UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DELL TECHNOLOGIES INC. AND DELL INC.

Petitioners

v.

CLOUD BYTE LLC
Patent Owner

U.S. Patent No. 9,482,632

DECLARATION OF HIMANSHU POKHARNA, PH.D. IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,482,632

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

I, Himanshu Pokharna, Ph.D., declare as follows:

1. I make this declaration based upon my own personal knowledge and, if called upon to testify, would testify competently to the matters stated herein.

2. I have been asked by the petitioners to provide technical assistance in connection with the *inter partes* review of U.S. Patent No. 9,482,632 (which I will refer to as the "'632 Patent"). This declaration is a statement of my opinions on issues related to the patentability of claims 1-9 (which I will refer to as the "challenged claims") of the '632 Patent.

3. My compensation is not based on the content of my opinions or the resolution of this matter. I have no financial interest in the outcome of this proceeding.

I. BACKGROUND AND QUALIFICATIONS

4. In formulating my opinions expressed in this declaration, I have relied on my knowledge, training, and experience in the relevant field, which I will summarize briefly. Additional details are provided in my curriculum vitae, which I understand has been marked as Exhibit 1004.

5. I received my Bachelors of Technology and Masters of Technology degrees (equivalent to B.S. and M.S. in the United States) in Mechanical Engineering from the Indian Institute of Technology, Bombay, India in 1990 and 1992, respectively. I received my Ph.D. degree in Nuclear Engineering from

Purdue University, West Lafayette, Indiana, in 1997. My Ph.D. thesis focused on modeling of two-phase flow dynamics in heat transfer systems and specifically developed analytical models for the simultaneous flows of water and water vapor in a system during heat absorption. In addition, I received by MBA degree from The Wharton School of University of Pennsylvania, Philadelphia, Pennsylvania, in 2006.

6. For over 25 years, I have led various companies in their thermal technology development. I founded and currently serve as the CEO and Director of Deep Materials Inc., a company devoted to developing thermal management components, such as thermal interface materials and heat sinks for computing and consumer electronic systems. Deep Material products are widely used in servers as well as PCs for thermal management of some of the key components. I am also the Founder and Board Member of Inficold Inc., a company specializing in the design and manufacture of thermal storage integrated refrigeration products, including cold storages, PCM packs, and air conditioners. Additionally, I am the Owner of Deeia Inc., a thermal consulting business that has developed a new loop thermosyphon technology for data center cooling. I also serve as a senior technical advisor/CTO to Ventiva, a company specializing in a new kind of air mover technology development. Ventiva air mover is a fan replacement with primary application in electronics cooling and computing system thermal management. My

main responsibility is to guide the technical team on system design, using Ventiva technology.

7. Before my current positions, I co-founded and served as Board Member and Vice President of Business Development for Sheetak Inc., a company that applies an innovative thermoelectric cooling technology to power generation and refrigeration. I also served as the Vice President of Product Development for k-Technology Corp., a defense hardware company developing high thermal conductivity materials. I also worked for Intel Corp. as Staff Engineer, Thermal Technology Manager, and then Group Manager, overseeing thermal technology development and deployment for the mobile products group and developing thermal architecture for laptop personal computers.

8. During my career, I also have authored and co-authored over 20 papers and keynote addresses on thermal technology for various journals and conferences. For example, I co-authored "Skin Cooling and Other Challenges in Future Mobile Form Factor Computing Devices," published in volume 39 of the Microelectronics Journal in 2008. I co-authored "Lid Cooling for Notebooks," published in the proceedings for the 11th Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems in 2008. I co-authored and presented "Mobile Thermal Challenges in Future Platforms" at THERMES 2007: Thermal Challenges in Next Generation Electronic Systems, Santa Fe, NM, in

2007. I also co-authored and presented "Challenges and Advances of Heat Pipes in Cooling Notebook Systems" at the ASME InterPACK Conference, Vancouver, Canada, in 2007. I also co-authored "Use of Heat Pipes in Multiple Component Cooling in Laptop PCs," published in the proceedings for the 8th International Heat Pipe Symposium in 2006. I also co-authored and presented "Remote Heat Pipe Based Heat Exchanger Performance in Notebook Cooling" at the ASME Summer Heat Transfer Conference, San Francisco, CA, in 2005.

9. I was selected as a speaker and delivered "Application of Thermal Management in Energy Devices" at the 2011 Annual Taiwan Thermal Management Association Meeting, Taipei, Taiwan. I also delivered "Notebook Thermal Technology: Need for Standardized Metrology—Call to Action for Taiwan Thermal Management Association" at the 2007 Annual Taiwan Thermal Management Association Meeting, Taipei, Taiwan. I was the co-author for a keynote paper titled "Heat Pipe Needs in Future Mobile Platforms" at the 14th International Heat Pipe Conference, Florianopolis, Brazil, in 2007. I was also the author of the keynote paper titled "Design and Test Methodologies of Use of Heat Pipes in Laptop PCs" which was presented at the 8th International Heat Pipe Symposium, Kumamoto, Japan, in 2006. I was also the keynote speaker and delivered "Microchannel Cooling in Computing Platforms: Performance Needs

and Challenges in Implementation" at the 2nd ASME-JSME International Microchannel Conference, Rochester, NY, in 2004.

10. These are examples. A full list of my publications and addresses is included in my curriculum vitae (EX1004).

11. Furthermore, I am the named inventor for more than 120 issued and pending patents on thermal technology. For example, I am the inventor of U.S. Patent No. 9,903,621 B1, entitled "Cooling System with Thermal Battery." I am also the inventor of U.S. Patent No. 9,574,832 B2, entitled "Enabling an Aluminum Heat Exchanger with a Working Fluid." I am also the inventor of U.S. Patent No. 8,043,703 B2, entitled "Thermally Conductive Graphite Reinforced Alloys." I am also the inventor of U.S. Patent No. 7,308,931 B2, entitled "Heat Pipe Remote Heat Exchanger (RHE) with Graphite Block." I am also the inventor of U.S. Patent No. 7,269,005 B2, entitled "Pumped Loop Cooling with Remote Heat Exchanger and Display Cooling." I am also the inventor of U.S. Patent No. 7,243,497 B2, entitled "Apparatus to Use a Refrigerator in Mobile Computing Device."

12. These are examples. A full list of the issued and pending patents are set forth in my curriculum vitae (EX1004).

13. Based on my substantial academic and professional experiences, I believe that I am qualified in the technology fields pertaining to the '632 Patent, as

at least a person of ordinary skill in the relevant art at the time of the claimed invention.

II. MATERIALS CONSIDERED

14. In preparation of this declaration, I have considered the materials discussed in this declaration, including for example the ’632 Patent and its prosecution history. In particular, I have reviewed and considered the following documents, among others, in connection with my analysis:

- EX1001: The ’632 Patent;
- EX1002: The prosecution history of U.S. Patent Application No. 14/018,152, which led to the issuance of the ’632 Patent;
- EX1005: English Translation of JP 2009-277053A (“Hira”);
- EX1006: Certificate of Translation for JP 2009-277053A;
- EX1007: English Translation of WO 2010/050080A1 (“Shiga”);
- EX1008: Certificate of Translation of WO 2010/050080A1;
- EX1009: U.S. Patent Application Publication No. 2011/0036554;
- EX1010: U.S. Patent Application Publication No. 2011/0240581;
- EX1011: U.S. Patent Application Publication No. 2011/0155675;
- EX1012: Random House Webster’s Computer & Internet Dictionary (3d ed. 1999) (excerpt);
- EX1013: Microsoft Computer Dictionary (5th ed. 2002) (excerpt);

- EX1014: Complaint for Patent Infringement; and
- EX1015: Cloud Byte's Preliminary Infringement Contentions with attached Exhibit 5.
- EX1019: Cloud Byte's Disclosure of Proposed Claim Constructions and Extrinsic Evidence with attached Exhibit A

15. My analysis and opinions are further based on my education, training, experience, and knowledge in the relevant field.

III. RELEVANT LEGAL STANDARDS

16. I am not an attorney. For the purposes of this declaration, I have been informed by counsel for the petitioners about certain aspects of the law that are relevant to forming my opinions. My understanding of the relevant law is as follows.

A. Prior Art

17. I understand that for an invention claimed in a patent to be found patentable, it must be (among other things) new and not obvious based on what was known before the invention was made.

18. I understand that the information used to evaluate whether a claimed invention was new and not obvious when made is generally referred to as "prior art." I understand that prior art includes all patents and printed publications that existed before the earliest filing date of the patent. This includes foreign language

material. I also understand that a patent is prior art if it was filed before the effective filing date of the claimed invention and that a printed publication is prior art if it was publicly available before the effective filing date.

19. I understand that in this *inter partes* review proceeding, the petitioners have the burden of proving that the challenged claims are unpatentable in light of the prior art by a preponderance of the evidence. I understand that a preponderance of the evidence is evidence sufficient to show that a fact is more likely true than not true.

20. I understand that patent claims in an *inter partes* review are interpreted by applying the same standard that applies in district court litigation. After the claims are construed, they are then compared to the prior art.

21. I understand that in this *inter partes* review proceeding, the prior art that may be used to evaluate whether the challenged claims are new and not obvious is limited to patents and printed publications. My analysis, which is set out in detail below, compares the challenged claims to patents and printed publications that I have been informed constitute prior art to the claims.

B. Person of Ordinary Skill in the Art

22. I understand that my assessment of the challenged claims and the teachings of the prior art as well as my analysis and opinions herein must be undertaken from the perspective of what would have been known or understood by

a person having ordinary skill in the art, reading the challenged patent on its priority date and in light of the specification and file history of the patent. I may refer to such a person as a "POSITA."

23. I further understand that in determining the level of ordinary skill in the art, I may consider factors including:

(a) the type of problems encountered in the art or field of invention,

(b) prior art solutions to those problems,

(c) the rapidity with which innovations are made,

(d) sophistication of the technology, and

(e) the educational level of active workers in the field.

24. I understand that a person of ordinary skill in the art, or POSITA, is not a specific real individual but is instead a hypothetical individual having the qualities reflected by the factors above. This hypothetical person has knowledge of all prior art in the relevant field and takes from each reference what it would teach to a person having the skills of a POSITA.

C. Anticipation

25. I understand that a patent claim may be "anticipated" if each element of that claim is present either explicitly or inherently in a single prior art reference, and that the elements should be arranged in the prior art reference as in the claim. I understand that for a claimed limitation to be inherently present, the prior art

reference need not expressly disclose the limitation so long as the claimed limitation necessarily flows from a disclosure in the reference.

D. Obviousness

26. I understand that prior art can render the claim "obvious" to a person of ordinary skill in the art. My understanding of this legal standard is set out below.

27. I understand that prior art can render a patent claim unpatentable where subject matter falling within the scope of the claim would have been obvious to a person of ordinary skill in the art. I understand that the following standards govern the determination of whether a patent claim is rendered "obvious" in light of the prior art. I have applied these standards in my evaluation of whether the challenged claims are obvious in light of the prior art.

28. I understand that a claimed invention is not patentable if it would have been obvious to a person of ordinary skill in the field of the invention at the time the claimed invention was made. Even if all the elements of a claim were not found in a single prior art reference, the claim is not patentable if the differences between the subject matter in the prior art and the subject matter in the claim would have been obvious to a POSITA at the time the application was filed. Prior art disclosing a method or device that falls within the scope of a claim can render

that claim obvious even if other, different methods or devices might also fall within the scope of the claim.

29. I understand that a determination as to whether a claim would have been obvious should be based on four factors (though not necessarily in the following order): (i) the level of ordinary skill in the art at the time the application was filed; (ii) the scope and content of the prior art; (iii) the differences between the claimed invention and the prior art; and (iv) any "objective factors" indicating obviousness or non-obviousness that may exist in a particular case.

30. I understand that an obviousness analysis should not be based on hindsight but must be performed using the perspective of a person of ordinary skill in the relevant art as of the effective filing date of the patent claim.

31. I understand that secondary indicia of non-obviousness may include: (1) a long felt but unmet need in the prior art that was satisfied by the invention of the patent; (2) commercial success of processes covered by the patent; (3) unexpected results achieved by the invention; (4) praise of the invention by others skilled in the art; (5) taking of licenses under the patent by others; (6) deliberate copying of the invention; (7) failure of others to find a solution to the long felt need; and (8) skepticism by experts. I also understand that there must be a relationship between any such secondary considerations and the claimed

invention. I further understand that contemporaneous and independent invention by others is a secondary consideration supporting an obviousness determination.

32. I understand that the teachings of two or more prior art references may be combined in the manner disclosed in a challenged claim if such a combination would have been obvious to one having ordinary skill in the art. In determining whether a combination would have been obvious, the following exemplary rationales may support a conclusion of obviousness:

- combining prior art elements according to known methods to yield predictable results;
- simple substitution of one known element for another to obtain predictable results;
- use of a known technique to improve similar devices (methods, or products) in the same way;
- applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
- "obvious to try" – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to

one of ordinary skill in the art;

- some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention; and
- common sense.

