

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CISCO SYSTEMS, INC.,
Petitioner,

v.

ORCKIT CORPORATION,
Patent Owner.

Case IPR2023-00714
U.S. Patent No. 6,680,904

PATENT OWNER'S RESPONSE PURSUANT TO 37 C.F.R. § 42.120

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2013	“About Orckit-Corrigent: Executive Summary,” 2011

2014	<i>Orckit Corporation v. Cisco Systems, Inc.</i> , Case No. 2:22-cv-00276, (E.D. Tex., April 13, 2023), Defendant’s First Amended Invalidity Contentions (Cover Pleading)
2015	<i>Orckit Corporation v. Cisco Systems, Inc.</i> , Case No. 2:22-cv-00276, (E.D. Tex., April 13, 2023), Defendant’s First Amended Invalidity Contentions (Exhibit A - ’904 Patent Charts)
2016	<i>Orckit Corporation v. Cisco Systems, Inc.</i> , Case No. 2:22-cv-00276, (E.D. Tex., April 13, 2023), Defendant’s First Amended Invalidity Contentions (Exhibit B - ’821 Patent Charts)
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I. INTRODUCTION

Orckit Corporation (“Orckit” or “Patent Owner”) submits this Patent Owner Response (“POR”) to Cisco Systems, Inc.’s (“Petitioner”) Petition challenging claims 1-26 (the “Challenged Claims”) of U.S. Patent No. 6,680,904 (the “’904 Patent”).

The ’904 Patent is directed to novel methods and apparatuses for providing subscribers with access to high-speed communication networks. As the specification teaches, the cost of network bandwidth and the need to accommodate a large and variable number of subscribers accessing high-speed networks through “Digital Subscriber Line Access Multiplexer” (or DSLAM) systems, gave rise to the development of network access systems characterized by a “multi-shelf” architecture. *See, e.g.*, Ex. 1001 at 1:25-33. The ’904 Patent describes the prior art topologies employed by such systems; and it teaches apparatuses and methods that provide subscribers with access to high-speed networks with greater efficiency, robustness, and reliability. *See, e.g.*, Ex. 1001 at 1:34-2:3.

At a high level, the claims of the ’904 Patent recite a topology that includes the following elements, among others: (i) two network devices (e.g., network switches) termed “master units” that provide an interface between a core network (e.g., the internet) and a plurality of other network devices termed “slaves units;” (ii)

a number of “subscriber lines” that connect to each of the “slave units;” and (iii) a manner of connecting the “slaves” and “masters” (referred to as a “daisy chain”) in which the first slave is connected to the “first master,” the last slave is connected to the “second master,” and the slaves are otherwise connected to one another in series. This topology allows for enhanced scalability, since it permits serving more slaves—and therefore more subscribers—by simply adding slaves to a daisy chain without the need to add more masters or change the interfaces on existing masters. *See, e.g.,* Ex. 1001 at 6:33-36.

The claims of the '904 Patent further recite elements directed to the manner in which network data traffic is transmitted to and from the various network elements in the claimed multi-shelf access and network topologies. For some embodiments, in normal operations, downstream data traffic from the core network to the subscribers follows a path from the core network, via the first master and first slave, along the daisy chain, to the relevant slave and subscriber line. Likewise, upstream data traffic from subscriber lines to the core network, is passed from the relevant subscriber line, via the corresponding slave, first slave, and first master, to the core network. Such embodiments require that the “first master” operate as an active master that passes data to and from the core network, while each slave facilitates

traffic by either passing data to the next slave on the daisy chain or alternatively to a subscriber line associated with that slave. *See, e.g.*, Claim 4.

The claims of the '904 Patent claims further recite a number of fault protection mechanisms designed to minimize the network access disruption experienced by subscribers in the event of faults that may occur in a number of different places along the network, including the slaves, the masters, or the lines that connect different network devices. For example, claim 5 requires a “protection interface” that “couples the second master unit to the first master unit, and over which ... data packets are conveyed between the first and second master units in case of a fault,” such that the second master may provide redundancy in case of a fault in the first master. Likewise, Claim 6 requires the first master to “bicast[] the upstream data packets that it receives from the slave units to the network and ... to the second master unit” and the “second master” to “transmit[] the upstream data packets to the network.” Addressing potential faults along the daisy chain or in one or more of the “slaves,” claim 7 requires that, in the event of a fault, “data flow in a portion of the daisy chain between the location of the fault and the second master unit is reversed,” and downstream data packets are “passed from the second master unit to ... the last slave unit in the chain” and from there to the appropriate slave unit corresponding to

the relevant subscriber and “upstream data packets are passed by the last slave unit to the second master unit.”

The combination of these and other elements found in the claims of the '904 Patent improve upon the scalability, efficiency, and fault-tolerance of prior art multi-shelf access architectures that were used for providing subscribers with access to a core network. Petitioner effectively concedes that the combination of the elements recited in the claims of the '904 Patent is novel, as it has failed to identify any reference that combines all of the elements in the '904 Patent. Petitioner asserts that the claims are obvious in light of two prior art references (Vink and Patrick) and the descriptions of prior art multi-shelf systems found in the '904 Patent itself (referred to in the petition as Applicant Admitted Prior Art or “AAPA”).

The Board should reject Petitioner’s grounds. As an initial matter, Petitioner’s asserted prior art does not disclose all of the claimed elements in the challenged claims, and Petitioner has failed to provide specific reasons for which a POSA would have combined the prior art it has asserted. As explained above, the '904 Patent is directed to multi-shelf access systems for subscriber-based networks in which “masters” provide an interface between a core network and slaves that serve subscribers. Petitioner’s primary reference, Vink is directed to local area networks that consist entirely of masters, slaves, and undefined input/output modules; and

Vink does not disclose or otherwise suggest (a) a core network, lines to subscribers, and various other claimed elements (e.g., the specific manners of directing traffic in the event of a fault); (b) a reason for which a POSA would adapt Vink's disclosed topology to serve subscribers in the manner claimed by the '904 Patent claims; or (c) how Vink's system *could* be adapted by a POSA to form part of a broader network (a task that required specialized knowledge as of 1999 when the '904 patent application was filed). Petitioner's asserted Patrick reference includes a "core" network, but it (a) describes an entirely different topology than the topologies of the '904 Patent and of Vink; (b) fails to provide any motivation for adapting Vink's topology in light of Patrick for serving subscribers; and (c) fails to provide any direction on how a POSA would adapt Vink's topology (which Vink describes as suited to hospitals or factories and not subscriber-based systems) so that it could be utilized in a subscriber-based network with access to a core network. Likewise, the AAPA multi-shelf access topologies described in the '904 Patent do not suggest that it would be desirable—or even practical—to implement Vink's master/slave topology in a subscriber-based network.

In short, a POSA reviewing Vink, Patrick, and the prior art systems described in the '904 Patent as of the relevant 1999 timeframe would have (i) no reason to combine these references, (ii) no guidance on how to combine them, and (iii) no

reason to believe that such a combination would be successful or require no more than ordinary skill. Indeed, when pressed on these points at his deposition, Petitioner's expert Dr. Houh could offer no more than conclusory opinions based on nothing more than his own say-so. Given that Petitioner's challenge cannot stand on *ipse dixit*, the Board should reject it and uphold the claims on this basis alone.

Besides the deficiencies in the Petition, as explained in detail below and in the declaration of Patent Owner's expert Miguel Gomez, the primary references upon which Petitioner relies (Vink and Patrick) are directed to entirely incompatible types of networks. A POSA faced with the problem of improving a multi-shelf access system such as the systems described in the '904 Patent and AAPA would not have looked to Vink or Patrick, or combined these two references. Moreover, as Mr. Gomez explains in his declaration, a POSA attempting to combine Vink and Patrick would have faced significant challenges beyond the level of ordinary skill, which would have deterred such a combination.

Accordingly, for these reasons, and as explained in further detail below, Patent Owner respectfully asks that the Board issue a Final Written Decision finding all challenged claims patentable over the asserted prior art.

II. BACKGROUND

A. Procedural History

This proceeding is one of four IPRs filed by Petitioner against Patent Owner. The other IPRs are IPR2023-00401 (U.S. Pat. No. 7,545,740), IPR2023-00402 (U.S. Pat. No. 8,830,821) and IPR2023-00554 (U.S. Pat. No. 10,652,111). Each of the '740, '821, '111 and '904 Patents was asserted by Patent Owner against Petitioner in *Orckit Corporation v. Cisco Systems, Inc.*, Case No. 2:22-cv-00276 (E.D. Tex. July 22, 2022) (the “District Court Case”). Patent Owner and Petitioner have agreed to a jointly stipulated dismissal of the district court litigation without prejudice. Ex. 2024 [Stipulation of Dismissal].

B. Patent Owner

Orckit Corporation owns the '904 patent, which originated from significant research and development by Orckit Communications Ltd. (also known as Corrigent-Systems Ltd., referred to herein as “Orckit-Corrigent”).

Orckit-Corrigent was founded in 1990 in Israel by Izhak Tamir and Eric Paneth. Orckit-Corrigent’s products offered networking infrastructure for the delivery of residential, business, and mobile backhauling services in packet-based networks.

By the early 2000s, Orckit-Corrigent was a pioneer in telecommunications, with revenues some years exceeding \$500M from sales to various tier 1 global telecommunications providers. Over the years, Orckit-Corrigent and its subsidiaries

developed and sold products in a variety of telecommunications areas, including DSL, Packet Transport Networks (PTN), Carrier Ethernet technologies, PWE (Pseudo-Wire Emulation) technology, and Resilient Packet Ring (RPR) technology, which was developed and introduced to the market as the IEEE 802.17 Standard, part of the company's packet transport technology. In 2007, Orckit-Corrigent launched its CM4000 PTN line of products, which were purchased and deployed by telecom providers worldwide, including leading Indian carrier Bharat Sanchar Nigam Ltd. (BSNL); T-Systems (Deutsche Telekom) in Germany; Tele2, a leading Pan-European Scandinavian Service Provider; redIT (formerly MetroNet) in Mexico, and others. At one time, Orckit-Corrigent had offices in Israel, US, India, Japan, Korea, Germany, Russia, Brazil, Mexico, Thailand, and the Philippines.

Orckit-Corrigent also engaged in extensive research and development (investing over \$200M) and prosecuted an extensive patent portfolio. Many of the patents in this portfolio were practiced by its products, notably, the CM-4000 product family, which was a series of packet transport network switches (consisting of, among other products, the CM-4140, CM-4206 and CM-4314T/4314 models), and the CM-401x portfolio of switches that included the CM-4011, CM-4012 and CM-4013 products. Ex. 2014 [Orckit-Corrigent Executive Summary].

