, 4:55-57, 8:20-29, 8:50-64, Fig. 5), 66; Ex. 1003 at ¶133 (same), 197. In fact, based on my review, I understand

that the portions of Drake cited by Petitioner and Dr. Mowry disclose that the QoS allocation reply is sent to source station 10, as described above. EX. 1006, 4:55-57, 8:20-29. Yet, based on my review, Petitioner and Dr. Mowry ignore this teaching in Drake that the QoS allocation reply is sent to source station 10, without any disclosure regarding the reply being sent to QoS requestor manager 12. *See* Pet., 42-43.

296. Moreover, based on my review, Petitioner and Dr. Mowry do not rely on Goossens2003 to remedy the deficiency in Drake, as their analysis does not discuss any teachings of Goossens2003. Pet., 66; Ex. 1003 at ¶197.

e. connection between the first and second module is established (Limitations 6[d], 10[e])

297. I have assumed for my analysis in this section (i.e., § IX.D.2) that Petitioner and Dr. Mowry rely on Drake's source station 10 for the claimed "first module." *Supra* § IX.D.2.c, n.8;. However, to the extent that Petitioner and Dr. Mowry seek to alternatively rely on Drake's application 11 as the claimed "first module," then the alleged combination of Goossens2003 and Drake fails to meet limitations 6[d] and 10[e], which recite, in part, "[the target] connection between the first and second module [is] established." EX. 1001, 19:2-5, 20:4-6. That is because, based on my review, I understand that neither Petitioner's analysis for limitations 6[d]/10[e] nor the corresponding portions of Dr. Mowry's declaration

mention Drake’s application 11, much less include argument or evidence that a “connection between” application 11 and Drake’s target station 29 (alleged “second module”) “[is] established,” as recited by these limitations. *See* Pet., 67 (citing Petition section VII.A.7.e regarding limitation 6[d] in Ground 1), 43-44 (Petition section VII.A.7.e); Ex. 1003 at ¶198, 134; *see also* Pet., 70 (relying on limitation 6[d] analysis for limitation 10[e]), 59, 67 (relying on Drake’s target station as the claimed “second module”); Ex. 1003 at ¶209 (relying on limitation 6[d] analysis for limitation 10[e]).

X. CONCLUSION

I reserve the right to modify or supplement my opinions, if necessary, based on further review and analysis of the evidence in this case, including review and analysis of information that may be provided to me subsequent to the date of this Declaration.

I declare under penalty of perjury under the laws of the United States that the foregoing is a true and correct reflection of my opinions. This declaration is executed this 19th day of November, 2024.

A handwritten signature in black ink, appearing to read "N. Bagherzadeh", written in a cursive style.

Dr. Nader Bagherzadeh