33. I understand that the obviousness analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, but instead can take account of the ordinary innovation and experimentation in the relevant field that does no more than yield predictable results.

34. I understand that, in assessing whether there was an apparent reason to modify or combine known elements as claimed, it may be necessary to look to interrelated teachings of multiple patents and printed publications, the effects of commercial demands, and the background knowledge of a person of ordinary skill in the art. I further understand that any motivation that would have applied to a person of ordinary skill in the art, including motivation from common sense or derived from the problem to be solved, is sufficient to explain why references would have been combined.

35. I understand that modifications and combinations suggested by common sense are important and should be considered. Common sense suggests

that familiar items can have obvious uses beyond the particular application being described in a prior art reference, that if something can be done once it would be obvious to do it multiple times, and that in many cases a person of ordinary skill in the art can fit the teachings of multiple patents together in an obvious manner to address a particular problem. Further, the prior art does not need to be directed to solving the same problem that is addressed in the challenged claims.

36. I understand that a person of ordinary skill in the art is also a person of ordinary creativity. In many fields, it may be that there is little discussion of obvious techniques, modifications, and combinations, and it may be the case that market demand, rather than scientific research or literature, will drive a new design. When there is market pressure or design need to solve a particular problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has a good reason to employ the known options. If this leads to the expected success, then it is likely the product of ordinary skill and common sense as opposed to patentable innovation. I understand that if a combination was obvious to try, that may show that it was obvious and therefore unpatentable. That a particular combination of prior art elements was obvious to try suggests that the combination was obvious even if no one made the combination.

E. Written Description

37. I have been informed that patent claims must be supported by an adequate written description. In order for a patent to obtain a priority date based on a prior application, that prior application must provide adequate written description support for the claims. To meet the written description requirement, the particular disclosure must reasonably convey to those of skill in the art that, as of the relevant filing date, the inventor was in possession of the claimed subject matter. I further understand that the level of detail required to satisfy the written description requirement varies depending on the nature and scope of the claims and on the complexity and predictability of the relevant technology. The test for the written description requirement requires an objective inquiry into the four corners of the relevant disclosure from the perspective of a person of ordinary skill in the art.

IV. TECHNICAL ANALYSIS OF THE ’632 PATENT

A. Overview of the Patent Specification

38. The ’632 Patent is entitled “Abnormality Detection Device.” EX1001, 1. The patent issued on November 1, 2016, was filed on September 4, 2013, and claims priority to a Japanese patent application filed on September 5, 2012. The ’632 Patent is generally related to “an abnormality detection device that detects an abnormality of a cooling function of ICT (Information and Communication Technology) equipment such as a server[.]” EX1001, 1:13-16.

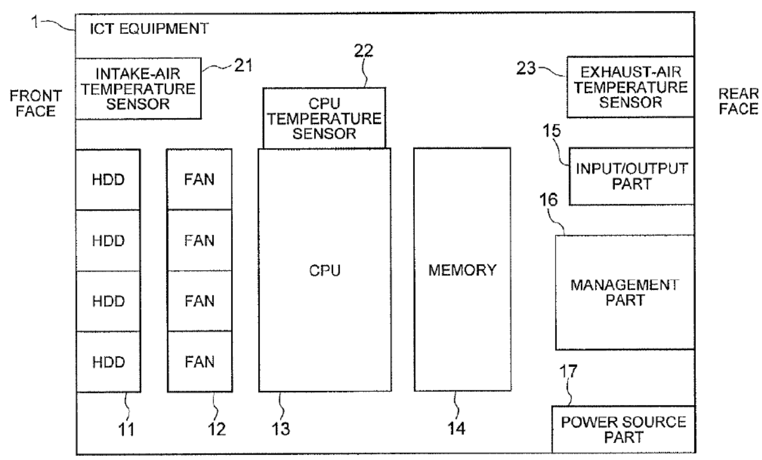
The claimed invention "detect[s] an abnormality of a cooling function, such as clogging of a filter," in ICT equipment. EX1001, 2:6-11.

39. The '632 Patent describes a prior art technique in which "the CPU temperature is compared with the allowable temperature defined for the intake-air temperature, and it is thereby determined whether the abnormality such as clogging of the filter is occurring." EX1001, 1:56-59. However, for such prior art, "in a case where the operational status of the ICT equipment is not constant, it may be impossible to detect an abnormality such as clogging or, by contrast, it may be determined that an abnormality such as clogging is occurring in spite of no abnormality." EX1001, 1:60-64.

40. The '632 Patent purports to "provide an abnormality detection device that solves a problem such that it is impossible to accurately detect an abnormality of a cooling function, such as clogging of a filter in a case where the operational status of ICT equipment is not constant." EX1001, 2:6-11. More particularly, the patent relates to "[a]n estimating unit [that] estimates the upper limit of possible temperatures in a predetermined position of ICT equipment when the quantity of intake air into the ICT equipment is appropriate" and a "determining unit [that] determines that an abnormality is occurring when the result of detection by a temperature sensor…that detects the temperature in the predetermined position is beyond the upper limit estimated by the estimating unit." EX1001, Abstract.

41. The patent contains figures illustrating embodiments of the invention. For example, Figure 1 shows ICT equipment 1 including “an intake-air temperature sensor 21,” “a plurality of cooling fans (FANS) 12,” “a CPU 13 generating much heat and a CPU temperature sensor 22 detecting the component temperature of the CPU 13,” and “a management part 16 that is realized by a chip set….” EX1001, 3:37-50.

FIG. 1

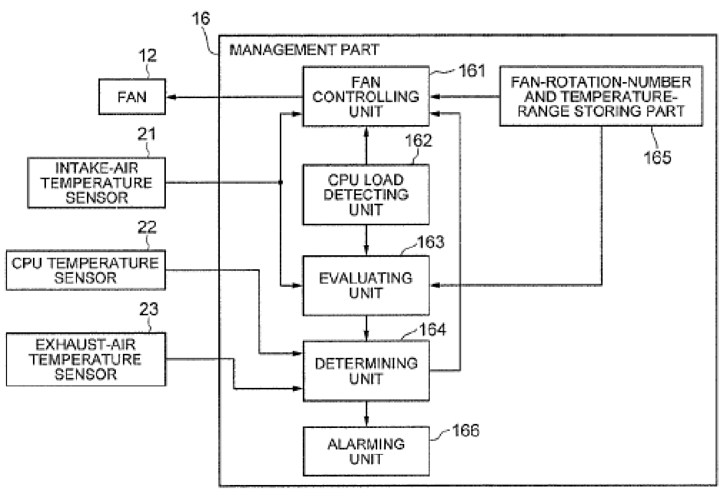


EX1001, Fig. 1.

42. The ’632 Patent states that “[w]hen the cooling fans 12 rotate, air is taken in through an inlet opening (not shown) formed on the front face of the case” and “flows toward the rear” to be “exhausted through an outlet opening….” EX1001, 3:51-55. “A filter for excluding dust is attached to the inlet opening.” EX1001, 3:55-56.

43. Figure 2 of the ’632 Patent shows a management part 16 that “includes a fan controlling unit 161, a CPU load detecting unit 162, an estimating unit 163, a determining unit 164, a fan-rotation-number and temperature-range storing part 165, and an alarming unit 166 such as a buzzer of an LED.” EX1001, 3:57-61.

FIG. 2



EX1001, Fig. 2.

44. “The CPU load detecting unit 162 is used for detecting the operational status of the ICT equipment 1.” EX1001, 4:39-40. “The fan-rotation-number and temperature-range storing unit 165 stores the number of rotations of the fans, the range of intake-air temperatures, and the range of CPU temperatures, in association with a combination of the temperature of intake air and a load on the CPU.” EX1001, 3:62-66.

45. Figure 3 shows “an example of the stored content in the fan-rotation-number and temperature-range storing part 165.” EX1001, 3:66-4:1; see also 5:20-23. Each row of table 165 represents a set of conditions for the ICT equipment, consisting of an intake air temperature range, a CPU load, a fan rotation number, an exhaust air temperature range, and a CPU temperature range. EX1001, 4:6-35.

FIG. 3

165 FAN-ROTATION-NUMBER AND TEMPERATURE-RANGE STORING PART

INTAKE-AIR TEMPERATURE	CPU LOAD	FAN ROTATION NUMBER	EXHAUST-AIR TEMPERATURE RANGE	CPU TEMPERATURE RANGE
Ta1≦Ta<Ta2	L1≦L<L2	R1	Tb1≦Tb<Tb2	Tc1≦Tc<Tc2
Ta1≦Ta<Ta2	L2≦L<L3	R2	Tb2≦Tb<Tb3	Tc2≦Tc<Tc3
⋮	⋮	⋮	⋮	⋮
Ta1≦Ta<Ta2	L10≦L<L11	R10	Tb10≦Tb<Tb11	Tc10≦Tc<Tc11
Ta2≦Ta<Ta3	L1≦L<L2	R1'	Tb1'≦Tb<Tb2'	Tc1'≦Tc<Tc2'
Ta2≦Ta<Ta3	L2≦L<L3	R2'	Tb2'≦Tb<Tb3'	Tc2'≦Tc<Tc3'
⋮	⋮	⋮	⋮	⋮
Ta2≦Ta<Ta3	L10≦L<L11	R10'	Tb10'≦Tb<Tb11'	Tc10'≦Tc<Tc11'
⋮	⋮	⋮	⋮	⋮

EX1001, Fig. 3.

46. The “estimating unit 163 has the function of searching an exhaust-air temperature range and a CPU temperature range stored in association with the result of detection by the intake-air temperature sensor 21 and the result of detection by the CPU load detecting unit 162, from the fan-rotation-number and temperature-range storing part 165.” EX1001, 5:7-13; see also 3:62-4:35, 4:59-66.

47. The determining unit 164 takes the CPU temperature range and the exhaust-air temperature range identified the estimating unit, compares them to the actual measurements from the CPU temperature sensor 22 and the exhaust-air temperature sensor 23, and determines "whether an abnormality of a cooling function such as clogging of the filter is occurring." EX1001, 5:14-20.

B. Overview of the Prosecution History

48. The '632 Patent issued based on Patent Application No. 14/018,152, which was filed on September 4, 2013. EX1002, 2-57. The application contained nine claims, including three independent claims (i.e., application claims 1, 8, and 9). EX1002, 33-36.

49. On December 14, 2015, the examiner issued an Office Action rejecting all application claims. EX1002, 85-96. The examiner rejected all application claims as obvious based on U.S. Patent Application Publication No. 2007/0215341 ("Urita") and U.S. Patent Application Publication No. 2011/0057803 ("Yamaoka"). EX1002, 87-96.

50. On April 14, 2016, the applicant filed a response making certain amendments to the application claims and asserting various arguments to distinguish the cited prior art. EX1002, 122-130.

51. For example, the applicant added the following clause to claim 1: "wherein the operational status of the ICT equipment and the intake air

temperature of the ICT equipment determines a rotation speed of the cooling fan." EX1002, 123. The applicant made similar amendments to application claims 8 and 9. EX1002, 125-127.

52. The applicant argued that "Urita does not teach detecting an intake air temperature" and that "[i]t would not have been obvious to combine Urita with Yamaoka to include this feature as Urita is directed to detecting cooling system deterioration by measuring an actual CPU temperature and an estimated CPU temperature and comparing the two." EX1002, 128. According to the applicant: "If either the actual or estimated CPU temperature of Urita were to be replaced by an intake air temperature derived from Yamaoka, the principle of operation and purpose of Urita—to compare actual and estimated CPU temperatures and determine deterioration based on a comparison of the two—would be violated." EX1002, 128-129. The applicant further argued that "if the temperature sensor in Urita was modified to measure air intake temperature, it would then not teach detecting a detected equipment temperature, as the temperature sensor would be monitoring actual and estimated air intake temperature, not a detected equipment temperature." EX1002, 129. Finally, the applicant argued that combining the "sensor of Yamaoka" with "the system of Urita" would not disclose all the limitations of the application invention because "it would not disclose a determining unit configured to determine that an abnormality is occurring when a

result of detection by a temperature sensor that detects a detected equipment temperature in the predetermined position is beyond the upper limit estimated by the estimating unit." EX1002, 129.

53. On June 29, 2016, the examiner issued a Notice of Allowance. EX1002, 148-155. The '632 Patent issued on November 1, 2016. EX1001, 1.

C. The Patent Claims

54. The '632 Patent contains nine claims, including three independent claims (i.e., claims 1, 8, and 9). Claim 1 reads as follows:

> [1pre] An abnormality detection device for detecting an abnormality in Information and Communication Technology (ICT) equipment having a cooling fan, the abnormality detection device comprising:
>
> [1a] a hardware processor comprising:
>
> [1b] an estimating unit configured to estimate an upper limit of possible temperatures in a predetermined position of ICT equipment when a quantity of intake air into the ICT equipment is appropriate, based on a result of detection by an operational status detecting unit that detects an operational status of the ICT equipment and a result of detection by an intake-air temperature sensor that detects an intake air temperature of intake air of the ICT equipment,
>
> [1c] wherein the operational status of the ICT equipment and the intake air temperature of the ICT equipment determines a rotation speed of the cooling fan; and
>
> [1d] a determining unit configured to determine that an abnormality

> is occurring when a result of detection by a temperature sensor that detects a detected equipment temperature in the predetermined position is beyond the upper limit estimated by the estimating unit.