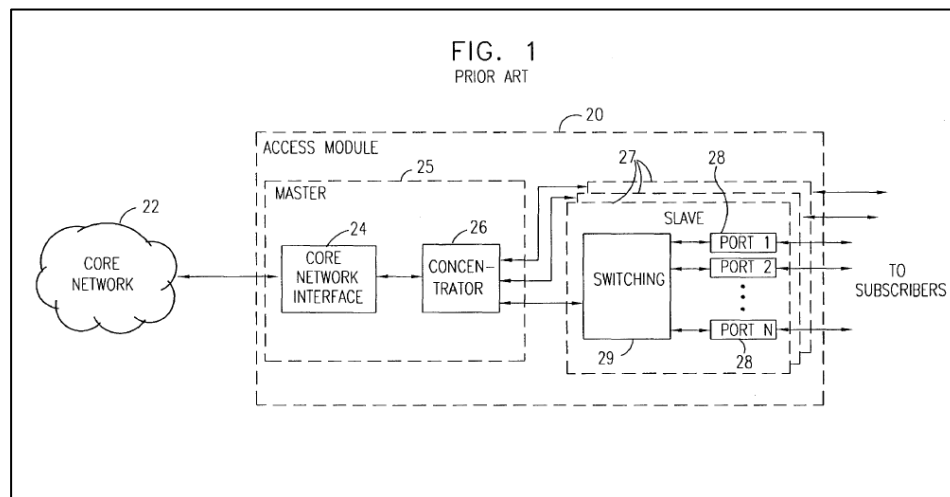
In 2012, Orckit-Corrigent entered into debt restructuring/bankruptcy proceedings in Israel. After a series of transactions that followed the Israel proceedings, Orckit Corporation acquired a smaller set of Orckit-Corrigent's patents, including the '904 patent.

C. '904 Patent

The '904 Patent is titled “Bi-directional chaining of network access ports” and is directed to apparatuses and methods for providing network subscribers with access to a core network. Ex. 1001, 1:34-39, 2:4-22, claims 1, 4, 9, 11, 14, and 19. In particular, the '904 Patent claims are directed to improved subscriber line access systems (e.g., the “Digital Subscriber Line Access Multiplexer (DSLAM) systems”) through which subscribers connect to high-speed networks. *See, e.g.*, Ex. 1001 at 1:25-33.

As the '904 Patent explains, subscribers of network access services (e.g., “DSL subscribers”) connected to high-speed networks through access systems (e.g., “DSLAM”) that, due to the “high cost of network bandwidth,” had to be designed to serve “between 100 and 1000 subscribers” and “concentrated their traffic through one or a few network trunks.” *Id.* “The need to serve such a large and potentially variable number of subscribers in [each such system] led to the development of ‘multi-shelf’ access architectures.” *Id.*

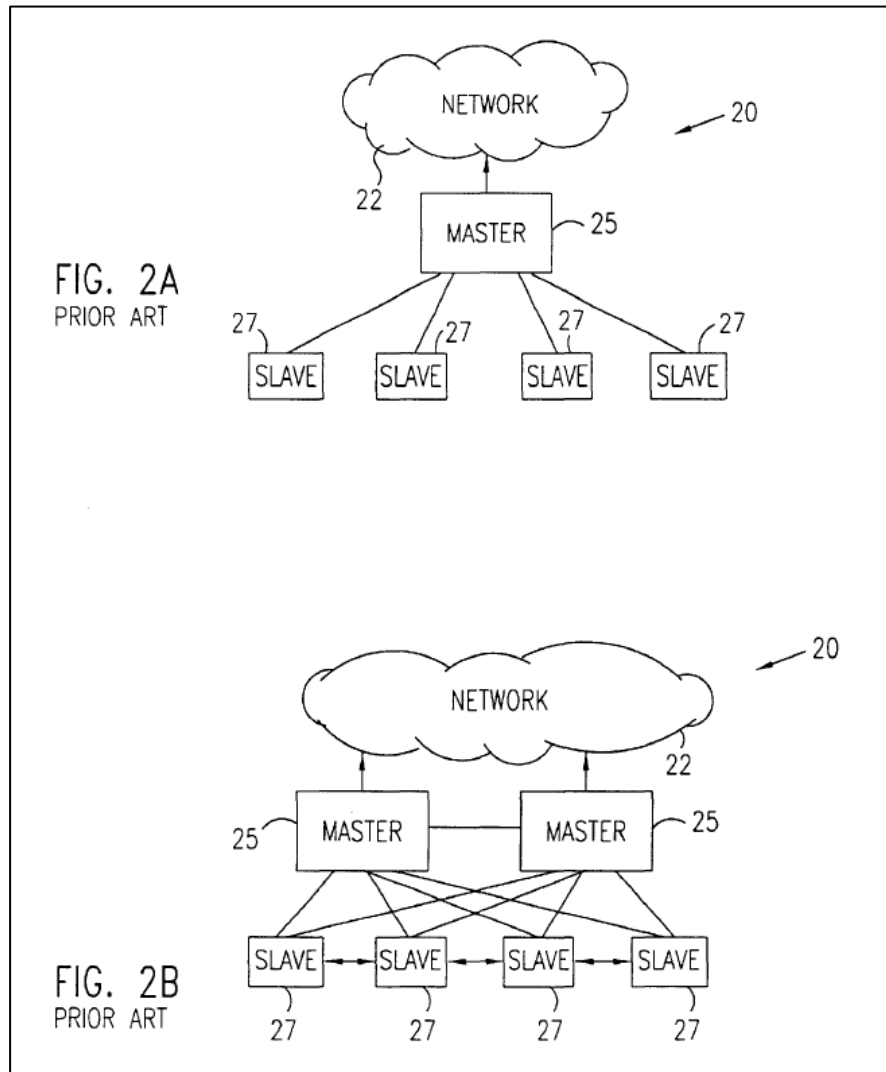
The patent provides examples of multi-shelf architecture systems and related topologies that were known in the art at the time of the invention. For example, Fig. 1, which is excerpted below, shows a prior art multi-shelf access system in which subscriber lines obtain network access to a “core network” through an “access module” that consists of: (i) a master (i.e., a network device providing a “core” interface through which data is received from a plurality of downstream “slave” units and transmitted upstream to the core network) and (ii) a number of slave units that switch traffic received to/from ports to various subscribers. *See, e.g., Ex. 1001 at 1:34-51, 6:22-53, Fig. 1.*



Further, the '904 Patent provides examples of multi-shelf system topologies that were known in the art. For example, as shown in Fig. 2A, in a “star” topology, each slave is connected only to a single master, and as shown in Fig. 2B, in a “redundant star” topology, each slave unit is connected to two or more alternative

master units, so as to provide protection in case of a failure in one of the master units.

See, e.g., Ex. 1001 at 1:52-59.

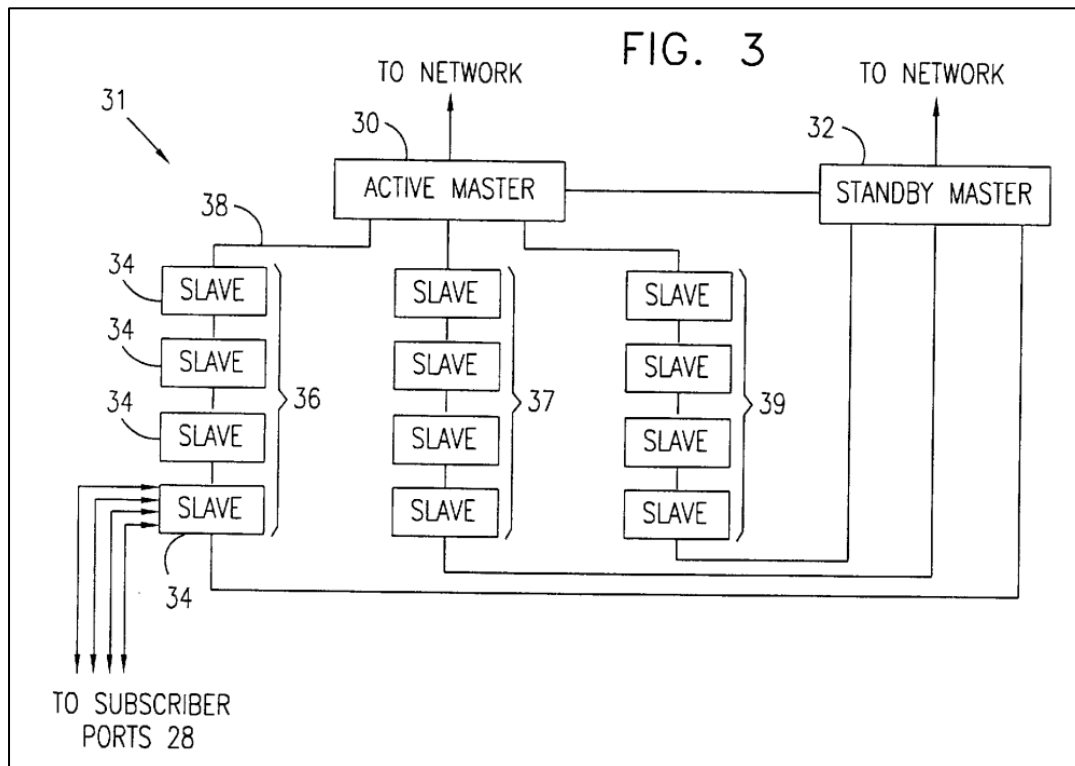


The '904 Patent is directed to apparatuses and methods that improve upon prior art multi-shelf access architecture through a multi-shelf access system that provides efficient, high-speed transfer of data packets with improved robustness and reliability.

The claims¹ of the '904 Patent are directed to apparatuses and methods for deploying multi-shelf network access systems that generally utilize—among other elements—the following elements and features: (i) two network devices termed “master units” (“first” and “second”) that provide a “physical interface” to a “packet-switched network” (*e.g.*, a “core network” such as the internet); (ii) a plurality of network devices termed “slave units” (*e.g.*, network switches) that comprise “one or more ports to respective subscriber lines;” (iii) one or more “daisy chains” of slave units in which the slaves are connected in series (*i.e.*, such that a first slave is connected to the second slave, the last slave is connected to the second-to last slave, and every slave in between is connected to the slave immediately preceding it and to the slave immediately succeeding it); and (iv) in each daisy chain, the first slave is connected to the first master unit but not the second master unit, and the last slave

¹ The '904 Patent has 6 independent claims (1, 4, 9, 11, 14, 19) and 20 dependent claims, all of which are at issue in this proceeding. Consistent with the description in the '904 Patent, the claims recite apparatus, systems, and methods comprising, for example, first and second master units interfaced with a packet-switched network and linked to a plurality of slave units in one or more daisy chains.

is connected to the second master unit but not the first master unit. *See, e.g.,* Ex. 1001, abstract, 2:4-22, claims 1, 4, 9, 11, 14, 19. Figure 3 shows an exemplary embodiment of the claimed invention:



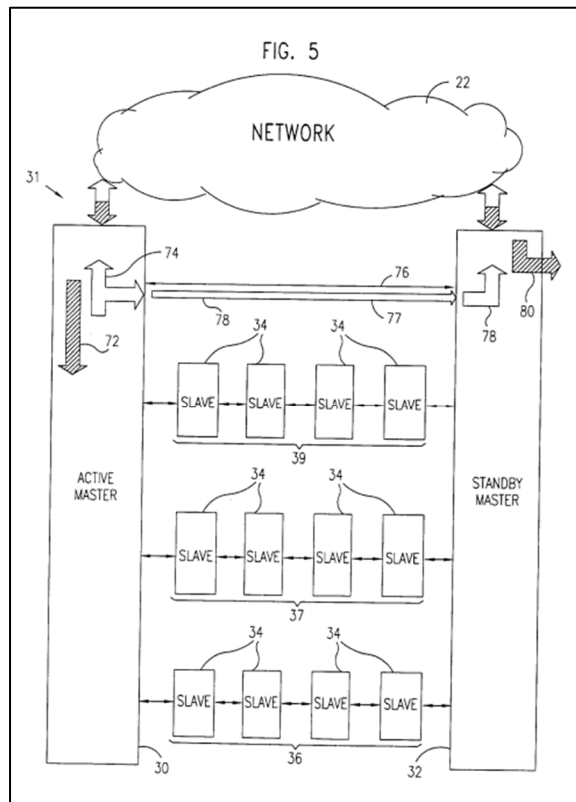
Ex. 1001, Fig. 3.

In the embodiment of Fig. 3, the two master units 30 and 32 are linked to one another and to a plurality of slave units, each of which belongs to one or more daisy chains 37, 38, and 39. Ex. 1001, 6:21-36. “Each slave comprises multiple subscriber ports 28, which link system 31 to respective subscriber locations.” *Id.*

In the embodiment of Fig. 3, the two masters are designated “active” and “standby.” “Master 30 is termed the active master, because in normal operation of

system 31, i.e., in the absence of faults in the system, downstream traffic from the network is routed from master 30 down chains 36, 37 and 39 to the respective slaves 34. Upstream traffic from the slaves is likewise routed up the chains to master 30.” Ex. 1001, 6:38-54. “In case of a fault in one of chains 36, 37 or 39[,] the traffic direction in all or a part of the faulty chain is reversed. Packets are then directed between some of the slaves and standby master 32, rather than directly between the slaves and active master 30. When a serious failure occurs in the active master, all traffic may be directed through the standby master.” Ex. 1001, 6:38-54.

“FIG. 5 is a block diagram that schematically illustrates details of data packet flow in system 31 under normal, fault-free conditions.” Ex. 1001, 8:31-41.



Ex. 1001, Fig. 5. “Hatched arrows, such as an arrow 72, represent downstream data flow, while unfilled arrows, such as an arrow 74, represent upstream data flow. Packets received from network 22 are routed by active master 30 down each of chains 36, 37 and 39, as indicated by arrow 72.” Ex. 1001, 8:31-41.

The '904 Patent teaches that advantages of this architecture include robustness and scalability. In particular, the claimed embodiments provide redundancy by deploying a second master, limit the effects of faults in the slaves, for example, by reversing the direction of data traffic in the event of a fault in one of the daisy chains, and allow for the addition of more slaves “as needed, without having to change the

number of interfaces associated with masters 30 and 32.” Ex. 1001, 2:46-52, 4:4-38, 6:34-36.

1. Prosecution History

The '904 Patent was filed as Appl. No. 09/472,683 on December 27, 1999. Ex. 1001. On February 4, 2003, the Examiner issued a non-final rejection rejecting some claims based on applicant-admitted prior art but allowing others. Ex. 1002, 157. On June 18, 2003, Applicant traversed the rejection by amending the rejected claims to recite additional elements, such as “a second slave unit connected to the first slave unit but not to the first or second master unit.” Ex. 1002, 169. The '683 Application subsequently issued as the '904 Patent on January 20, 2004. Ex. 1001.

D. Petitioner’s Cited References and Challenged Claims

The Petition asserts the following two grounds:

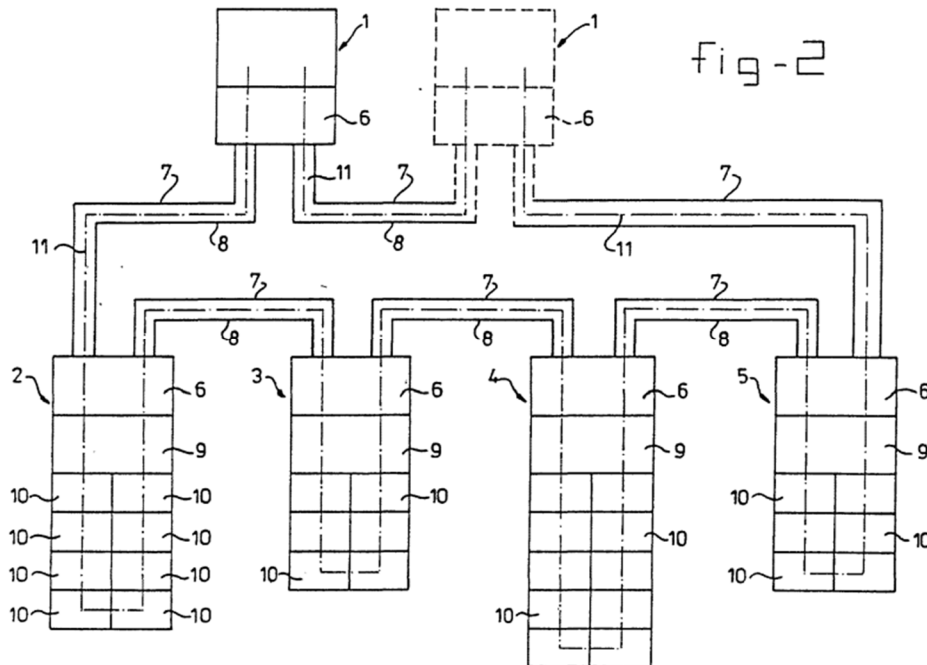
Ground	Claims	Basis
#1	1-26	35 U.S.C. § 103 over Vink and Patrick
#2	1-26	35 U.S.C. § 103 over Vink, Patrick, and AAPA

Paper 1, 2-3.

1. Vink (Ex. 1005)

International Patent Publication No. WO 91/14324 to Vink is titled “Method and communication system for the bit-serial exchange of data” and describes a system comprising a master station (1) connected to substations (slaves) (2, 3, 4, 5)

via transmission rings (7, 8) as shown by Figure 2 below:



Ex. 1005, Figure 2. “The master 1 and the slaves 2, 3, 4, 5 are mutually connected via a double-ring transmission system composed of transmitting/receiving units 6 and transmission lines 7, 8. The transmission lines 7, 8 may, for example, consist of coaxial cable, optical fibre cable and the like.” Ex. 1005, 15:31-35.

“The master station and the substations of said communication system each form a node between which information is bit-serial exchanged.” Ex. 1005, 11:9-11.

“Each slave 2, 3, 4, 5 comprises a control module 9 which is connected to the associated transmitting/receiving unit 6 and to which one or more input (I) and/or

output (0) module(s) are connected. The number of I/O modules 10 to be connected to a control module may vary from slave to slave depending on its function, for example controlling a measurement and control process.” Ex. 1005, 15:36-16:4. “The operation of the relevant transmission ring 7, 8 can be monitored by means of line error detectors 15.” Ex. 1005, 17:10-13. “[T]he data bits by the slave or the I/O modules can take place in synchronism with the transmission of the data bits via the transmission system 7, 8. All these features result in a transparent communication structure.” Ex. 1005, 17:25-29.

2. Patrick (Ex. 1006)

U.S. Patent No. 5,790,541 to Patrick et al. (“Patrick”) is titled “Apparatus, method, system and system method for distributed routing in a multipoint communication system” and describes a method and system “for distributed internetwork routing of information in a communication system.” Ex. 1006, abstract. The system may comprise a primary station 101 connected to a network 105 and a plurality of secondary stations 110 as shown in Fig. 1. Ex. 1006, 3:11-15. The connection between the primary station and secondary stations may be a hybrid optical fiber, a coaxial cable, a fiber optic cable, a twisted pair wires, or wireless and satellite communication. Ex. 1006, 3:15-20. The connection between the primary station and the network may be through “the Internet, on line services, telephone and

cable network.” Ex. 1006, 3:20-24.

Patrick further discloses that, in the prior art, a terminal may be connected to a MAC network such as a LAN or ATM network. Ex. 1006, 5:39-49, 2:36-39. Patrick however criticizes these connections as “problematic.” In particular, Patrick provides that:

The prior art routing methodology illustrated in FIGS. 6 and 7, as mentioned above, is problematic when applied to the IP routing protocol in a centralized network involving potentially thousands of geographically distributed secondary nodes. Such a network is envisioned when ATM or other metropolitan-area networks provide connections of millions of consumer homes to the Internet. The principal problem is the relative dearth of IP addresses, as the IP protocol uses only 32 bits to encode both the network portion and the host portion of the internetwork address. Ex. 1006, 8:36-56.

E. Level of Ordinary Skill

The Institution Decision adopted Petitioner’s level of ordinary skill. DI, 5-6. For purposes of this Patent Owner Response, Patent Owner does not dispute Petitioner’s proposed level of ordinary skill.

III. CLAIM CONSTRUCTION

Although the Petition proposed a construction for the term “second master unit,” the Institution Decision “determine[d] that no terms need to be construed at this time.” D.I., 6; *see Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms...that are in controversy, and only to the extent necessary to resolve the controversy.’”).

For the purposes of this Response, Patent Owner submits that “subscriber lines” should be construed as “communication lines to users of subscription-based network services.” The term “subscriber lines” appears in all of the independent claims, and Patent Owner’s proposed construction reflects the term’s plain and ordinary meaning. The specification provides contemporaneous examples of such subscriber lines, for example, a “Digital Subscriber Line (DSL)” that the patent describes as a communication line “that enables broadband digital data to be transmitted over twisted-pair wire, which is the type of infrastructure that links most home and small business subscribers to their telephone service providers.” Ex. 1001, 1:10-14. The specification thus makes clear that the claimed subscriber lines must be part of a broader infrastructure used by network providers to provide subscribers with access to a network, rather than simply connections between devices deployed in a local network.