I have separately identified each limitation (i.e., 1pre, 1a, 1b, 1c, 1d) for reference.

55. Independent claim 8 recites an "Information and Communication Technology (ICT) equipment including a cooling fan" that detects an abnormality as in claim 1. Claim 8 reads as follows:

> [8pre] An Information and Communication Technology (ICT) equipment including a cooling fan, comprising:
>
> [8a] an operational status detecting unit configured to detect an operational status of the ICT equipment;
>
> [8b] an intake-air temperature sensor configured to detect an intake air temperature of intake air of the ICT equipment;
>
> [8c] an equipment temperature sensor configured to detect an equipment temperature in a predetermined position of the ICT equipment;
>
> [8d] a hardware processor including:
>
> [8e] an operational status detecting unit configured to detect an operational status of the ICT equipment;
>
> [8f] an estimating unit configured to estimate an upper value limit of possible temperatures in a predetermined position of the ICT equipment when a quantity of intake air into the ICT equipment is

appropriate, based on a result of detection by the operational status detecting unit and a result of detection by the intake-air temperature sensor, an operational status of the ICT equipment, and an intake air temperature,

[8g] wherein the operational status of the ICT equipment and the intake air temperature of the ICT equipment determines a rotation speed of the cooling fan; and

[8h] a determining unit configured to determine that an abnormality is occurring when a result of detection by the detected equipment temperature sensor is beyond the upper limit estimated by the estimating unit.

Again, I have separately identified each limitation (i.e., 8pre, 8a, 8b, etc.) for reference.

56. Independent claim 9 recites an "abnormality detection method of Information and Communication Technology (ICT) equipment including a cooling fan." Claim 9 reads as follows:

9. An abnormality detection method of Information and Communication Technology (ICT) equipment including a cooling fan, the method comprising:

detecting an operational status and an intake air temperature of the ICT equipment;

by an estimating unit, estimating an upper limit of possible temperatures in a predetermined position of the ICT equipment when a quantity of intake air into the ICT equipment is appropriate, based on the detected operational status and the air intake temperature, a result of detection by an operational status detecting unit that detects an operational status of the ICT equipment and a result of detection by an intake-air temperature sensor that detects a temperature of intake air of the ICT equipment;

determining a rotation speed of the cooling fan based on the detected operational status and the air intake temperature; and

by a determining unit, determining that an abnormality is occurring when a result of detection by a detected equipment temperature sensor that detects a temperature in the predetermined position is beyond the upper limit estimated by the estimating unit.

57. In addition, the ’632 Patent includes dependent claims 2-7 that each depend directly from claim 1.

D. Person of Ordinary Skill in the Art

58. As discussed above, I have been informed and understand that the level of ordinary skill in the relevant art at the time of the claimed invention is relevant to inquiries such as the meaning of claim terms, the meaning of disclosures in prior art references, and the reasons that a person of ordinary skill in the art might have combined the teachings of certain prior art references.

59. In my opinion a person of ordinary skill in the art with regard to the ’632 Patent would have had an undergraduate degree (or equivalent) in mechanical engineering, electrical engineering, computer engineering, computer

science, or a comparable subject and would have had two to three years of work experience in the design and architecture of thermal management systems of electronic devices. Alternatively, a person of ordinary skill in the art would have had an advanced degree (or equivalent) in mechanical engineering, electrical engineering, computer engineering, computer science, or a comparable subject and would have had one year of post-graduate research or work experience in the design and architecture of thermal management systems of electronic devices. Similar skills and knowledge could be acquired by other means. Further, a person of ordinary skill in the art would have been aware of, familiar with, and generally knowledgeable about the thermal management technology used in electronic devices, such as servers and other computers, and would have been familiar with then-existing thermal management principles and techniques for such electronic devices.

60. In reaching my opinion about the level of ordinary skill in the art, I have considered the types of problems, and techniques for addressing them, discussed in the ’632 Patent and in the prior art references cited on its face.

The ’632 Patent is directed to an approach for detecting an abnormality in the thermal management of ICT equipment, such as a clogged dust filter that would impair normal cooling by fans. EX1001, 1 (Abstract), 1:13-17, 2:6-11.

The ’632 Patent describes an “estimating unit” that “estimates the upper limit of possible temperatures" for the ICT equipment under different operating conditions and a "determining unit" that determines whether "an abnormality is occurring" based on temperature sensor readings. EX1001, 1 (Abstract); see also 5:40-6:67, Fig. 4. The patent does not dictate the programming for estimating the upper limit temperature or for determining that an abnormality is occurring. This indicates that a person of ordinary skill in the art would be someone capable of implementing the functionality described in the patent without detailed instruction. Further, the patent's disclosure suggestions someone familiar with the functioning of electronic components as well as temperature and fan rotation speed control. The cited prior art on the face of the '632 Patent also discusses temperature control for electronic devices. Thus, the '632 Patent and cited prior art address problems and technical solutions to those problems that support my opinion regarding the level of ordinary skill in the art.

61. Further, for over 25 years, including when the '632 Patent was filed, I led various companies in their thermal technology development. From my work in the industry in the 2000s and into the 2010s, I am familiar with the rapidity with which innovations were being made in the art and the education level of active works in the relevant field. Thus, my personal experience also informs and supports my opinion regarding the level of ordinary skill in the art.

62. In view of my educational background, as well as my decades of academic and professional experience (as discussed above), I was a person of more than the ordinary level of skill in the art in the 2012-2013 timeframe. My Ph.D. thesis focused on modeling of two-phase flow dynamics in heat transfer systems. I have been designing, building, and analyzing thermal management systems, including those relying on airflow generated by fans, for over 25 years. I have also been working with and presenting to individuals who met the above criteria for persons of ordinary skill in the art for many years. I have worked in a number of industry positions, including leading up to and through the 2012-2013 timeframe, including working for Intel Corp., k-Technology Corp., Ventiva Inc., and Sheetak, where I worked alongside or oversaw the work of engineers and others whose experience level is consistent with my definition of a person of ordinary skill in the art. Thus, I was, and am, familiar with the understanding and knowledge of persons of ordinary skill in the art as of 2012-2013, and I was, and am, familiar with the subject matter of the ’632 Patent, including technology relating to thermal management of electronic devices.

63. Although my qualifications and experience exceed those of the hypothetical person of ordinary skill in the art defined above, my analysis and opinions regarding the ’632 Patent have been based on the perspective of a person of ordinary skill in the art in 2012-2013.

64. To the extent that a person of ordinary skill in the art is defined slightly differently than I define it above, or the qualifications have minor substantive differences, I would also be at least a person of ordinary skill in the art based on my academic and industry background described in this declaration. I have considered whether my opinions expressed in this declaration would change if the level of ordinary skill in the art were varied by a few years or varied somewhat with respect to subject matter. My opinions would not change in light of such minor variations.

E. Claim Construction

65. I have been advised and understand that patent claims in an *inter partes* review are interpreted by applying the same standard that applies in federal district court proceedings, which I understand is referred to as the *Phillips* standard.

66. I understand that under the *Phillips* standard, claim terms are typically given their ordinary and customary meaning as would have been understood by a POSITA at the time of the invention based on the language of the claims, the patent specification, and the prosecution history. I understand that these sources of evidence are often referred to as "intrinsic evidence" or the "intrinsic record" of the patent. I understand that under the *Phillips* standard, extrinsic evidence such as

expert or inventor testimony, dictionary definitions, and prior art publications can also be considered but are given less weight than the intrinsic evidence.

67. I understand that when a claim limitation recites a generic term (e.g., "means") with associated functional language it may invoke means-plus-function treatment under Section 112 of the Patent Act. I also understand that when a claim limitation uses the term "means" and functional language, a presumption arises that means-plus-function treatment applies. I understand that means-plus-function language typically begins with "means for" followed by functional language. I also understand that other generic nonce words can substitute for "means" and may still invoke means-plus-function treatment. I further understand that means-plus-function treatment is not appropriate where the claim language supplies sufficient structure for performing the claimed function.

68. I understand that when claim language invokes means-plus-function treatment, the specification must provide corresponding structure such that a person of ordinary skill in the art will understand the structure that performs the recited function. I also understand that the scope of means-plus-function terms will be construed to cover that corresponding structure and equivalents of it. As such, I understand that construction of means-plus-function terms requires identification of a function as well as corresponding structure for that function. I also understand that, for a reference to anticipate or render obvious a means-plus-

function term, it must provide equivalent structure for performing an equivalent function.

69. For purposes of my analysis of the challenged claims of the ’632 Patent, I have used the plain and ordinary meaning to a POSITA as clarified below. I have been asked to address the following claim terms to clarify how I have applied them in my analysis.

1. “in a case where a result of detection by the intake-air temperature sensor is equal”

70. Dependent claim 2 recites that “the estimating unit is configured to, <u>in a case where a result of detection by the intake-air temperature sensor is equal</u>, estimate a lower temperature value as the upper limit, as the operational status detected by the operational status detecting unit indicates a lower utilization rate.” EX1001, 8:33-38 (emphasis added).

71. The ’632 Patent discusses this limitation in connection with Figure 3, which illustrates “an example of the stored content in the fan-rotation-number and temperature-range storing part 165.” EX1001, 3:66-4:1.

FIG. 3

165 FAN-ROTATION-NUMBER AND TEMPERATURE-RANGE STORING PART

a result of detection by the intake-air temperature sensor is equal

INTAKE-AIR TEMPERATURE	CPU LOAD	FAN ROTATION NUMBER	EXHAUST-AIR TEMPERATURE RANGE	CPU TEMPERATURE RANGE
Ta1≦Ta<Ta2	L1≦L<L2	R1	Tb1≦Tb<Tb2	Tc1≦Tc<Tc2
Ta1≦Ta<Ta2	L2≦L<L3	R2	Tb2≦Tb<Tb3	Tc2≦Tc<Tc3
⋮	⋮	⋮	⋮	⋮
Ta1≦Ta<Ta2	L10≦L<L11	R10	Tb10≦Tb<Tb11	Tc10≦Tc<Tc11
Ta2≦Ta<Ta3	L1≦L<L2	R1'	Tb1'≦Tb<Tb2'	Tc1'≦Tc<Tc2'
Ta2≦Ta<Ta3	L2≦L<L3	R2'	Tb2'≦Tb<Tb3'	Tc2'≦Tc<Tc3'
⋮	⋮	⋮	⋮	⋮
Ta2≦Ta<Ta3	L10≦L<L11	R10'	Tb10'≦Tb<Tb11'	Tc10'≦Tc<Tc11'
⋮	⋮	⋮	⋮	⋮

EX1001, Fig. 3 (annotated). The ’632 Patent states that, “in a case where an intake-air temperature Ta is equal, the upper limits and the lower limits of the exhaust-air temperature range and the CPU temperature range are lower as a CPU load L is smaller.” EX1001, 4:1-5 (emphasis added).

72. Based on the disclosure in the ’632 Patent, the statement in claim 2 that intake-air temperature is “equal” refers to the intake-air temperature being the same (i.e., not changing) even though the ICT equipment is operating under multiple different conditions. For example, the CPU load may be higher or lower, but the intake-air temperature remains the same (i.e., equal).

73. With this understanding, the plain meaning of claim 2 is that when the ICT equipment is in multiple different operating conditions while the intake-air temperature remains the same, the “estimating unit” will “estimate a lower

temperature value as the upper limit" when the "utilization rate" is lower. In other words, if the intake-air temperature stays the same, the estimated upper temperature limit will rise and fall along with the operational status such as CPU load. If, for example, CPU load is low, then the threshold temperature indicating an abnormality will be relatively lower. But if CPU load is high, then the threshold temperature indicating an abnormality will be relatively higher.

2. "estimating unit," "operational status detecting unit," "determining unit," "temperature range storing unit," "fan controlling unit"

74. The independent claims of the '632 Patent and several dependent claims recite an "estimating unit," an "operational status detecting unit," and a "determining unit." EX1001, 8:15-32, 9:14-15, 9:23-10:8, 10:15-24, 10:28-32. Claim 4 recites a "fan controlling unit." EX1001, 8:62-67.

75. I understand that Petitioners do not contend these terms ("estimating unit," "operational status detecting unit," and "determining unit") are mean-plus-function limitations. The claims do not refer to any "means for" performing a function and the terms were not construed as a means-plus-function terms during prosecution. EX1002, 86-95, 122-130. I understand that the Patent Owner does not contend that the terms are means-plus-function limitations in the related litigation. EX1015, 9, 7-187. For purposes of my analysis, I have applied the plain meaning of these terms.

76. I have also been asked to consider if my opinions expressed below would change if I applied a different construction assuming that these terms were construed as a means-plus-function claim.

77. If I make that assumption, I believe that for claim 1 the relevant function performed by the "estimating unit" would be to "estimate an upper limit of possible temperatures in a predetermined position of ICT equipment when a quantity of intake air into the ICT equipment is appropriate, based on a result of detection by an operational status detecting unit that detects an operational status of the ICT equipment and a result of detection by an intake-air temperature sensor that detects an intake air temperature of intake air of the ICT equipment." For claim 8, the function would be to "estimate an upper value limit of possible temperatures in a predetermined position of the ICT equipment when a quantity of intake air into the ICT equipment is appropriate, based on a result of detection by the operational status detecting unit and a result of detection by the intake-air temperature sensor, an operational status of the ICT equipment, and an intake air temperature." For claim 9, the function would be "estimating an upper limit of possible temperatures in a predetermined position of the ICT equipment when a quantity of intake air into the ICT equipment is appropriate, based on the detected operational status and the air intake temperature, a result of detection by an operational status detecting unit that detects an operational status of the ICT

equipment and a result of detection by an intake-air temperature sensor that detects a temperature of intake air of the ICT equipment." The corresponding structure in the '632 Patent for each of these functions would be a CPU functioning as evaluating unit 163 illustrated in Figure 2, also referred to as estimating unit 163 (EX1001, 4:59-5:14, 5:22-32). If I were to apply this construction, my opinions below would not change because the prior art I discuss discloses these functions for the reasons I explain below for the relevant limitations and because the prior art discloses an equivalent structure to perform the functions. See Sections VI.A.1.c, VI.A.3.g, and VI.A.4.c, below.

78. If I assume the limitations reciting an "operational status detecting unit" are means-plus-function limitations, I believe that for claims 1, 8, and 9 the relevant function performed by the "operational status detecting unit" would be to "detect an operational status of the ICT equipment." The corresponding structure would be a CPU functioning as CPU load detecting unit 162 in Figure 2 (EX1001, 4:36-37, 5:22-32). If I were to apply this construction, my opinions below would not change because the prior art I discuss discloses the function for the reasons I explain below for the relevant limitations and because the prior art discloses an equivalent structure to perform the function. See Sections VI.A.1.c, VI.A.3.g, and VI.A.4.c, below.

79. If I assume the limitations reciting a "determining unit" are means-plus-function limitations, I believe that for claim 1 the relevant function performed by the "determining unit" would be to "determine that an abnormality is occurring when a result of detection by a temperature sensor that detects a detected equipment temperature in the predetermined position is beyond the upper limit estimated by the estimating unit." For claim 8, the function would be to "determine that an abnormality is occurring when a result of detection by the detected equipment temperature sensor is beyond the upper limit estimated by the estimating unit." For claim 9, the function would be "determining that an abnormality is occurring when a result of detection by a detected equipment temperature sensor that detects a temperature in the predetermined position is beyond the upper limit estimated by the estimating unit." The corresponding structure in the '632 Patent for each of these functions would be a CPU functioning as determining unit 164 illustrated in Figure 2 (EX1001, 5:15-21, 5:22-32). If I were to apply this construction, my opinions below would not change because the prior art I discuss discloses these functions for the reasons I explain below for the relevant limitations and because the prior art discloses an equivalent structure to perform the functions. See Sections VI.A.1.e, VI.A.3.i, and VI.A.4.e, below.

80. If I assume the limitation reciting a "fan controlling unit" in claim 4 is a means-plus-function limitation, I believe the relevant function would be to

"control a number of rotations of cooling fans to reduce a number of rotations of the cooling fans when a result of detection by the temperature sensor is below a lower limit estimated by the estimating unit." The corresponding structure would be a CPU functioning as fan controlling unit 161 illustrated in Figure 2 (EX1001, 4:45-58, 5:22-32). If I were to apply this construction, my opinions below would not change because the prior art I discuss discloses the function for the reasons I explain below for the relevant limitation and because the prior art discloses an equivalent structure to perform the function. See Section VI.A.2.c, below.

81. I have reviewed my analysis of the relevant claim limitations, and I have concluded that the same disclosures I cite in the prior art would also apply even if I were to assume means-plus-function constructions. In other words, my opinions expressed below would not change.

V. PRIOR ART REFERENCES

82. I am informed that each of the following references constitutes prior art to the '632 Patent.

A. Hira (EX1005)

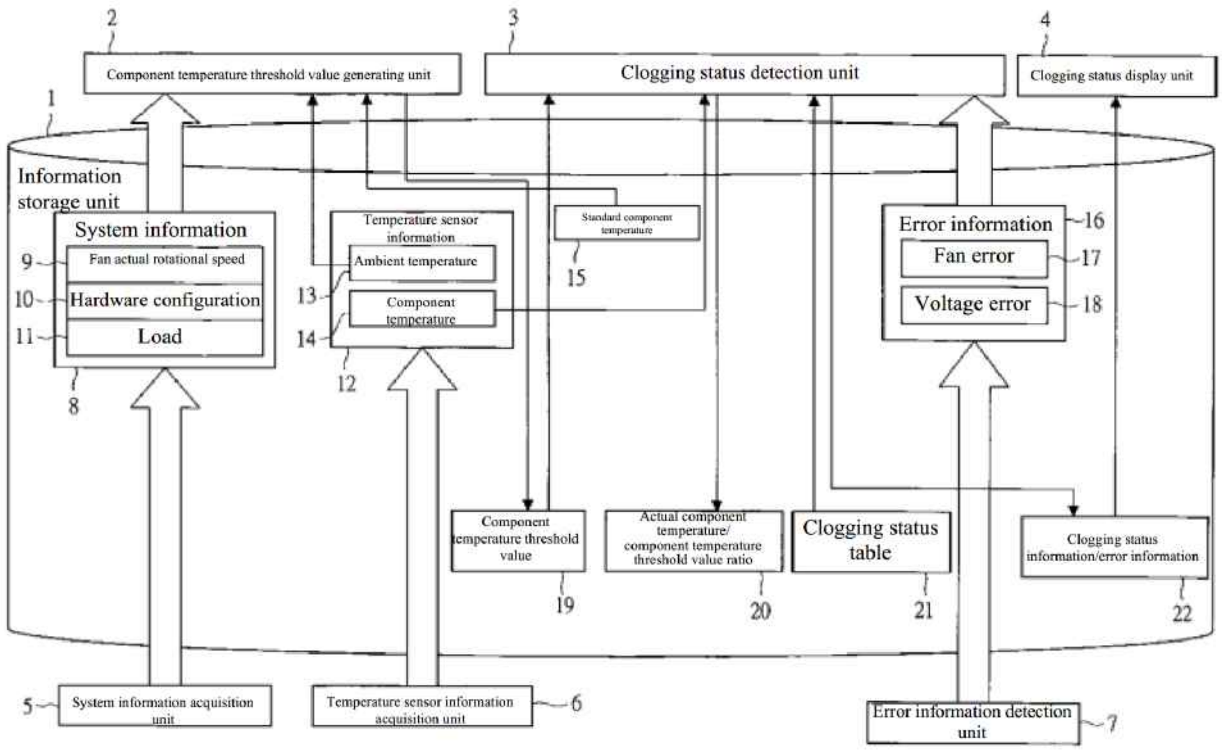
83. Hira is an English translation of Japanese Unexamined Patent Application Publication No. JP2009277053A entitled "Dust filter clogging status detection method and dust filter clogging status detection device." EX1005, 1. I have reviewed a declaration certifying that Hira is a true and accurate translation of

Japanese Unexamined Patent Application Publication No. JP2009277053A. EX1006. Hira was filed on May 15, 2008, and was published on November 26, 2009. EX1005, 1.

84. Hira was not cited during prosecution of the ’632 Patent.

85. Hira discloses a “dust filter clogging status detection” method and device “for detecting clogging status of dust filters inside information processing devices such as PCs and server systems….” EX1005, [0001]. Hira’s invention includes “a component temperature threshold value generating unit” that “generates component temperature threshold values for the multiple components making up the information processing device” and “a clogging status detection unit which detects the clogging status of the dust filter….” EX1005, [0008].

86. Figure 1 in Hira is “a configuration diagram illustrating the configuration of a dust filter clogging status device according to one embodiment of the present invention.” EX1005, [0012]. Hira’s “dust filter clogging status detection device is configured as part of an information processing device such as a PC/server system….” EX1005, [0014]. The device includes “information storage unit 1,” such as a hard disk drive, for storing information including “system information 8 (actual fan rotation speed 9, hardware configuration 10, load 11),” as illustrated within information storage unit 1 in the figure. EX1005, [0015].



<u>**Hira, Fig. 1**</u>

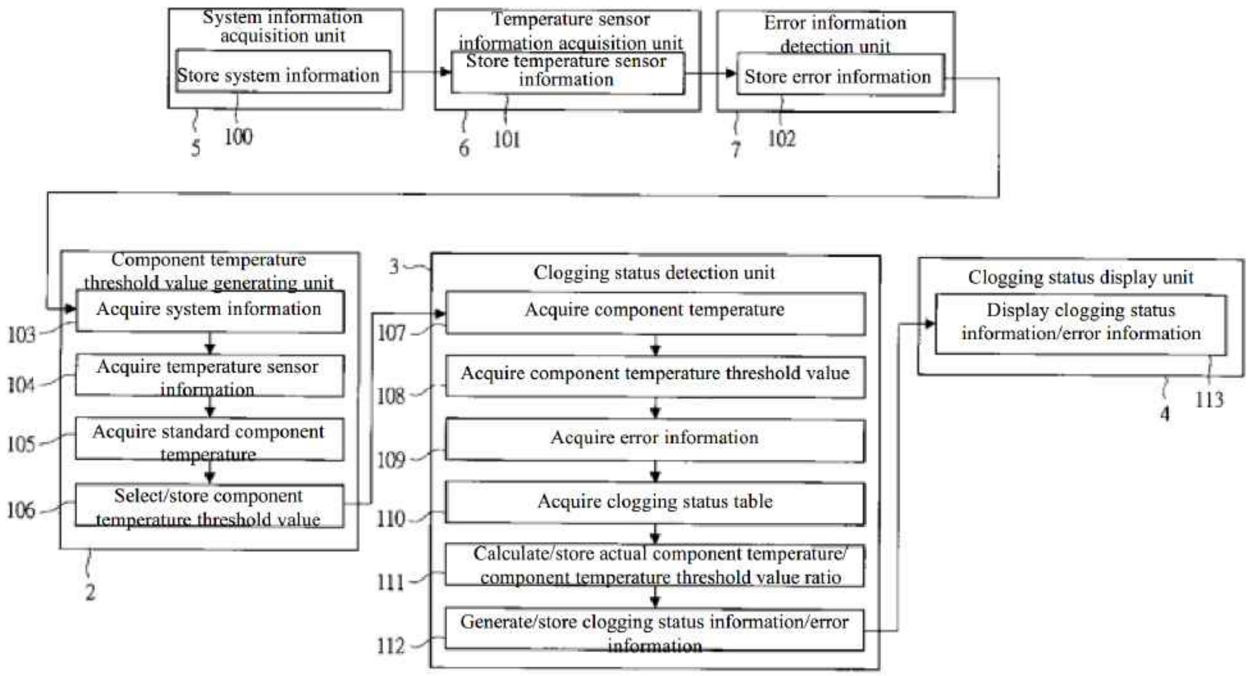
EX1005, Fig. 1.

87. Hira's Figure 1 also illustrates several functions, which Hira refers to as "units" and shows them outside information storage unit 1, that are performed on the server's CPU including "component temperature threshold value generating unit 2" and "clogging status detection unit 3." EX1005, [0014]. Arrows in Figure 1 indicate how the various units write to or read from information storage device 1.

88. Hira's Figure 8 is "a flowchart showing the dust filter clogging status detection operation of the dust filter clogging status detection device according to

one embodiment of the present invention." EX1005, [0029]. In the first three steps 100, 101, and 102, Hira collects and stores "system information from the operating system, etc.," "temperature sensor information," and "error information." EX1005, [0030].