The patent further explains that the claimed subscriber lines “enable users to access digital networks at speeds tens to hundreds of times faster than current analog modems and basic ISDN service” and “thus opens the most critical bottleneck in local-loop access to high-speed networks, such as Asynchronous Transfer Mode (ATM) and Internet Protocol (IP) networks, without requiring major investments in new infrastructure.” Ex. 1001, 1:14-24. And, the patent goes on to provide examples of a multi-shelf architecture that can be used to connect thousands of subscribers utilizing a multi-shelf access system to a high-speed network:

A range of DSL Standards have been defined, known generically as “xDSL,” wherein the various standards have different data rates and other associated features but share common principles of operation. DSL Subscribers are connected to high-speed networks through Digital Subscriber Line Access Multiplexer (DSLAM) systems. Because of the high cost of network bandwidth, a single DSLAM must typically be designed to serve between 100 and 1000 Subscribers and to concentrate their traffic through one or a few network trunks. The need to Serve Such a large and potentially variable number of subscribers in the one DSLAM has led to the development of multi-shelf access architectures. Ex. 1001, 1:20-24.

Further, the patent describes a preferred embodiment with protective mechanisms designed to minimize the disruption that may be experienced by

subscribers using multi-shelf access systems to access those high-speed networks, which the patent describes as “core networks:”

In preferred embodiments of the present invention, a multi-shelf access system comprises two master units (“masters”) and a plurality of slave units (“slaves”) One of the masters serves as an active master, through which the slaves normally receive data packets from a core network and transmit packets back upstream to the network. The other master is termed a standby master. The slaves are connected in one or more daisy chains between the active and standby masters, and are configured so that both downstream and upstream packets can be transmitted in either direction along each of the chains, i.e., from or to either of the two masters. Thus, if a failure occurs in any one of the slaves or in a link between them, the traffic direction in the chain in which the failure has occurred is simply reversed so as to run through the standby master. Substantially no reprogramming of the slaves is required for this purpose. All of the slaves (except possibly a slave that has failed) continue to provide service to subscribers, typically with only a short interruption until corrective action is completed. Ex. 1001, 2:4-27.

Accordingly, the claims and the specification make clear that “subscriber lines” are “communication lines to users of subscription-based network services.”

IV. NO COMBINATION OF THE CITED PRIOR ART REFERENCES TEACHES OR SUGGESTS EVERY LIMITATION OF THE CLAIMS

As discussed below, Vink—by itself or in combination with Patrick and AAPA—does not render obvious any of claims 1-26 of the '904 Patent.

As an initial matter, Vink teaches a topology for a local area network (“LAN”) used to connect devices having I/O modules to associated peripheral devices. Vink’s LAN is not connected to a “core network” that is external to its LAN, and Vink does not teach connecting its LAN to such a network. Consistent with its focus on LANs, Vink does not teach (i) two master units that comprise a physical interface to a packet-switched network; (ii) slave units that comprise ports to “subscriber lines” (i.e., “communication lines to users of subscription-based network services”); or (iii) other limitations in the claims that are directed to providing reliability and redundancy to methods and apparatuses used for providing core network access to subscribers.

Further, to the extent that Patrick or AAPA suggests an interface to an external or “core” network, a POSA would not have been motivated to combine Vink with either Patrick or AAPA. Indeed, Petitioner has failed to provide any motivation for such a combination in the prior art or as part of a POSA’s level of skill in the art other than conclusory opinions from its expert Dr. Houh. Moreover, as explained by Patent Owner’s expert Miguel Gomez, attempting such a combination—i.e., of

the LAN disclosed in Vink and a subscriber-based system such as those to which Patrick and AAPA are directed—would have required knowledge above the level of ordinary skill as of the priority date of the '904 Patent. Indeed, as even Petitioner's expert admitted at his deposition, Vink, Patrick, and AAPA do not teach a POSA how to perform the specific steps required for such a combination.

A. Claims 1, 4, 11, 14, and 19: Vink in view of Patrick and AAPA does not render obvious “master units...comprising a physical interface to a packet-switched network”²

1. The '904 Patent Claims are directed to core network access systems in which two masters provide an interface to a core network.

The '904 Patent describes a preferred embodiment of the invention as “a multi-shelf access system” in which an active master unit provides network access to slave units that comprise ports to subscriber lines by “receiv[ing] data packets from a core network” and “transmit[ting] packets back upstream to the network.” Ex. 1001, 2:6-10. The '904 Patent is thus expressly directed to a topology for providing network access to subscribers. Consistent with the preferred embodiment,

² As every challenged independent claim requires a physical interface to a packet-switched network, this argument also applies to all their dependent claims (i.e., all of claims 1-26 require a physical interface to a packet-switched network).

the Challenged Claims require (i) two master units that comprise “a physical interface to a packet-switched network;” (ii) slave units that are connected to one another in one or more “daisy chains;” and (iii) a “first slave unit” in each daisy chain “connected ... to the first master” as well as a “last slave unit connected ... to the second master unit.” Given that the masters must provide an interface to a packet-switched network, a POSA would thus readily understand that the claimed “packet-switched network” is a “core” network that is external to the one or more loops formed by the two masters and each of the daisy chains. Ex. 2005, ¶¶56-57. That the masters provide an interface to an external, core network—*i.e.*, a subscriber-based network such as the internet—is further reinforced by the requirement in the claims that each of the slave units comprise ports leading to “subscriber lines.” *Id.* Accordingly, the presence of an external network—and that the claimed master units provide an interface to such a network—is a key limitation of the claims in the ’904 Patent. As explained below, Vink fails to disclose this limitation and to render it obvious in view of Patrick and AAPA.

2. Vink discloses a LAN topology in which there is no interface to a core network, let alone through two masters, as required by the claims.

In contrast to the claims of the ’904 Patent, Vink is directed to a materially different communication system in which the masters do not provide an interface to

an external network and no device in Vink is even connected to such a network. Ex. 1005, 1:6-15; Ex. 2005, ¶¶58-60. Vink does not disclose any connection to an external network. Instead, Vink describes a local area network in which devices are connected by coaxial cables and the like to one or more masters in a cascade arrangement. Ex. 1001, 1:11-34. Vink teaches that its cascade arrangement may be used to improve connections between devices that connect to one another on a local area network, which Vink describes as generic commercial equipment (I/O modules) used under the control of a master station:

The invention relates to a method and a communication system for exchanging data in discrete or digital form with one or more input (I) and/or output (O) modules, by means of serial transfer of data bits under the control of at least one master station (master). Communication systems of this type are in practice known per se. Examples are the so-called “Local Area Networks” (LAN’s) in, inter alia, office, factory, hospital and production environments. *Id.*, 1:6-15

Vink discloses that the commercial equipment in its LAN may be further connected to peripheral devices that utilize local data buses such as VME and SCSI and local data protocols to achieve the connections; and, further, Vink identifies delay issues known in the art with respect to such systems’ ability to provide the

“cause and effect unambiguousness” that is required in the “control environments” in which those systems are deployed:

Communication systems constructed in accordance with the LAN concept generally have the disadvantage that, for use in, for example, industrial measurement and control environments having a large number of I/O points (for example 1,000 or over), they are too slow to be able to fulfil the required cause-and-effect unambiguousness, owing, among other things, to the communication protocols needed. Because the information is transferred bit serially via the network but, on the other hand, is generally processed in parallel by the stations connected via bus networks, such as the known VME bus and SCSI bus, used for coupling microcomputer systems and peripheral equipment, a further delay can arise as a consequence of the required parallel-to-serial (P/S) and serial-to-parallel (S/P) conversion, which may be understood as follows. Ex. 1005, 2:5-17

Consistent with these disclosures, Vink discloses a closed network of devices that does not provide access to an external (or “core”) network. Ex. 2005, ¶60. In particular, Vink is directed to a “method and communication system [that purports to] provide unambiguousness in the communication of cause-and-effect relationships at the I/O level, in particular, for measurement and control applications, monitoring purposes and data acquisition.” Ex. 1005, 2:5-17. Moreover, there is no

teaching in Vink about connecting its local network to a core network, let alone by providing an interface to a core network through its masters.³ Ex. 2005, ¶¶58-60.

3. A POSA would not modify Vink to provide an interface to a core network.

The Petition effectively concedes that Vink does not disclose masters that comprise a physical interface to a packet-switched network (i.e., a core network), as it does not allege that Vink’s local network is connected or provides access to an external network. Paper 2, 20. Instead, Petitioner asserts that Vink could be modified to provide access to such a network based on Patrick or AAPA. Paper 2, 21-22. Petitioner’s assertion fails because: (i) there are several reasons why a POSA would not have been motivated to modify Vink’s masters for external network access, including that Vink’s disclosed system is incompatible with providing access to an

³ Vink distinguishes the LAN networks to which its disclosure is directed from “public networks equipped with cables or radio links” that are used for providing “point-to-point connections between two stations” in its disclosure. Ex. 1005 at 1:16-23. There is no other mention of wide area networks in Vink; and there is no suggestion that its LAN should be connected to such networks, let alone in the manner described in the ’904 Patent.

external network; (ii) Petitioner has failed to provide sufficient reasons for which a POSA would have nevertheless attempted to modify Vink in light of Patrick and AAPA to provide access to an external network, let alone in the specific manner required by the claims of the '904 Patent; and (iii) to the extent that a POSA would have even attempted to modify Vink in the manner claimed by Petitioner, such a modification would have required skill beyond the ordinary level of skill as of the priority date of the '904 Patent. Ex. 2005, ¶¶61-75.

First, a POSA would not have used (or adapted) Vink to provide subscribers with access to a core network because Vink's system is limited to a local area network that utilizes communication protocols that a POSA would understand to be incompatible with systems—such as those described by the '904 Patent or AAPA—used to provide subscribers with access to an external network. Ex. 2005, ¶¶62-69.

For example, a POSA would know that providing subscriber devices on a LAN (e.g., computers or other peripherals) with access to an external packet-switched network (such as the Internet), those devices and other network elements (e.g., slaves) would require the assignment of a hierarchical address, which Vink effectively teaches against. Ex. 2005, ¶¶62-64.