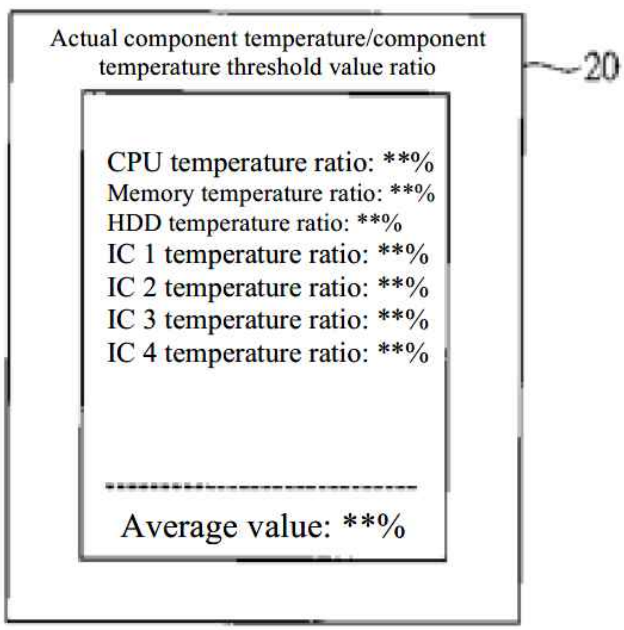
FIG. 8



EX1005, Fig. 8. "Then, component temperature value generating unit 2" acquires "system information 8" (step 103), "temperature sensor information 12" (step 104), and "standard component temperature 15" (step 105), and it uses the acquired information to generate and store the appropriate "component threshold value 19" (step 106). EX1005, [0031]. "Then, clogging status detection unit 3" acquires the current "component temperature 14" (step 107), "component temperature threshold value 19" (step 108), "error information" (109), and "clogging status table 21" (step 110), and it calculates the "actual component temperature/component temperature threshold value ratio 20" (step 111). EX1005, [0032]-[0033]. "Then, clogging status information/error information 22 is generated" (step 112). EX1005, [0034]. And finally, "the clogging status display unit 4 acquires clogging status information/error information 22 from the information storage unit 1 and displays this information (step 113)." EX1005, [0035].

89. Figure 5 in Hira shows "an example of actual component temperature/component temperature threshold value ratios" for multiple different components including CPU, memory, etc. EX1005, [0022], [0026].

FIG. 5



EX1005, Fig. 5. Hira uses the "average value" of those ratios. EX1005, [0026].

90. Hira's Figure 6 is "an example of a clogging status table," which "is prepare in advance during the design/development phase and stored in the information storage unit 1…." EX1005, [0022], [0027].

FIG. 6

Clogging status table

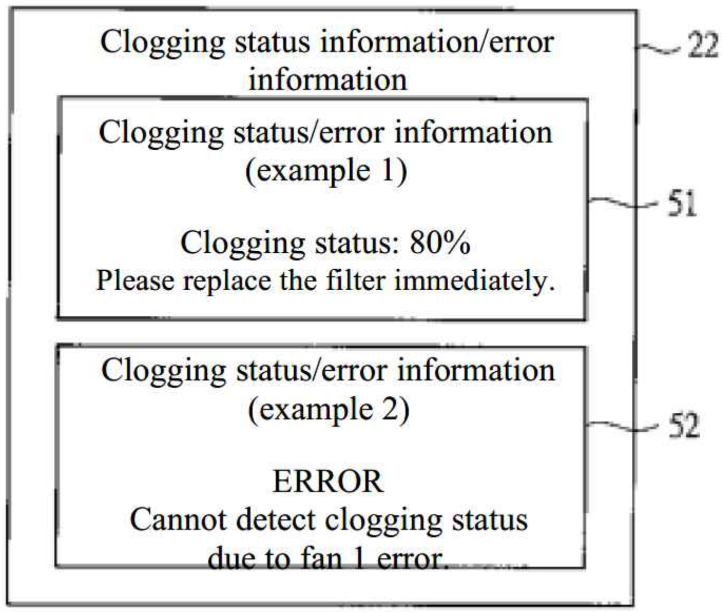
Actual temperature/temperature threshold value average value	Clogging status	Message
~%	~30%	No problems.
~%	30~70%	Please prepare to replace the filter.
~%	70~100%	Please replace the filter immediately.

21

EX1005, Fig. 6. The table "is composed of clogging status and messages for each average value of actual component temperature/temperature threshold value." EX1005, [0027]. Based on the illustrated example, a POSITA would understand that a relatively low ratio would be associated with a clogging status of less than 30% clogged and indicate "No problems" while a relatively high ratio would be associated with a clogging status of more than 70% clogged and prompt the message "Please replace the filter immediately."

91. Figure 7 in Hira "shows an example of clogging status/error information used in the dust filter clogging status detection device…." EX1005, [0022].

FIG. 7



EX1005, Fig. 7. "Clogging status information/error information 22, as shown in FIG. 7, is composed of clogging status and messages as in clogging status/error information (example 1) 51." EX1005, [0028]. "When error information exists, it is composed of error information and content indicating that clogging cannot be detected, as in clogging status/error information (Example 2) 52." EX1005, [0028].

92. A person of ordinary skill in the art would have naturally considered Hira because it is in the same field of endeavor as the '632 Patent (i.e., electronic devices, such as server computers). Additionally, Hira and the '632 Patent addresses the same problem of thermal management within electronic device

enclosures. More particularly, both address the specific issue of determining when dust filters have become clogged and do so when the electronic device is operating under varying conditions. EX1005, 1 (Abstract), [0001], [0004], [0008]-[0010]; EX1001, 1 (Abstract), 1:12-17, 2:6-11, 3:8-11.

B. Shiga (EX1007)

93. Shiga is an English translation of international patent application publication number WO2010050080A1 entitled "Physical computer, method for controlling device, and server system." EX1007, 1. I have reviewed a declaration certifying that Shiga is a true and accurate translation of international patent application publication number WO2010050080A1. EX1008. Shiga was filed on February 24, 2009, and was published on May 6, 2010. EX1007, 1.

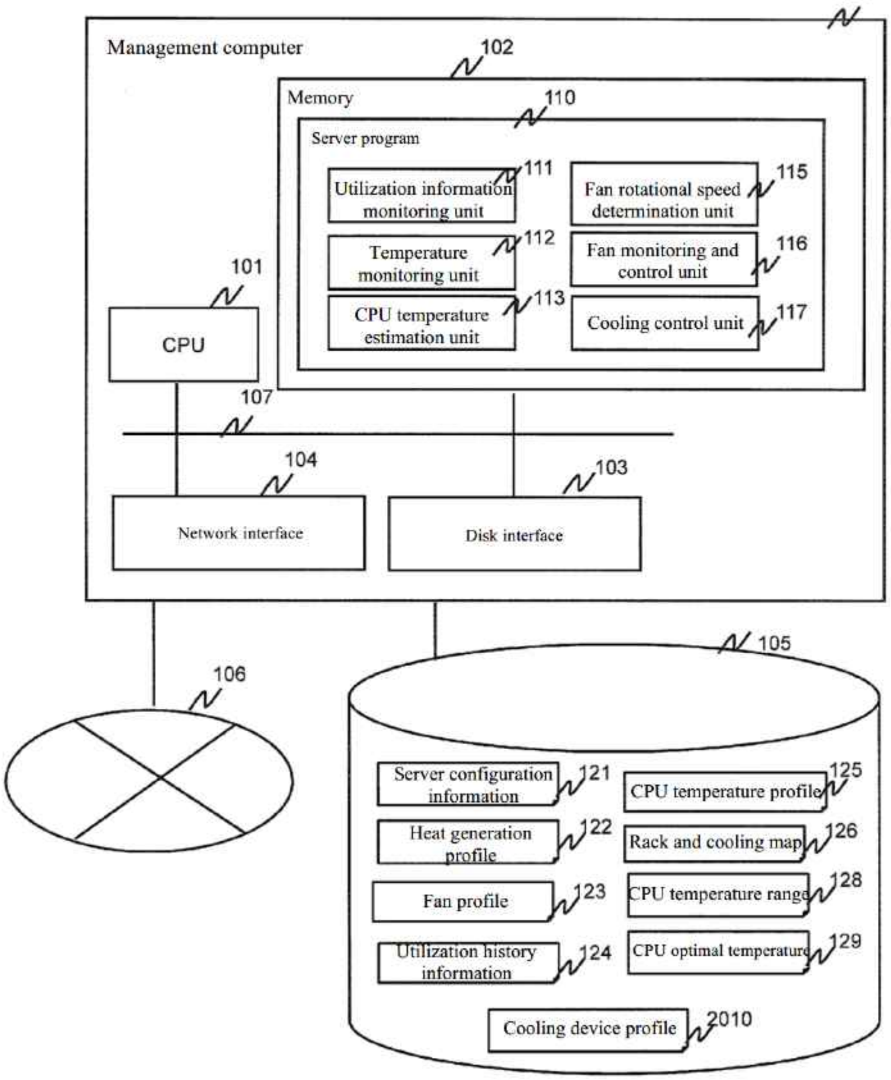
94. Shiga was not cited during prosecution of the '632 Patent.

95. Shiga discloses a technique for "[c]ooling control for reducing overall power consumption of a system," such as a computer server, and "particularly to a method for controlling the output of fans in physical computers and cooling devices according to CPU utilization rate." EX1007, 1 (Abstract), [0001]. Shiga describes "the server system of the present invention" as "a server system characterized in that it comprises the server device, which has a processor and a fan, and measures the temperature and utilization rate of the processor, the rotational speed of the fan, and the intake air temperature…." EX1007, [0013].

The system uses the “temperature and utilization rate of the processor, the rotational speed of the fan, and the intake air temperature” to calculate the “estimated temperature of the processor after a predetermined time period” (i.e., at a future time). EX1007, [0013]. If the estimated temperature exceeds a threshold, the system adjusts the “target rotational speed of the fan” to bring the temperature down below the threshold. EX1007, [0013]. Shiga states that “by cooling CPUs in advance and maintaining optimal temperature, power consumption due to leakage current can be minimized and cooling efficiency can be increased.” EX1007, [0014].

96. Figure 2 in Shiga illustrates a “management computer 100” that manages “one or more physical computers 200” (e.g., server computers). EX1007, [0018]. The management device is connected to and “detects the utilization status of the multiple physical computers 200.” EX1007, [0020].

FIG. 2



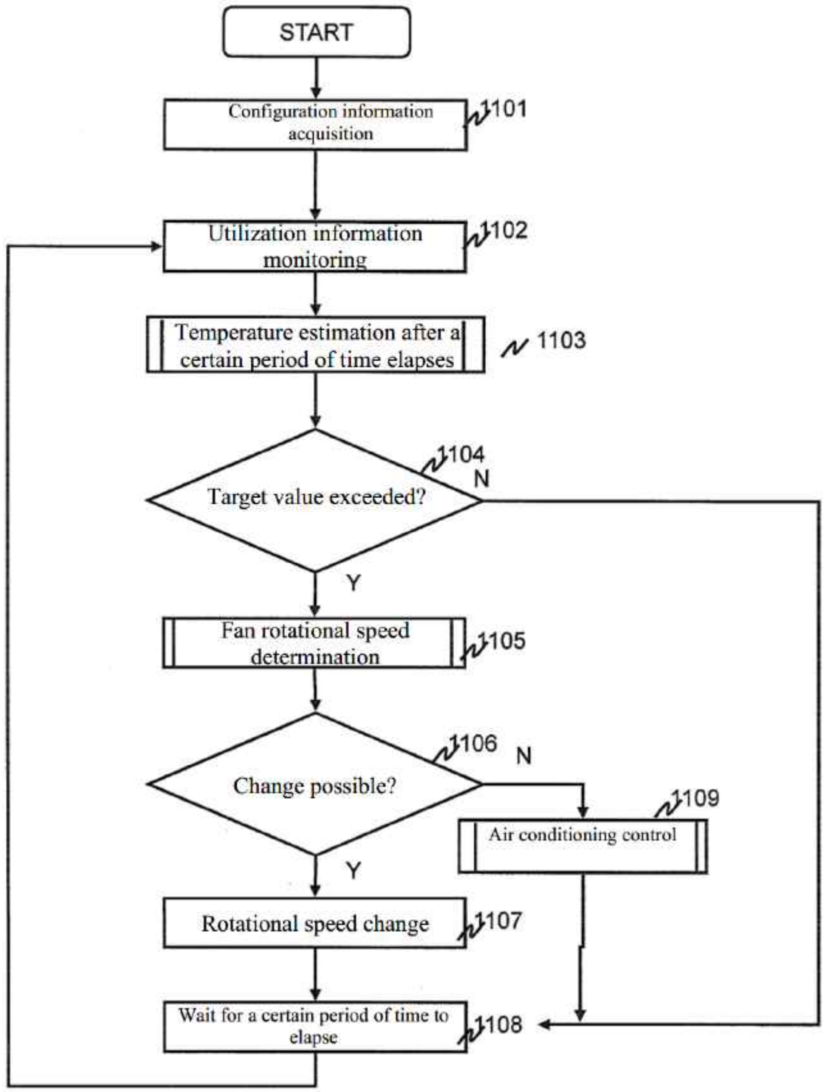
EX1007, Fig. 2.

97. As illustrated in Figure 2, management computer 100 includes "server program 110." EX1007, [0022]. Included in server program 110 is "utilization information monitoring unit 111" (also referred to by Shiga as "utilization information and power monitoring unit 111"), which "collects utilization information and power consumption information from the physical computers 200." EX1007, [0022]. Server program 110 also includes "temperature

monitoring unit 112" that "acquires the intake air temperature, CPU temperature, and exhaust temperature of the physical computers." EX1007, [0022].

98. While Shiga describes (and Figure 2 illustrates) server program 110 on a management computer connected to one or more physical computers (e.g., servers), Shiga states that "the server program 110 may also be stored in the memory of the physical computer…to perform the fan control and air conditioning unit control of the present embodiment example within the physical computer." EX1007, [0091].