A hierarchical address is an address having multiple levels (a hierarchy), with each level identifying a specific subnetwork in the hierarchy. Ex. 2005, ¶62. As

explained by Patent Owner's expert Miguel Gomez, the Internet can be thought of as divided into multiple subnetworks, each of which may comprise multiple smaller subnetworks. Ex. 2005, ¶62. The last subnetwork in that hierarchy of subnetworks typically identifies specific machines that may connect to one another as well as gain access to the core network through the same subnetwork. *Id.* Consistent with this hierarchical arrangement of subnetworks, IP addresses used on the Internet identify the highest level subnetwork, followed by the lower level subnetworks in order, and finally identify the specific machine on the lowest level subnetwork (e.g., IP addresses assign the first 24 bits of the 32-bit address to identify subnetworks, and the last 8 bits to identify machines on the lowest level subnetwork). Ex. 2005, ¶¶62-64.

Dr. Houh's testimony confirms that a POSA would understand hierarchical systems to operate in the fashion described above:

Q. Okay. Well, my understanding of a hierarchical system based on what you've described is that basically, you have different tiers of addresses such that once you identify the address of a particular tier, then other tiers are grouped underneath that tier. Is that -- is that a fair understanding?

A. Yeah. I -- I mean, I'm not trying to give a comprehensive, you know, all-encompassing definition here, but that generally seems

to work under what I understand, you know, these types of -- of address schemes are.

Ex. 2027, 55:3-13

In addition, by identifying subnetworks by level, hierarchical addressing allows data to be routed to the relevant top level subnetwork and then to the relevant subnetwork on each subsequent hierarchical level until arriving at the machine on the lower level subnetwork. Ex. 2005, ¶65. Again, Dr. Houh's testimony confirms that systems providing large numbers of devices (e.g., subscribers) with access to a core network must use hierarchical address systems:

Q. And ... you could also have a system where you don't have any tiers but devices communicate with one another by having a precise address that corresponds only to a particular device. Correct?

A. I -- I mean, there may be some local systems that -- that work that way, you -- you know. But -- but in terms of broader interconnectivity to other devices, they -- they typically, because there's so many other devices to -- to -- that you could possibly communicate with. And then systems with large numbers of addressable computers are typically arranged in a more hierarchical fashion.

Q. Why?

A. ...I can't tell you every reason why. But, you know, it -- it -- it -- you -- you -- you don't have to know details about the other end and you can still get to them, you know. So I don't need to know exactly where this computer is. I haven't -- and -- and neither does the network know where an exact computer is. It can route based on -- on the -- on the -- on the address prefix, which kind of can get it closer and closer to the ultimate destination. You know, I -- I suppose local area technologies may -- may have some -- like, you know, if -- if you're not going outside your -- your -- your own space, your own network or subnetwork, then -- then it may look nonhierarchical at that point. But -- but, you know, in order to interact with the -- the rest of the network, you -- you know, it -- it helps to -- to have these hierarchies.

Ex. 2027, 55:3-56:19

This type of hierarchical addressing is necessary for providing access to core external networks such as the Internet including because (i) address hierarchies are needed to allow network devices to route data to other devices on the core network in a consistent format and (ii) a finite bit flat address system can only represent a limited number of addresses, which is insufficient to accommodate the exponentially growing number of subscribers/users and associated addresses on such networks.

Ex. 2005, ¶65.

For these reasons, a POSA would understand that the claimed masters of the '904 Patent—which provide an interface to a core network—utilize hierarchical network protocols and addressing systems to communicate between the network and the slaves. Ex. 2005, ¶¶62-65.

In contrast to core network access systems that employ hierarchical addressing and related protocols, Vink—which is directed to a local area network—uses local protocols that employ non-hierarchical addressing for communication between the master and other devices on its LAN. Ex. 2005, ¶¶66-68. Vink expressly refers to the types of local communication protocols that can be used with its LAN topology:

LAN topologies generally used in practice are star, bus, ring and tree configurations in which the data bits are transferred serially to the connected stations. Generally in packet form, that is to say a particular station cannot transmit uninterrupted information but only packets containing a measured information content. A large variety of protocols, such as CSMA/CD "token passing", Aloha etc., have been developed for controlling the communication.
Vink at 1:24-34

At least as of 1999, a POSA would know that these protocols (e.g., Aloha and CSMA/CD “token passing”) are suited to LAN communications. Ex. 2005, ¶¶66.

Vink's disclosure of these protocols would suggest to a POSA that Vink's network topology is limited to a LAN. Ex. 2005, ¶¶66-68.

Further, Vink expressly discloses a non-hierarchical (or flat) address system, in which each slave is assigned a fixed address based on its position in the cascade sequence employed in the Vink LAN. Ex. 2005, ¶¶67-68. In particular, Vink states that the devices in its local area network are provided unambiguous addresses, from which it would have been evident to a POSA that its addressing system is non-hierarchical:

- In order, however, to allow the slaves to operate mutually as independently of one another as possible with retention, of course, of the deterministic operation of the communication system as a whole, it is advantageous to provide a slave with an unambiguous address and to add address information bits to the data bits to be exchanged. Ex. 1005, 11:32-34
- As discussed already in the introduction, every slave can be provided with an unambiguous address and the addressing of the separate I/O modules 10 can take place on the bases of their sequence in the cascade arrangement. Consequently, a unit 20 which is capable of decoding the address of a slave, a unit 21 which is 5 capable of detecting information about the number of data bits for a relevant slave and, if necessary, a unit 22 which is capable of reading

out information about the type coding of the I/O modules connected to the local data bus, for example a module having only an input side or a module having only an output side, are provided. Ex. 1005, 17:38-18:13;

- As a result, the whole again has a structure corresponding to a shift register, every I/O module being implicitly addressed, as in the system according to Figure 1, by its position in the chain. Ex. 1005, 16:11-14

Petitioner's expert Dr. Houh likewise testified that Vink discloses a non-hierarchical address system:

Q. Have you encountered such a nonhierarchical address system in your experience with networking?

A. Well, I -- I mean, I suppose there are other ways of -- of addressing items. I -- I think like, for example, Vink talks about addressing in some sort of order, all right? So -- so I -- I think in -- in that case, the -- the ordering is -- is not necessarily hierarchical there because it's based on ordering of the devices.

Ex. 2027, 54:19-55:2.

In sum, it is indisputable that Vink expressly teaches that (i) its local area network uses an unambiguous (or fixed) addressing system that assigns non-hierarchical addresses to its slaves, and (ii) using such a non-hierarchical addressing

system is needed “to allow the slaves to operate mutually as independently of one another as possible with retention, of course, of the deterministic operation of the communication system as a whole.” Ex. 2005, ¶¶66-68. Thus, Vink teaches that using a non-hierarchical address system is essential for the operation of Vink’s system. *Id.*

A POSA would understand from these disclosures and relevant expert testimony that (i) Vink’s non-hierarchical network cannot communicate with a core network such as the Internet, since doing so would require a hierarchical addressing system; and (ii) Vink teaches against adapting its network for use with a hierarchical addressing system, since doing so would eliminate the purported advantages associated with using a non-hierarchical system, i.e., the exact opposite of what is needed to hook up Vink’s LAN to the Internet. Ex. 2005, ¶69.

Second, Petitioner fails to provide a rationale for which a POSA would attempt to modify Vink in light of Patrick or AAPA to provide an interface to a core network, let alone by “first and second master units, each comprising a physical interface to a packet-switched network.” Ex. 2005, ¶¶70-72. The only purported benefit alleged by Petitioner and its expert is the assertion that “subscribers connected to Vink’s communication system would have benefitted by gaining access

to a wider array of information that is available on the external network, such as information available on other computers/servers.” Paper 2, 23.

As a threshold matter, Petitioner has failed to identify any support in the prior art for the assertion that Vink’s users—who are not subscribers, as admitted by Petitioner’s expert (Ex. 2027, 85:9-86:22)—would benefit from “gaining access to a wider array of information that is available on the external network[.]”

Further, “access to a wider array of information” is a generic benefit of wide area networks writ large. Ex. 2005, ¶70. Thus, a POSA seeking to obtain such benefits would not use Vink—a system whose non-hierarchical design principles are ill-suited for use with external networks—as the starting point of a system for providing subscribers with access to an external core network, such as the multi-shelf access systems to which the ’904 Patent is directed. Ex. 2005, ¶¶70-72. In addition, the Federal Circuit has long held that this type of generic need (e.g., gaining access to more information) is insufficient to provide a motivation to combine specific elements found in the prior art, *i.e.*, in this case, an interface to a core network (found in AAPA and Patrick) with the specific topology of Vink, which is disclosed in the context of limited applications suited to LANs. *See Forest Lab ’ys, LLC v. Sigmapharm Lab ’ys, LLC*, 918 F.3d 928, 935 (Fed. Cir. 2019) (“a generic

need for more antipsychotic treatment options did not provide a motivation to combine these particular prior art elements”).

In any event, the “measurement and control applications, monitoring purposes and data acquisition” to which Vink is directed would not have been understood by a POSA as the types of applications that would have benefitted from core network access. Ex. 2005, ¶70. And when asked at his deposition as to whether he could identify any such applications that could benefit from such access, Dr. Houh could only identify “internet of things” types of applications that were not in use at the time of the invention, and which Dr. Houh failed to include in his declaration. Ex. 2027, 151:19-22 (Q. You’ve described a number of applications that could be referred to broadly as the internet of things. Is that fair? A. Well, today, sure. That’s – that’s a phrase today.); *see also* Ex. 2027, 146:6-154:25 (giving as examples of applications “monitoring and control applications” a variety of applications known as “internet of things” that include internet enabled phone applications, remote cameras and garage doors, smart doorbells, cloud-based phone systems, and the like, none of which have been shown by Petitioner to have been in use as of the time of the priority date of the ’904 Patent).

Furthermore, a POSA would not adapt Vink in light of Patrick/AAPA (or Patrick/AAPA in light of Vink) for the simple reason that the systems in each of

these references operates effectively, as is, for its intended purpose and function, and there is no teaching that such a modification would improve those systems in any respect. It is well-established that where “each [prior art] device independently operates effectively, a person having ordinary skill in the art, who was merely seeking to create a better device... would have no reason to combine the features of both devices into a single device.” *Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1369 (Fed. Cir. 2012). Here, Vink discloses a LAN that is used for connecting a series of network devices (not subscribers, as discussed below) connected by local data buses such as SCSI (Ex. 1005, 1:6-15), in which it is advantageous to use non-hierarchical addressing. *See, e.g.*, Vink at Abstract (“The present method and system for which it is advantageous to the specific purpose of “provid[ing] unambiguousness in the communication of cause-and-effect relationships at I/O level, in particular, for measurement and control applications, monitoring purposes and data acquisition.”); *see also supra* (discussing non-hierarchical addresses in Vink); Ex. 2005, ¶¶71-72. A POSA would recognize that there is no reason to connect Vink’s system—which is directed to peripherals and does not teach subscribers—to provide access to an external network. *Id.* Indeed, Vink not only operates effectively for its intended purpose of enabling “measurement and control applications, monitoring purposes and data acquisition”

without an interface to such a network, but its main teaching (use of non-hierarchical addresses) for accomplishing that purpose effectively *is incompatible with the hierarchical address system that would be required to practice the proposed combination*. Ex. 2005, ¶71. Accordingly, a POSA would not be motivated to adapt Vink in light of Patrick and AAPA to provide access to a core network.