99. Figure 11 shows the "control flow" for an embodiment of Shiga's cooling control technique. EX1007, [0063]-[0064]. After system configuration information is acquired (step 1101), "the utilization information monitoring unit 111 collects utilization information and power consumption…and stores this in the server utilization history 124" (step 1102). EX1007, [0065].



EX1007, Fig. 11. The unit collects this information using "measurement agent 223," which "is a software program that runs on the computer 200 and collects utilization information such as CPU utilization rate, memory utilization rate, and network interface utilization rate of the device on which the program runs…." EX1007, [0029].

100. Next, in step 1103, "the CPU temperature estimation unit 113 estimates the CPU temperature…after a certain period of time elapses…."

EX1007, [0066]. When Shiga refers to the estimated CPU temperature "after a certain period of time elapses" it means the estimated temperature at a future point in time. The "CPU temperature estimation unit 113 references the server utilization history 124 and obtains the CPU utilization rate 714 of the physical computer 200 that is the object of this processing…." EX1007, [0068]. It also "obtains the current CPU temperature and server device intake air temperature using the temperature monitoring unit, and obtains the current fan rotational speed using the fan monitoring and control unit 116." EX1007, [0070]. "Then…it determines the CPU temperature change (cooling effect) if the current fan rotational speed is maintained from the current time until a certain period of time elapses…." EX1007, [0070]. "Finally, the CPU temperature change corresponding to the generated amount of heat is added to the current CPU temperature, the temperature change due to the fan is subtracted, and the result is set as the CPU temperature after a certain period of elapses…." EX1007, [0071].

101. If the estimated future CPU temperature "exceeds the established threshold value" (step 1104=Yes), the "temperature monitoring unit obtains the intake air temperature at the physical computer" and the "fan rotational speed determination unit 115" determines "the fan rotational speed needed to reduce the CPU temperature after a certain period of time elapses to within the upper limit value" (step 1105). EX1007, [0072]; see also EX1007, [0073]-[0075]. The

"server program 110 verifies whether the physical computer 200 can modify the fan rotational speed to the calculated rotational speed," e.g., it determines whether the new speed "exceeds the maximum value" (step 1106). EX1007, [0078]. If the change is possible (step 1106=Yes), "the fan monitoring and control unit 116 issues instructions to the physical computer 200 to modify the fan rotational speed" (step 1107). EX1007, [0078]. If the necessary change in fan speed is not possible (step 1106=No), "the cooling control unit 117 lowers the intake air temperature of the physical computer 200" by adjusting air conditioning in the computer room. EX1007, [0079].

102. A person of ordinary skill in the art would have naturally considered Shiga because it is in the same field of endeavor as the '632 Patent (i.e., electronic devices, such as server computers). Additionally, Shiga and the '632 Patent addresses the same problem of thermal management within electronic device enclosures. EX1007, 1 (Abstract), [0001], [00012], [0091]; EX1001, 1 (Abstract), 1:12-17.

VI. THE CHALLENGED CLAIMS ARE INVALID AS OBVIOUS BASED ON THE COMBINATION OF HIRA AND SHIGA

103. It is my opinion that the challenged claims of the '632 Patent are obvious based on the combination of Hira and Shiga for reasons as I will explain below.

A. Motivation to Combine Hira and Shiga

104. A POSITA implementing Hira's server computer would have naturally considered a prior art reference like Shiga because both references describe inventions applicable to computers and both focus on thermal management of such devices. EX1005, 1 (Abstract), [0001], [0008], [0014]; EX1007, 1 (Abstract), [0001], [0012], [0014]. Both prior art references disclose cooling fans to control the temperature of electronic components in a computer. EX1005, [0015]-[0018], [0023]-[0025]; EX1007, [0001], [0012]-[0013], [0020]. Both prior art references disclose measuring utilization, or load, of the CPU and other components as well as the intake-air temperature. EX1005, [0015], [0017], [0023]-[0025]; EX1007, [0001], [0012]-[0013], [0022], [0029]. Both prior art references disclose thermal management techniques using system parameters including component utilization rate and intake-air temperature. EX1005, [0015], [0017], [0023]-[0025]; EX1007, [0001], [0012]-[0013], [0022], [0029].

105. Hira's server computer includes variable speed cooling fans used for thermal management. This would be clear to a person of ordinary skill in the art because the use of such fans was common in servers like those described by Hira. Further, Hira states that the disclosed dust filter clogging status detection method uses system information including the "actual fan rotational speed 9," which "is the ratio of actual rotational speed to maximum rotational speed for each fan installed

in the system." EX1005, [0023]. Hira also describes "[s]tandard component temperature 15," which includes "multiple items of information…consisting of all combinations of ambient temperature, configuration, load, and fan rotational speed." EX1005, [0024]. It is clear that Hira's server computer includes cooling fans that operate at variable speeds.

106. While Hira's server computer includes variable speed cooling fans for thermal management, Hira does not disclose any particular technique for controlling them. EX1005, [0023]-[0025]. However, Shiga does disclose a specific cooling technique that is readily applicable to the fans cooling Hira's server. EX1007, [0022], [0091]. A POSITA implementing Hira's server would therefore have been motivated to look to Shiga to provide a method for controlling the speed of Hira's variable speed cooling fans.

107. A person of ordinary skill in the art would recognize the benefit of using Shiga's technique because it provides "[c]ooling control for reducing overall power consumption" of a computer system. EX1007, 1 (Abstract). Shiga explains also states that, "by cooling CPUs in advance and maintaining optimal temperature, power consumption due to leakage current can be minimized and cooling efficiency can be increase." EX1007, [0014]; see also [0090] ("As described above…the CPU can be cooled in advance to maintain optimal temperature, minimizing power consumption due to leakage current and improving

cooling efficiency.”). These benefits described by Shiga would have motivated a POSITA to implement Shiga’s cooling control method in Hira’s server.

108. A POSITA could have modified Hira’s server to implement Shiga’s cooling control method without undue experimentation and with a reasonable expectation of success. Shiga describes a “server program 110” that implements cooling control functionality and is executed on the server computer’s CPU. EX1007, [0022], [0028], [0078], [0091]. Shiga’s server program 110 uses sensor and other data collected by Hira’s computer, such as intake air temperature, CPU load, etc. A POSITA could therefore have implemented Shiga’s program in Hira without the need to significantly modify Hira, for example, by adding or changing temperature sensors. A POSITA could have readily implemented Shiga’s server program 110 on Hira’s server to be executed using Hira’s CPU. It would have been accomplished largely, or entirely, by simply modifying the programming of Hira’s computer. It would have been well within the skill level of a POSITA to modify Hira’s server to implement Shiga’s cooling control functionality.

109. Modifying Hira based on Shiga as I have described would have involved no more than the use of prior art elements according to known methods to yield predictable results.

1. Independent Claim 1

110. As I discuss below, the combination of Hira and Shiga discloses every limitation of claim 1 to a person of ordinary skill in the art.

a. [1pre] An abnormality detection device for detecting an abnormality in Information and Communication Technology (ICT) equipment having a cooling fan, the abnormality detection device comprising:

111. Hira discloses the preamble of claim 1.

112. In particular, Hira discloses a "dust filter clogging status detection device for detecting clogging status of dust filters inside information processing devices such as PCs and server systems…." EX1005, [0001]. The '632 Patent states that "ICT equipment" can be a "server." EX1001, 1:13-17; see also 1:20-23 ("ICT equipment such as a server may have a cooling fan within a case thereof so as to prevent the internal temperature of the case from excessively rising due to heat generation by an electronic component such as a CPU."), 8:6-7 ("The present invention can be applied to ICT equipment such as a server."). Hira's "information processing device such as a PC/server system" (EX1005, [0001]) is *Information and Communication Technology (ICT) equipment* as recited in claim 1. (I note that I italicize claim language throughout my analysis of the claims.)

113. The '632 Patent also states that an object of the claimed invention is to "detect an abnormality of a cooling function, such as clogging of a filter…." EX1001, 2:6-11. Thus, Hira's "dust filter clogging status device" is an

abnormality detection device for detecting an abnormality (clogging status of dust filters) *in Information and Communication Technology (ICT) equipment* (such as Hira's server system).

114. Hira's dust filter clogging status detection device is intended for use in ICT equipment *having a cooling fan*. A POSITA would have known that "PCs and server systems," as disclosed by Hira, have one or more *cooling fan[s]*. In addition, Hira's server system collects and saves information regarding cooling fans, including "actual fan rotational speed 9" and "fan error 17." EX1005, [0015]; see also [0023]-[0025], Figs. 1, Fig. 2(b) (showing "fan actual rotational speed" for "fan 1," "fan 2," and "fan 3"); Figs 3 and 4 (showing a range of values for each of the three fans' "actual rotational speed"); Fig. 7 (showing "clogging status information/error information" specific to fan 1)2(b), 3, 4, 7. Hira states that "[t]he actual fan rotational speed 9 is the actual rotational speed of each fan installed in the system." EX1005, [0016]. Hira's server has at least one *cooling fan*.

115. Thus, Hira discloses an *abnormality detection device for detecting an abnormality in Information and Communication Technology (ICT) equipment having a cooling fan* as recited in the preamble of claim 1.

b. [1a] a hardware processor comprising:

116. Hira discloses *a hardware processor*.

117. Hira discloses a "dust filter clogging status device" that "is configured as part of an information processing device such as a PC/server system" that "has information processing functions such as CPU/HDD/memory…." EX1005, [0014]. Hira states that "component temperature threshold value generating unit 2, clogging status detection unit 3," and other functions are "processed through processing by an information processing unit comprising a CPU, etc." *Id*. A POSITA would know that a CPU, as in Hira's computer, is *a hardware processor*. Dictionary definitions confirm my understanding in this regard. EX1012, 3 ("CPU…Sometimes referred to as the *processor* or *central processor*…."), 5 ("processor Short for *microprocessor* or CPU."); EX1013, 3 ("processor *n. See* central processing unit, microprocessor").

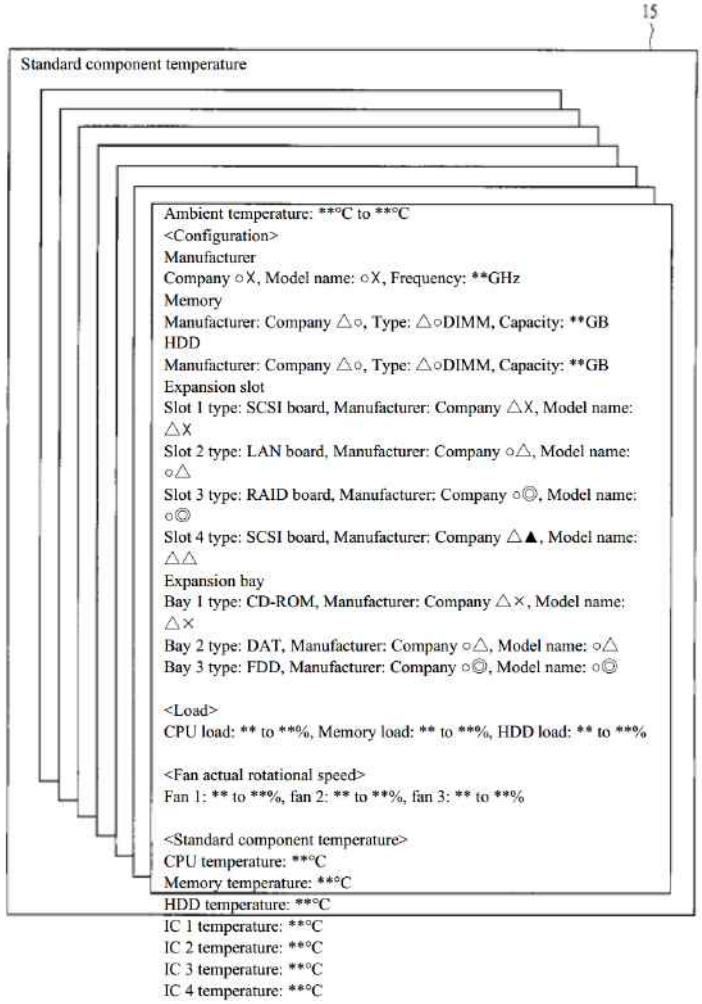
118. In addition, Hira's CPU is used to perform the functions discussed for the following limitations of claim 1 (*a hardware processor comprising*…) as I explain below.

c. [1b] an estimating unit configured to estimate an upper limit of possible temperatures in a predetermined position of ICT equipment when a quantity of intake air into the ICT equipment is appropriate, based on a result of detection by an operational status detecting unit that detects an operational status of the ICT equipment and a result of detection by an intake-air temperature sensor that detects an intake air temperature of intake air of the ICT equipment,

119. Hira discloses this limitation of claim 1. As I will explain, Hira's dust filter clogging status detection device includes "component temperature threshold value generating unit 2," which constitutes *an estimating unit* as in claim 1.

120. This claim limitation begins by reciting *an estimating unit* that is *configured to estimate an upper limit of possible temperatures in a predetermined position of ICT equipment when a quantity of intake air into the ICT equipment is appropriate*.

121. In Hira, standard component temperature 15 contains "information on standard component temperatures for each ambient temperature 13, hardware configuration 10, load 11, and actual fan rotational speed 9." EX1005, [0017]. Standard component temperature 15 is illustrated in Hira's Figure 3.



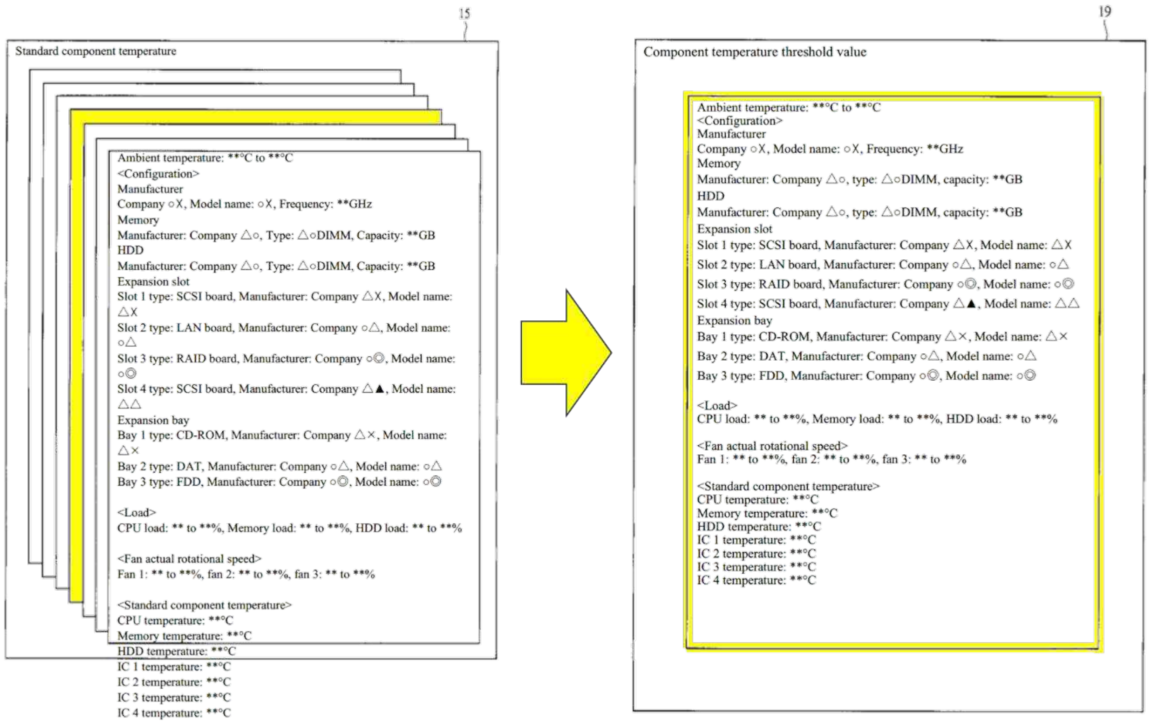
EX1005, Fig. 3.

122. As shown in Figure 3, standard component temperature 15 "is multiple items of information prepared during the design/development phase and stored in the information storage unit 1, being information consisting of all combinations of ambient temperature, configuration, load, and fan rotational speed." EX1005, [0024]. The figure illustrates standard component temperature 15 as a set of multiple pages where each page includes standard component temperature information for a different predetermined combination of

ambient temperature, system configuration, load, and fan speed. Hira states that "the standard component temperature information could alternatively be converted to a database of standard component temperatures corresponding to hardware configuration, load, and actual fan rotational speed…." EX1005, [0038].

123. Hira's component temperature threshold value generating unit 2 "generates component temperature threshold values for multiple components making up the information processing device" (such as a server system). EX1005, [0013]. In particular, "component temperature threshold value 19, as shown in FIG. 4, is obtained by extracting component temperatures applicable to the current system status from standard component temperature 15…." *Id.*, [0025].

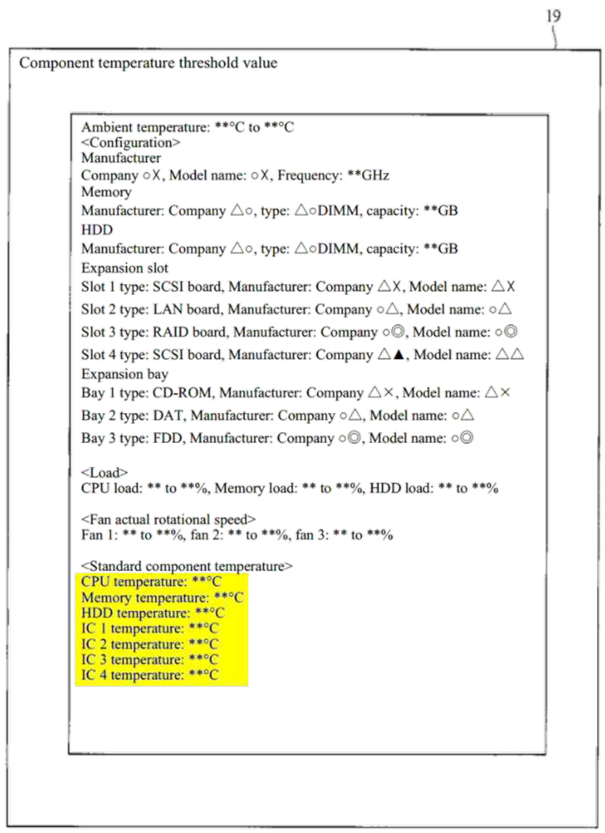
124. The following annotated illustrations using Figures 3 and 4 show how Hira's component temperature threshold value generating unit 2 uses the current system status to search for the corresponding selection in standard component temperature 15 and uses it to generate component temperature threshold value 19.



EX1005, Figs. 3-4 (annotated). I have randomly selected the fourth page in Figure 3 simply to illustrate how Hira's device operates. Hira does not specify any particular example.

125. Once selected, "[t]he standard component temperature information within the component temperature threshold value 19 becomes the component temperature threshold value used when detecting filter clogging status." EX1005, [0025].

126. The component temperature threshold value 19 "is temperature threshold value information for CPU/memory/HDD/other ICs, etc." EX1005, [0019] The component temperature thresholds for various components are illustrated in Figure 4.



EX1005, Fig. 4 (annotated).

127. Because the threshold temperatures in component temperature threshold value 19 (highlighted above) are generated from the standard component temperatures indicated in standard component temperature 15, the specific component temperature threshold values are the expected, normal component temperature thresholds given a particular system location (e.g., ambient air temperature) and configuration. EX1005, [0025], [0031], [0036]. This is the point of Hira's invention: the standard component temperature values are the expected component temperature thresholds (*upper limit of possible temperatures*) under various different, normal operating conditions (*a predetermined position of ICT*

equipment when a quantity of intake air into the ICT equipment is appropriate), so that if the actual temperatures exceed the expected temperatures (or the ratio of actual to expected temperature is too great) it indicates to Hira that the dust filter is clogged.

128. A POSITA would have this understanding for the further reason that Hira discloses comparing current component temperatures to the generated component temperature threshold values to determine whether the filter is clogged, as I will discuss for limitation 1d. A POSITA would recognize that, in Hira, the threshold values are the expected upper limits in a given environment and configuration (*in a predetermined position of ICT equipment*) with an operational fan and a filter that is not clogged (*when a quantity of intake air into the ICT equipment is appropriate*).

129. Thus, Hira's component temperature threshold values constitute *an estimate* of *an upper limit of possible temperatures in a predetermined position of ICT equipment when a quantity of intake air into the ICT equipment is appropriate*.

130. The claim further recites that the estimated *upper limit of possible temperatures* is based on two things: (i) *a result of detection by an operational status detecting unit that detects an operational status of the ICT equipment and*, (ii) *a result of detection by an intake-air temperature sensor that detects an intake*

air temperature of intake air of the ICT equipment. Hira meets both requirements because component temperature threshold value generating unit 2 (*estimating unit*) generates component temperature threshold value 19 (*upper limit of possible temperatures*) "by selecting a standard component temperature 15 matching [i] system information 8 and [ii] temperature sensor information 12…." EX1005, [0038]; see also [0036]. And systems information 8 and temperature sensor information 12 include (i) *a result of detection by an operational status detecting unit that detects an operational status of the ICT equipment and*, (ii) *a result of detection by an intake-air temperature sensor that detects an intake air temperature of intake air of the ICT equipment*

131. Hira's system information 8 constitutes *a result of detection by an operational status detecting unit that detects an operational status of the ICT equipment*. "[S]ystem information acquisition unit 5 acquires system information from the operating system, etc. and stores system information 8 in the information storage unit 1…." EX1005, [0030], Figs. 1, 8. The acquired system information 8 includes "actual fan rotational speed 9, hardware configuration 10, [and] load 11" (EX1005, [0015]), which are each *an operational status of the ICT equipment*. *Id*., [0016]. Indeed, load 11 includes the CPU load (EX1005, [0016]), which the '632 Patent specifically states is *an operational status of the ICT equipment*. EX1001, 4:36-40 ("The CPU load detecting unit 162 is used for detecting the

operational status of the ICT equipment 1."), 7:11-13 ("the CPU load detecting unit" is "an operational status detecting unit").

132. Thus, Hira's system information 8 is *a result of detection by an operational status detecting unit* (system information acquisition unit 5) *that detects an operational status of the ICT equipment* (e.g., CPU load, hardware configuration, fan speed).

133. Hira's temperature sensor information 12 constitutes *a result of detection by an intake-air temperature sensor that detects an intake air temperature of intake air of the ICT equipment*.

134. Hira's "temperature sensor information acquisition unit 6 acquires temperature sensor information from temperature sensors, etc. and stores temperature sensor information 12 in the information storage unit 1…." EX1005, [0030], Figs. 1, 8. The acquired temperature sensor information 12 includes "ambient temperature 13…." EX1005, [0015]. "Ambient temperature 13 is temperature information for the ambient environment of the system." *Id*., [0017]. A POSITA would understand that Hira's "ambient temperature" is the *intake air temperature of intake air of the ICT equipment*, because the ambient air in the space around the system is drawn directly into the server system as intake air. Ambient air temperature ***is*** intake air temperature.

135. It would have been apparent to a POSITA that Hira's ambient air 13 is the intake air temperature. EX1009, [0004] ("The cooling of the servers is generally assured by ambient air, which is drawn on the front side of the server and led inside the server over components to be cooled…and emitted on the rear side of the server."); EX1010, [0003] ("In order to prevent the server from overheating, internal fans are typically integrated into the server to provide both an intake of cooler air, which may be ambient or conditioned, and an output of hot air. Most commonly, the intake of cooler air occurs at the front of the server, and the output of hot air occurs at the rear of the server"); EX1011, [0003] ("Electronic equipment, such as a server device, often has a cooling fan inside to disperse heat generated during operation of the equipment. The fan takes ambient air into the equipment for a cooling purpose….").

136. Further, Hira's disclosure of acquiring and using air temperature suggests to a POSITA the design choice to use intake air temperature because intake air is the cooling air that fans blow across components in the electronic device in order to cool them, as was well known to a POSITA. EX1009, [0004]; EX1010, [0003]; EX1011, [0003].

137. Thus, Hira's ambient temperature 13 constitutes *a result of detection by an intake-air temperature sensor* (temperature sensor providing information to

temperature sensor information acquisition unit 6) *that detects an intake air temperature of intake air of the ICT equipment*.

138. Hira's "component temperature threshold value generating unit 2 [*estimating unit*] calculates component temperature threshold values 19 [*an upper limit of possible temperatures in a predetermined position of ICT equipment when a quantity of intake air into the ICT equipment is appropriate*] from ambient temperature 13 [*a result of detection by an operational status detecting unit that detects an operational status of the ICT equipment*], actual fan rotational speed 9, hardware configuration 10, and load 11 [*a result of detection by an intake-air temperature sensor that detects an intake air temperature of intake air of the ICT equipment*]." EX1005, [0036].