Likewise, Petitioner has failed to point to anything suggesting that the systems in either Patrick or AAPA do not operate effectively or would benefit from Vink’s topology. In other words, a POSA would have no reason to modify either AAPA or Patrick to employ the topology disclosed in Vink. In this circumstance, a POSA would not adapt Vink in light of Patrick or AAPA as a matter of law. *Kinetic Concepts*, 688 F.3d 1342, 1369 (Fed. Cir. 2012).

Indeed, to the extent that a POSA wanted to design a system that conferred Petitioner’s purported benefit of “gaining access to a wider array of information that is available on the external network,” such a POSA could simply practice AAPA or Patrick with respect to any devices as to which it would be desirable to provide access to an external network and would have no reason whatsoever to engage in the exercise of *adapting* Vink, as there is nothing suggesting that Vink’s topology would render the systems of Patrick or AAPA more effective in conferring that benefit. *See In re Anova Hearing Labs, Inc.*, 809 Fed. Appx. 840, 843 (Fed. Cir. 2020) (noting

that when a primary prior art reference already provides a solution to the problem solved by the challenged patent, there must be evidence as to why there would be a reason to modify that primary reference to include an additional or redundant solution)); Ex. 2005, ¶72. Indeed, Petitioner has not analyzed whether, let alone demonstrated that, Vink’s topology would render Patrick or AAPA more effective in any respect.

Third, even assuming that a POSA would somehow decide to combine Vink with Patrick alone or with AAPA to provide an interface to a core network in the manner required by the claims (i.e., despite the fundamental incompatibility of Vink with the proposed combinations and the lack of any benefit therefrom), such a combination would require steps beyond the ordinary level of skill at the time of the invention. Ex. 2005, ¶¶73-74.

As Dr. Houh testified in his deposition, a POSA would have to adapt Vink—at the very minimum with “appropriate software to...route packets”—in order to “provide the option in Vink’s system for the master units to be connected to an external packet switched network.” Ex. 2027, 107:5-108:2. As Patent Owner’s expert Miguel Gomez opines, the functionalities of this software would need to adapt Vink’s LAN protocols and address system to make it suitable for access to external core networks. Ex. 2005, ¶¶73-74. When asked at his deposition to identify the types

of software that would have been available to a POSA to adapt Vink’s system—and whether integrating those systems would have been within the skillset of a POSA—as of the time of the invention, Dr. Houh provided only conclusory opinions and otherwise non-responsive answers. Ex. 2027, 110:4-116:12.

While Dr. Houh included in his responses that it would have been obvious to him to design protocols to interface Vink’s system with an external network, he failed to provide any specific basis for this opinion both in his declaration and at his deposition. *Id.* It is well-established that more is required than Dr. Houh’s say-so to establish what would have been part of the level of ordinary skill as of the time of the invention. *TQ Delta, LLC v. Cisco Sys.*, 942 F.3d 1352, 1359 (Fed. Cir. 2019) (“This court’s opinions have repeatedly recognized that conclusory expert testimony is inadequate to support an obviousness determination on substantial evidence review”); *Arendi SARL v. Apple Inc.*, 832 F.3d 1355, 1361 (Fed. Cir. 2016) (holding that to supply a missing limitation, “the limitation in question [should be] unusually simple and the technology particularly straightforward” and require “reasoned analysis and evidentiary support.”). Here, there is a complete dearth of evidentiary support as to a POSA’s background knowledge in the record, and Dr. Houh cannot be permitted to plug that gap on the fly during cross-examination. *Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013) (“In recognizing the role

of common knowledge and common sense, we have emphasized the importance of a factual foundation to support a party's claim about what one of ordinary skill in the relevant art would have known.”) Besides his say-so, Dr. Houh has presented no evidence that such protocols could be designed. And despite his conclusory assertions otherwise, Dr. Houh has not shown that he could design such protocols or provide concrete details of how he would do so.

To the extent that these steps are obvious to Dr. Houh, that is legally insufficient to establish obviousness as of the time of the invention, as test of obviousness is whether the invention would have been obvious to one of ordinary (average) skill, not one of expert skill, at the time of the invention, not today. *See Env't. Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 697 (Fed. Cir. 1983) (emphasizing “the need to adhere to the statute, i.e., to hold that an invention would or would not have been obvious, as a whole, when it was made, to a person of ‘ordinary skill in the art’—not to the judge, or to a layman, or to those skilled in remote arts, or to geniuses in the art”). Indeed, Dr. Houh was unable to identify a single protocol available to a POSA at the time of invention that could interface Vink’s system with an external network.

As Patent Owner’s expert opines, on the basis of his own experience as more than a POSA as of the priority date of the ’904 Patent, adapting Vink so that its

masters would provide an interface with a packet-switched network, as required by the claims of the '904 Patent, would require reprogramming Vink's non-hierarchical LAN protocols to allow for hierarchical addressing, an exercise that would have (i) required skill beyond the ordinary level at the time of the invention; and (ii) would be understood by a POSA to go against the teachings of Vink that a flat (or non-hierarchical) address system is desirable. Ex. 2005, ¶¶74-75.

For these reasons, Petitioner has failed to demonstrate that a POSA would have modified Vink in light of Patrick and AAPA such that its “master units [would] each compris[e] a physical interface to a packet-switched network.”

B. Claims 1, 4, 11, 14, and 19: Vink in view of Patrick and AAPA do not render obvious “slave unit comprising one or more ports to respective subscriber lines”⁴

The '904 Patent describes its preferred embodiment as “a multi-shelf access system” in which the disclosed master / slave configuration provides fault protection for one or more subscribers accessing the external network through the master / slave system. Ex. 1001, 1:10-33. The claims require that each of the “slave units”

⁴ As every challenged independent claim requires subscriber lines, this argument also applies to all of their dependent claims (i.e., all of claims 1-26 require subscriber lines).

comprise “one or more ports to respective subscriber lines,” and the claims and specification require a construction of “subscriber lines” as “communication lines to users of subscription-based network services.”

For example, the subscribers could be DSL subscribers who receive internet access through the described access architecture. *Id.* Petitioner’s expert Dr. Houh confirmed in deposition that “subscribers” are typically users and their devices accessing an external network such as the internet (i.e., not peripheral devices such as flash drives or the like attached by USB or SCSI interfaces to a computer). Ex. 2027, 94:7-98:5 (“Q. [W]ould you agree that a subscriber is a user and a user’s device accessing an external network? A. [C]ertainly when I’m a subscriber[,] I am subscribing to general internet access services. And -- and I think the subscribers that -- that are disclosed in -- in -- in Patrick do have access...”).

In contrast to the claims of the ’904 Patent, Vink does not teach “subscriber lines” under any reasonable interpretation. Vink teaches that its slaves are devices connected by I/O modules 10 to peripherals—not subscribers. Ex. 1005, 1:6-34. Vink explicitly confirms that its I/O modules 10 are connected via a local bus, “such as [a] VME bus or SCSI bus[,] to couple microcomputer systems and peripheral equipment together.” Ex. 1005, 2:5-3:5; abstract (“The I/O modules (10) are connected in cascade to a control module 11 (9) via a local data bus (19) for serial

bit transfer”); 13:28-14:1; 20:2-12. Thus, Vink discloses that its slaves communicate with peripheral devices which themselves are not subscribers. Ex. 2005, ¶¶76-82.

Petitioner asserts that Patrick and AAPA disclose “subscriber lines,” such that the combination of Vink and Patrick (or Patrick and AAPA) renders this limitation obvious. Paper 2, 33-35. However, as discussed above, a POSA would not be motivated to combine Vink with either Patrick or AAPA, including because Vink is not compatible with a subscriber-based network (and teaches against the protocols necessary to render operable such a network), Patrick/AAPA operate effectively to serve subscribers without the need to deploy their subscriber lines in Vink’s topology, and adapting Vink in light of Patrick/AAPA would have been outside a POSA’s skillset as of the relevant timeframe. Ex. 2005, ¶¶76-82.

As discussed *supra*, Vink discloses a local area network having fixed addresses for its slaves. Ex. 1005, 17:38-18:14. A POSA would understand that Vink’s slaves would not access an external network with a fixed address. Ex. 2005, ¶¶78, 80. Unless a slave utilizes a hierarchical address and not the fixed address explicitly taught by Vink, communications originating from the external network could not be addressed to that slave. *Id.* Further, using a non-hierarchical address in connection with the slaves—such that the slaves could not communicate with the external network—would be understood to a POSA to defeat the purpose of

providing subscriber lines in the Vink topology. Ex. 2005, ¶81. Moreover, the Petition does not explain why a POSA would combine Vink’s teaching of peripheral devices with Patrick’s or AAPA’s subscriber lines; and Petitioner presents no evidence that the interfaces used in Vink (which are suited to peripheral devices, not subscribers) could or would service “subscribers” as claimed. Ex. 2005, ¶¶78, 80-81.

Accordingly, Vink alone does not disclose slave units comprising ports to subscriber lines, and a POSA would not have been motivated to combine Vink with Patrick or AAPA to render the claimed subscriber lines obvious.

C. Claim 4: Vink in view of Patrick and AAPA do not render obvious “in normal operations, downstream data packets received from the network are passed from the first master unit to each of the daisy chains via the first slave unit in each chain, and upstream data packets received by the slaves in each chain from the subscriber lines are passed via the first slave unit in the chain to the first master unit for transmission over the network”⁵

In addition to the elements shared with the other independent claims discussed above, claim 4 separately recites “in normal operations, downstream data packets received from the network are passed from the first master unit to each of the daisy

⁵ This argument also applies to the claims which dependent from claim 4, including claims 5-8.

chains via the first slave unit in each chain, and upstream data packets received by the slaves in each chain from the subscriber lines are passed via the first slave unit in the chain to the first master unit for transmission over the network.”

In other words, claim 4 requires that—in normal operations—downstream packets from the network and upstream packets from the slaves/subscriber lines pass in opposite directions, via the first slave to the first master. Ex. 2005, ¶83. The Petition does not show that the data transmitted on Vink’s LAN is passed by the slaves in opposite directions—i.e., via the first slave—when it travels upstream/downstream from each of the slaves in Vink’s topology. Ex. 2005, ¶¶83-87.

The Petition alleges that Vink’s active master may supply information to slave units in the cascade. Pet., 39-40. Specifically, Vink describes the process for supplying data from the active master to the slaves in the cascade as follows:

- supplying the data bits for the I/O modules to the slaves via the transmission system, *the sequence of the data bits also corresponding to the sequence of the connected slaves*;
- receiving from the slaves via the transmission system, the data bits originating from the I/O modules, *the sequence of the data bits received also corresponding to the sequence of the connected slaves*;
- supplying control information to the slaves via the transmission system; and

- presenting and/or recording data bits of the I/O modules connected to a respective slave under the influence of the control information received, controlled by the slaves.

Ex. 1005, 6:16-27. Accordingly, Vink explicitly states that the sequence of data bits supplied to the slaves and the sequence of data bits received from the slaves ***both correspond to the sequence of the connected slaves***. Ex. 2005, ¶84. Based on this disclosure, the sequence of transmission from the master to the slaves and the sequence of transmission from the slaves to the master must be identical—that is, the slaves must transmit and receive data to the masters in the same order as that in which they are arranged. Ex. 2005, ¶¶85-86. For this to occur, Vink must transmit data from the master to the slaves and receive data from the slaves to the master in the same direction (i.e., clockwise or counterclockwise, but not clockwise and counterclockwise depending on whether the data is upstream or downstream). *Id.*

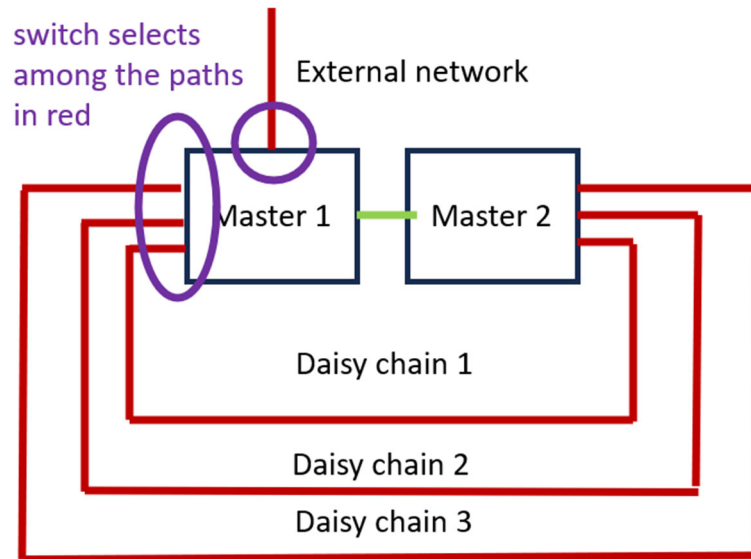
By contrast, as described above, claim 4 explicitly require that downstream packets from the networks and upstream packets from the subscriber lines pass in opposite directions. While the Petition alleges that at 42-43 that Vink is “designed to transmit or receive packets of data bits via a transmission system ring in one and/or the other direction,” this disclosure does not state that upstream and downstream traffic occur in opposite directions in normal operations. Ex. 2005, ¶87. Rather, this disclosure is related to Vink’s disclosure to reverse the transmission direction in the

event of a fault. *Id.* This is confirmed by the very next sentence, which states that “[m]aster and/or slaves constructed in this way are capable of functioning as a switching centre so that, for example, the master is able to reach as many connected slaves as possible in a fault situation.” Ex. 1005, 14:31-34. Thus, Vink teaches reversing the direction in the event of a fault but does not suggest that the direction of upstream and downstream packets are already opposite.

D. Claim 9: Vink in view of Patrick and AAPA do not render obvious master units comprising a switch and a pre-switch⁶

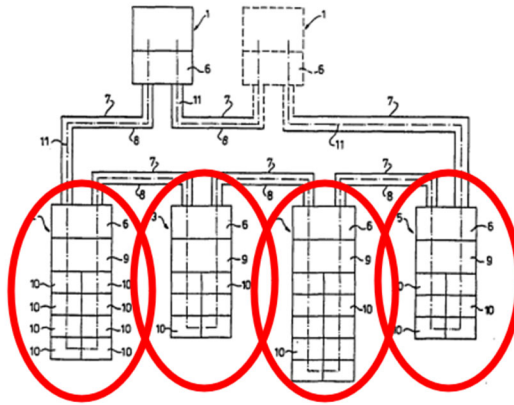
Claim 9 requires “a switch[] configured to route data packets between the respective physical interface and the one or more daisy chains.” Accordingly, claim 9 requires a switch that selects between either the external network or one of potentially several daisy chains to route data packets, as shown in the following diagram:

⁶ This argument also applies to claim 10 which depends from claim 9.



Ex. 2005, ¶¶88-95.

The Petition does not allege Vink suggests a switch with this functionality. Instead, the Petition alleges that Vink discloses control unit 36 and transmitting/receiving unit 6 which routes data to a slave on a particular path. Paper 2, 47-48 (“Vink explains that the control unit 36 ‘extract[s]’ information about the particular slave located along the daisy chain the data packets should be sent to and controls the data flow via the transmission lines 7, 8.”). In other words, control unit 36 and transmitting/receiving unit 6 does not select one of several possible communication paths—rather, it selects one of several possible destinations (slaves) on a single path:



**Vink's controller selects among
these slaves in a single chain—
not among one or more chains
and the external network**

Ex. 2005, ¶¶89-91. Petitioner's expert Dr. Houh confirmed in deposition that Vink's controller selects a slave along an alleged daisy chain. Ex. 2027, 178:19-180:10 ("Q. Is it your testimony in [paragraph 133] that there is a daisy chain and control computer 38 selects one slave in that daisy chain to which you refer in this paragraph as the correct slave unit? A. [I]t says that Vink teaches that the control computer 38 provides for and monitors the correct sequence of data bits for a relevant slave related to the sequence in which the I/O modules are arranged...And so -- so I -- I am saying that the control computer is what determines the routing of data packets to the right slave, and that would be the intended slave unit to receive the data packet based on where the I/O modules are located in the daisy chain."). Indeed, Dr. Houh testified that the address of the slave identifies the position of the slave in the alleged

chain. *Id.* (“[T]he addressing is based on the -- the position [of the slave] in the chain...”). Vink’s disclosure of selecting a specific slave on a path however does not meet claim 9’s requirement to select a daisy chain or an external network. Ex. 2005, ¶¶89-91. Indeed, Vink contains no indication that its controller is able to select between multiple daisy chains and the external network.

The same error infects Petitioner’s identification of the pre-switch. Ex. 2005, ¶¶92-93. Claim 9 requires that the pre-switch, “in the event of a fault at a location in one of the daisy chains,” “re-routes at least a portion of the data packets exchanged with one or more of the slaves in the daisy chain in which the fault has occurred through another one of the daisy chains.” In other words, in the event of a fault, the pre-switch identifies “another” daisy chain and reroutes the data packets through that other chain rather than through the faulty chain. Ex. 2005, ¶¶92-93.

Vink does not satisfy this requirement either. *Id.* In Vink, control computer 38 identified by the Petition as the pre-switch merely routes data to a slave on a particular path, as opposed to selecting one of several daisy chains. Paper 2., 49-55. Indeed, the Petition admits that Vink explicitly discloses that control computer 38 determines the routing of data packets *to the correct slave in the chain*: “Vink explains that ‘the control computer 38 provides for and monitors the correct sequence of the data bits for a relevant slave, related to the sequence in which the

I/O modules are arranged.’ In other words, the control computer 38 determines the routing of data packets to the correct slave unit based on where the I/O modules are located in the daisy chain.” *Id.*, 49-50 (internal citations omitted).

In the event of a fault, the Petition admits that Vink discloses that control computer 38 reverses the direction of data flow (i.e., data flows in the opposite direction) rather than routes the data through another daisy chain as claimed. Pet., 50 (“Vink also discloses that data packets are re-routed in the event of a fault at a location in one of the daisy chains (e.g., switch direction of data flow). *See* Ex. 1005, 14:28-34 (‘A very flexible system is obtained ... in that the at least one master and slaves are designed to transmit or receive packets of data bits via a transmission system ring in one and/or the other direction. Master and/or slaves constructed in this way are capable of functioning as a switching centre so that, for example, the master is able to reach as many connected slaves as possible in a fault situation.’); *id.*, 9:4-7 (‘It is furthermore possible, in the event of malfunctions in the transmission system, for example during the switching of transmission or communication directions, nevertheless to exchange the correct data bits with the correct slave.’)). The Petition presents no evidence that Vink routes data through one of several daisy chains, besides conjecture that it could do so because it teaches configurations with “more than two rings.” Paper 2, 50. But even with two rings and the modifications

proposed on page 53 of the Petition, Vink only teaches that, in the event of a fault, the data flow in a single ring can be reversed. Ex. 2005, ¶95. Vink teaches that reversing the daisy flow resolves the fault—there is therefore no need to reroute the data flow through another daisy chain. *See In re Anova*, 809 Fed. Appx. at 843 (noting that when a primary prior art reference already provides a solution to the problem solved by the challenged patent, there must be evidence as to why there would be a reason to modify that primary reference to include an additional or redundant solution). Thus, there is no teaching in Vink to route data through a different daisy chain. Without this requisite teaching, Petitioner has not met its burden to show the claimed pre-switch obvious in view of Vink.

Accordingly, Vink suggests neither the switch or the pre-switch of claim 9.

E. Claims 6, 20, and 23: Vink in view of Patrick and AAPA do not render obvious “the first master unit bicast the upstream data packets that it receives from the slave units to the network and, via the protection interface, to the second master unit, which transmits the upstream data packets to the network”

Claims 6 and 23 are both directed to the first master unit (1) conveying upstream data directly to the external network and (2) conveying the same upstream data to the second master unit, which then also conveys the upstream data to the external network. Thus, claims 6 and 23 claim a redundant process in which *the same* upstream data is conveyed to the external network *twice*—once directly by the

first master unit and once indirectly by the first master unit by way of the second master unit.

Similarly, claim 20 claim a redundant process in which *the same* downstream data is conveyed to the same slave *twice*—once directly by the first master unit and once indirectly by the first master unit by way of the second master unit. This is required by the dependency of claim 20 from claim 19—claim 19 requires the master to convey downstream packets “along the daisy chain in a first direction” and claim 20 then requires that master to convey downstream packets “in the second direction” by conveying the packets to a second master unit which conveys the packets to the slaves in the daisy chain. Ex. 2005, ¶98.

The Petition fails to show that Vink renders obvious the two steps required by claims 6, 20, and 23. Ex. 2005, ¶¶99-106.

Indeed, the Petition admits as much by deliberately erasing the word “bicast” from the claims: “Vink further suggests that ‘the first master unit []*casts* the upstream data packets that it receives from the slave units, via the protection interface, to the second master unit.’” Paper 2, 70. Removing this limitation, the Petition at most alleges that Vink’s masters may transmit upstream packets to the network (a POSA would not be able to modify Vink’s masters to do so for the reasons discussed above) or transmit upstream packets to a second master for

transmission to a network. Critically, the Petition has not alleged or shown that a master transmits the same upstream data to both the external network and to a second master for transmission to an external network as claimed. *Netflix, Inc. v. DIVX, LLC*, 80 F.4th 1352, 1356 (Fed. Cir. 2023) (Petitioner bears the burden of addressing each element of the claim); 37 C.F.R. § 42.104(b)(5). Even if Vink's masters were able to transmit upstream packets to a network and able to transmit upstream packets to a second master, Vink does not disclose that the master performs both steps for the same upstream data. Ex. 2005, ¶100. Even accepting everything Petitioner alleges as true, Vink at most performs one of the two steps, with no suggestion of performing a second step as claimed. *Id.* Indeed, the only suggestion alleged by the Petition for multicasting is the 1+1 Automatic Protection Switching technique described by the '904 Patent itself. The Petitioner argues that this is applicant admitted prior art, but Petitioner's argument fails for three reasons. Ex. 2005, ¶¶103-106. First, the 1+1 Automatic Protection Switching technique is only discussed in connection with multicasting packets from the active masters to the network as in claims 6 and 23 and is not discussed in connection with claim 20's requirement that packets received from the network passed from the first masters to the slaves and also from the first master to the second master to the slaves. Ex. 2005, ¶104 (*citing* Ex. 1001, 8:49-52).

Second, Vink's disclosures deter "bicasting" upstream data as claimed. Ex. 2005, ¶¶101-102. Vink discloses that in its multi-master concept, there is **one** active master while the other masters are passive. Ex. 1005, 16:19-17:2. In the event of a fault, one of the passive masters assumes the functions of the active master:

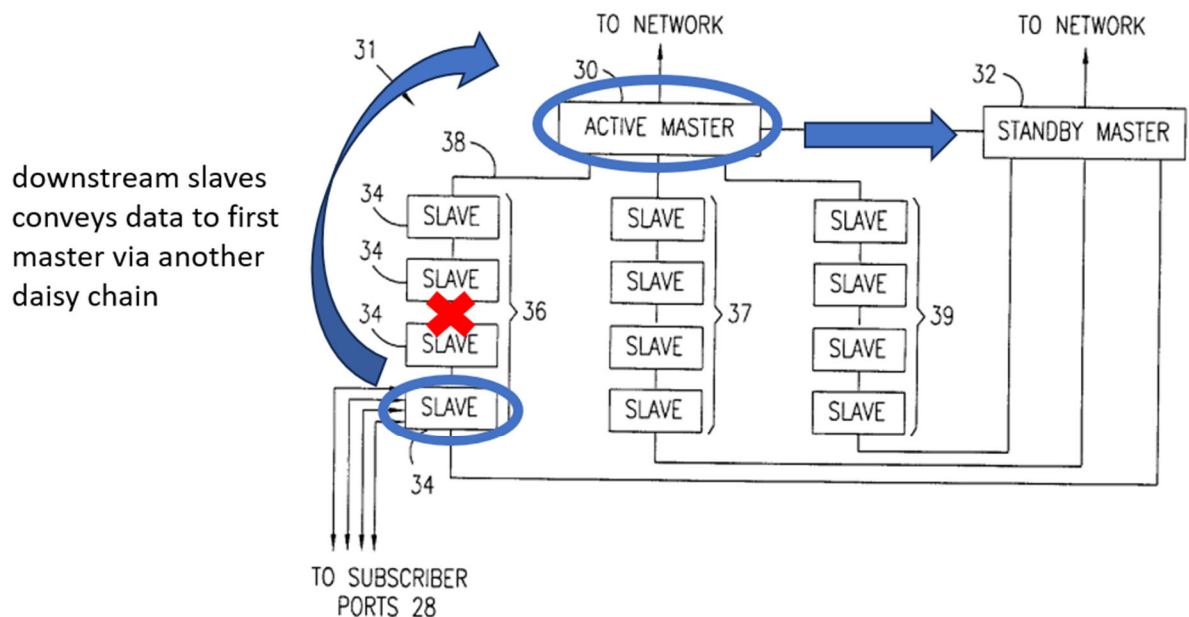
In such a multi-master concept, **one of** the masters is in general active in relation to data exchange, while one or more other masters only have a passive role therein. All the masters are so designed that they can assume the function of the active master, for example in the event of faults. The passive masters are easily able to detect errors of the active master because, as a consequence of their cascade arrangement and the serial transfer of data bits in the communication system according to the invention, they receive all the information which is intended for the active master. Consequently, no separate communication path is required between the various masters to keep the passive masters abreast of the operations, instruction etc. carried out by the active master. Such a "hot stand-by" mode is of importance, in particular, in industrial process measurement and control in which failure or delay in the production process may, inter alia, have serious financial consequences. It is obvious that, in such a multi-master concept, the conditions under which, and the manner in which, the tasks of a master are assumed by another master have to be specified in advance.

Id. Thus, Vink's disclosure contemplates the point of redundancy as a second, passive master stepping in or assuming the role of the active master in the event of a fault. Ex. 2005, ¶¶101-102. Given that Vink teaches that there is only ever one active master, there is no need for Vink's system to utilize two separate transmission paths when the purpose of the passive masters is to assume the role of the active master. *Id.* And third, the '904 Patent does not state that the specific redundancy in transmission in claims 6 and 23 are disclosed by or the same as the standard "1+1 APS" (automatic protection switching) technique. Ex. 2005, ¶¶106. Rather, "1+1 APS" refers generically to a source providing two copies of the same transmission and does not suggest a master bicast upstream data through a second master. Thus, it would not have been obvious to bicast upstream as in claims 6 and 23 or downstream data as in claim 20 in view of Vink.

F. Claim 8: Vink in view of Patrick and AAPA do not render obvious "the downstream packets for the slave units in the portion of the daisy chain between the location of the fault and the second master unit are conveyed to the second master unit from the first master unit via another one of the daisy chains"

As discussed with respect to claim 9 above, Vink at most teaches reversing the direction of data flow in its ring configuration and does not suggest routing packets via another daisy chain. Moreover, claim 8 specifies that packets from *a slave unit between the fault and the second master unit* are conveyed to the second

master unit from the first master via another daisy chain. Thus, claim 8 requires more than simply routing data from a master to a slave through another daisy chain in the event of a fault—claim 8 requires the slave's downstream packets reach the first master via another daisy chain, and the first master to then pass the downstream packets to the second master:



Ex. 2005, ¶108.

Even if Vink disclosed a master routing packets among multiple daisy chains as alleged for claim 9 (it does not, for the reasons discussed above), Vink would still not satisfy claim 8's requirement that the slave's downstream packets reach the first master via another daisy chain. Ex. 2005, ¶¶109-111. Indeed, since claim 8 requires the slave to be between the fault and the second master, Vink's solution in this

context would be to reverse the direction of data flow, thereby allowing the downstream packets from the slave to reach the second master along the faulty daisy chain. *Id.* Given the solution already taught by Vink, Petitioner presents no reason why a POSA would implement the entirely different procedure of claim 8 in which the affected slave routes the data through another daisy chain to the first master before reaching the second master. *Id.* Accordingly, nothing in Vink suggests the specific procedure of claim 8. *See In re Anova*, 809 Fed. Appx. at 843 **Error! Bookmark not defined.**(noting that when a primary prior art reference already provides a solution to the problem solved by the challenged patent, there must be evidence as to why there would be a reason to modify that primary reference to include an additional or redundant solution).

G. Claim 17: Vink in view of Patrick and AAPA do not render obvious “when one of the packets received by the pre-switch comprises a multicast packet addressed to one or more of the ports on the slave unit, the pre-switch sorts the multicast packet such that one copy of the packet is retained and another copy of the packet is passed to the second physical interface”

Claim 17 is directed to a “multicast packet,” one copy of which is retained by the slave and another copy of which is passed to the second physical interface to succeeding units along the daisy chain. The Petition contends that Vink discloses this element for the same reasons as claims 11 and 14 (specifically, elements 11d, 11f, and 14c). Paper 2, 89. None of Petitioner’s arguments with respect to elements

11d, 11f, and 14c however actually address the precise limitations of claim 17 requiring both retaining a copy of a multicast packet and passing a copy of the multicast packet to succeeding units in the daisy chain. Ex. 2005, ¶¶112-118.

Petitioner's arguments with respect to element 11d describe the components of Vink's slave unit (transmitting/receiving unit 6, control module 9, and I/O module 10) and does not discuss multicast packets or their treatment. Paper 2, 56. Petitioner's arguments with respect to element 11f describe a pre-switch either retaining data packets addressed to the ports or passing data packets addressed to other slaves onto the other slaves through the next transmission lines. Paper 2, 61-65. Indeed, the Petition's characterization of Vink as "retain[ing] **only** data packets addressed to the ports (e.g., output 33) of any I/O module 10 of the particular slave, while passing data packets addressed to other slaves onto the other slaves through the next transmission lines 7, 8" is a clear teaching away from a multi-cast packet that is both retained and passed. And petitioner's arguments with respect to element 14c is simply a citation to elements 11d and 11f.

The Petition simply does not address claim 17's recital of a multi-cast packet or identify where in Vink a packet is disclosed as being both retained by the slave and passed to subsequent slaves in the cascade. As such, Petitioner has not met its burden of showing claim 17 to be obvious in view of Vink.

V. CONCLUSION

For the reasons set forth above, Petitioner has not met its burden of proving claims 1-26 of the '904 Patent are unpatentable by a preponderance of the evidence. The Board should therefore issue a final written decision finding claims 1-26 not unpatentable.

Date: February 12, 2024

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CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME LIMITS

This Patent Owner's Response (the "POR") consists of 13,458, excluding table of contents, table of authorities, certificate of service, this certificate, or table of exhibits. The POR complies with the type-volume limitation of 14,000 words as mandated in 37 C.F.R. § 42.24. In preparing this certificate, counsel has relied on the word count of the word-processing system used to prepare the paper (Microsoft Word).

Respectfully submitted,

/ Minghui Yang /

Date: February 12, 2024

CERTIFICATE OF SERVICE

The undersigned hereby certifies that the following document was served by electronic service, by agreement between the parties, on the date below:

PATENT OWNER'S RESPONSE

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