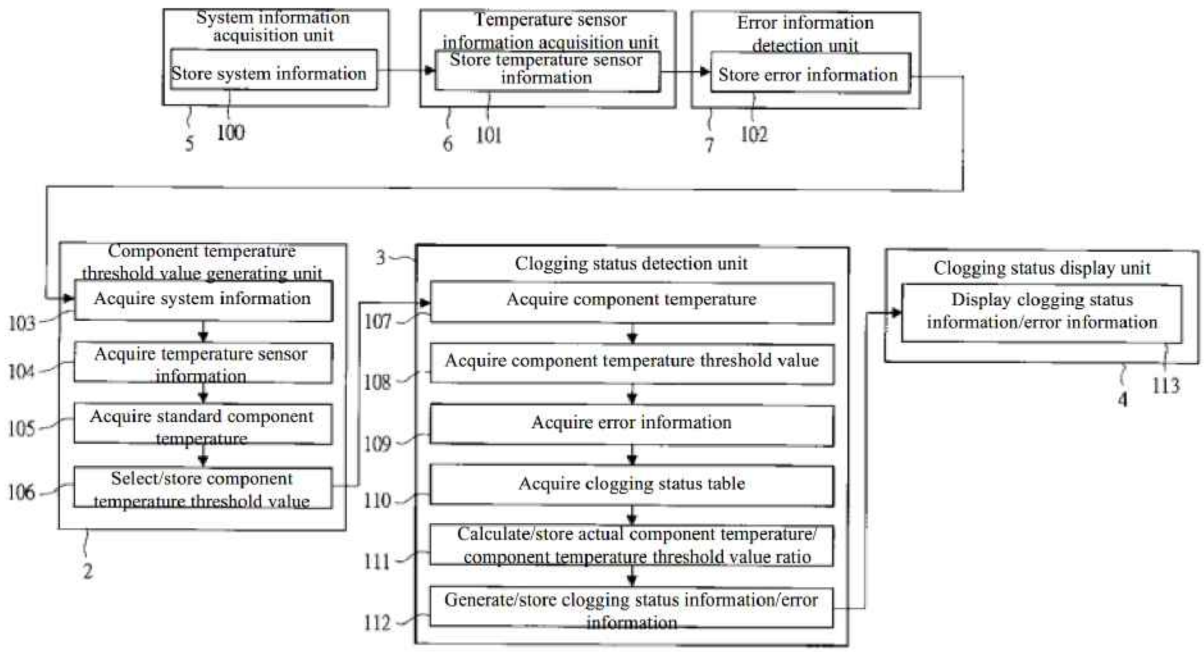
139. My opinion is supported by the fact that Hira's *estimating unit…estimate[s] an upper limit of possible temperatures* in the same manner described in the '632 Patent. In the '632 Patent, "the estimating unit 163 searches an exhaust-air temperature range and a CPU temperature range recorded in association with a combination of the result of detection by the intake-air temperature sensor 21 and the result of detection by the CPU load detecting unit 162, from the fan-rotation-number and temperature-range storing part 165…." EX1001, 5:44-51; see also 5:7-14. The estimating unit searches through a table (fan-rotation-number and temperature-range storing part 165) based on the

detected intake-air temperature and detected CPU load to find the appropriate exhaust air-temperature range and CPU temperature range. In essentially the same way, Hira's component temperature value generating unit 2 (*estimating unit*) searches through standard component temperature 15 based on CPU load and ambient/intake air temperature. EX1005, [0025]. Thus, Hira discloses limitation 1b in the same way that the '632 Patent does.

140. Thus, for the reasons stated above, Hira discloses limitation 1b. However, Hira provides additional disclosures that further confirm my opinion. I will discuss those additional disclosures next.

141. Figure 8 in Hira is a flow chart that further confirms that component temperature threshold value generating unit 2 constitutes the claimed *estimating unit* meeting this limitation of claim 1. EX1005, [0029].

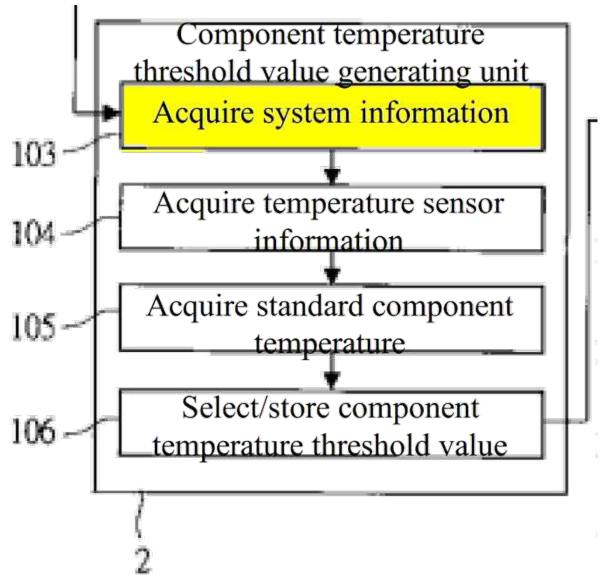
FIG. 8



EX1005, Fig. 8.

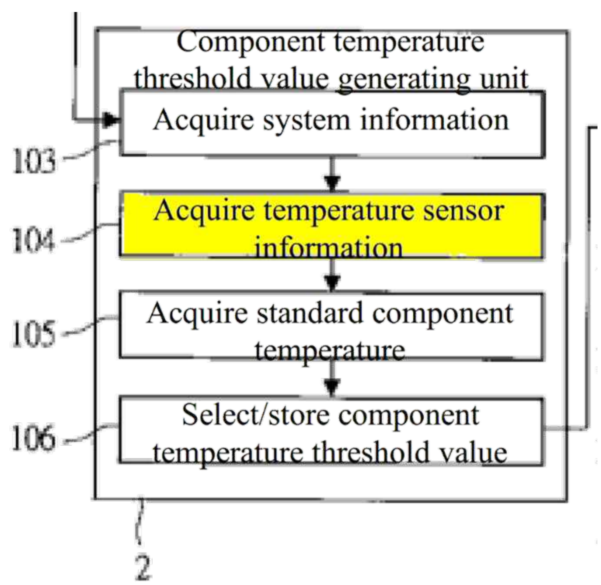
142. I will focus on the steps in component temperature threshold value generating unit 2 including steps 103, 104, 105, and 106 (shown on the left side of the figure above).

143. In step 103, component temperature threshold value generating unit 2 acquires "system information." EX1005, [0031]. As I discussed above, Hira's system information constitutes *a result of detection by an operational status detecting unit that detects an operational status of the ICT equipment*.



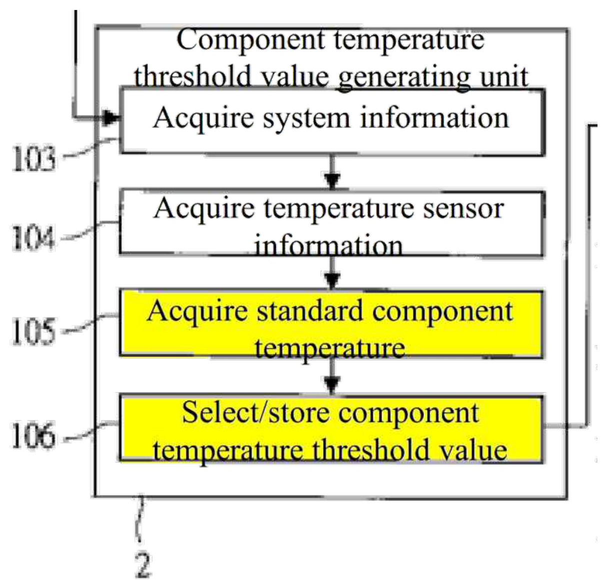
EX1005, Fig. 8 (partial view, highlighted).

144. Next, in step 104, component temperature threshold value generating unit 2 acquires "temperature sensor information" including ambient temperature 13. EX1005, [0015], [0031].



EX1005, Fig. 8 (partial view, highlighted). As I explained above, ambient air temperature 13 is the intake air temperature. Because ambient temperature 13 is the detected *intake air temperature*, the acquired ambient temperature is *a result of detection by an intake-air temperature sensor that detects an intake air temperature of intake air of the ICT equipment*.

145. In step 105, the unit acquires "standard component temperature" information (i.e., standard component temperature 15 in Figure 3), which includes standard/expected component *temperatures in a predetermined position of ICT equipment when a quantity of intake air into the ICT equipment is appropriate*. EX1005, [0031].



EX1005, Fig. 8 (partial view, highlighted). Then, in step 106, component temperature threshold value generating unit 2 generates and stores the "component temperature threshold value" (i.e., component temperature threshold 19 in Figure 4). EX1005, [0031]. Thus, this step 106 is *estimat[ing] an upper limit of possible* *temperatures in a predetermined position of ICT equipment when a quantity of intake air into the ICT equipment is appropriate* as recited in the claim.

146. Thus, Hira's Figure 8 and related text shows that component temperature threshold value generating unit 2 is the claimed *estimating unit* because it *estimate[s] an upper limit of possible temperatures in a predetermined position of ICT equipment when a quantity of intake air into the ICT equipment is appropriate* (steps 105 and 106) and it does so *based on a result of detection by an operational status detecting unit that detects an operational status of the ICT equipment* (steps 103) *and a result of detection by an intake-air temperature sensor that detects an intake air temperature of intake air of the ICT equipment* (step 104).

147. In addition, I have considered whether limitation 1b is disclosed by Hira if the limitation were to be construed as a means-plus-function limitation. See Section IV.E.2, above. It is disclosed by the prior art for the same reasons I have discussed in this section regarding limitation 1b. Hira's CPU functioning as component temperature threshold value generating unit 2 (*estimating unit*) to perform the functions described for this limitation is equivalent to a CPU functioning as evaluating unit 163/estimating unit 163 (EX1001, 4:59-5:14, 5:22-32, Fig. 2). Hira's CPU functioning as system information acquisition unit 5 (*operational status detecting unit*) to perform the functions described for this

limitation is equivalent to a CPU functioning as CPU load detecting unit 162 (EX1001, 4:36-37, 5:22-32, Fig. 2).

d. [1c] wherein the operational status of the ICT equipment and the intake air temperature of the ICT equipment determines a rotation speed of the cooling fan; and

148. The combination of Hira and Shiga discloses this limitation.

149. Hira's dust filter clogging status device detects *the operational status of the ICT equipment* as I discussed for limitation 1b. Hira's device detects "system information 8," which includes "actual fan rotational speed 9, hardware configuration 10, and load 11" (e.g., CPU load, memory load, etc.). EX1005, [0015]-[0016]. This detected information provides *the operational status of the ICT equipment*.

150. Hira's device also detects "ambient temperature 13," which is *the intake air temperature of the ICT equipment* as I discussed for limitation 1b. EX1005, [0015], [0017].

151. Additionally, Shiga discloses a cooling control technique that uses the same information collected by Hira to *determine[] a rotational speed of the cooling fan* as recited in this limitation of claim 1.

152. Specifically, Shiga discloses "server program 110" that can be implemented on a server computer (like Hira's server) to provide cooling control. EX1007, [0091] ("the server program 110 may also be stored in the memory of the

physical computer … to perform the fan control and air conditioning unit control of the present embodiment example within the physical computer"). The server program's "utilization information and power monitoring unit 111 collects utilization information and power consumption information from the" computer. EX1007, [0022]. This collected information includes "CPU utilization rate" (which a POSITA would understand to be the CPU load), "memory utilization rate, and network interface utilization rate of the device" and "power consumption status" of the computer. EX1007, [0029], [0043]-[0045]. Thus, as in Hira, Shiga discloses monitoring *the operational status of the ICT equipment*.

153. Shiga's temperature monitoring unit 112 also acquires "the intake air temperature…of the physical computer[]," which is *the intake air temperature of the ICT equipment*. EX1007, [0022].

154. Shiga's server program uses *operational status information* and *intake air temperature* to *determines a rotation speed of the cooling fan*. In particular, the server program's "CPU temperature estimation unit 113" calculates the anticipated temperature of the CPU after a predetermined amount of time based on, among other things, CPU utilization and temperature information (*operational status information*) and "server device intake air temperature" (*intake air temperature*). EX1007, [0067]-[0071]. Based on the anticipated CPU temperature, the server

program determines whether to maintain the current fan speed or to change it (*determines a rotation speed of the cooling fan*). EX1007, [0072]-[0076].

155. Thus, Shiga's server program "calculates the estimated temperature of the processor after a predetermined time period" based on "the temperature and utilization rate of the processor [*the operational status of the ICT equipment*], the rotational speed of the fan, and the intake air temperature [*the intake air temperature of the ICT equipment*], and determines a target rotational speed of the fan [*determines a rotation speed of the cooling fan*]…." EX1007, [0013].

e. [1d] a determining unit configured to determine that an abnormality is occurring when a result of detection by a temperature sensor that detects a detected equipment temperature in the predetermined position is beyond the upper limit estimated by the estimating unit.

156. Hira discloses this limitation. Hira's dust filter clogging status detection device includes "clogging status detection unit 3," which constitutes *a determining unit* as in claim 1.

157. Hira's "clogging status detection unit 3…detects the clogging status of the dust filter on the basis of the component temperature threshold values 19 and component temperatures 14 inside the information processing device." EX1005, 1 (Abstract); see also 2 (claim 3), [0008], [0013], Fig. 1. Thus, Hira's clogging status detection unit 3 is *a determining unit configured to determine that an abnormality* (dust filter clog) *is occurring*.

158. The clogging status detection unit 3 determines that the dust filter is clogged by calculating the ratio of "component temperature 14 and component temperature threshold value 19…." EX1005, [0032]-[0033]. Hira calculates the ratio (referred to as "actual component temperature/component temperature threshold value ratio 20") for multiple components as well as an average ratio value. EX1005, [0033]-[0034], Fig. 5.

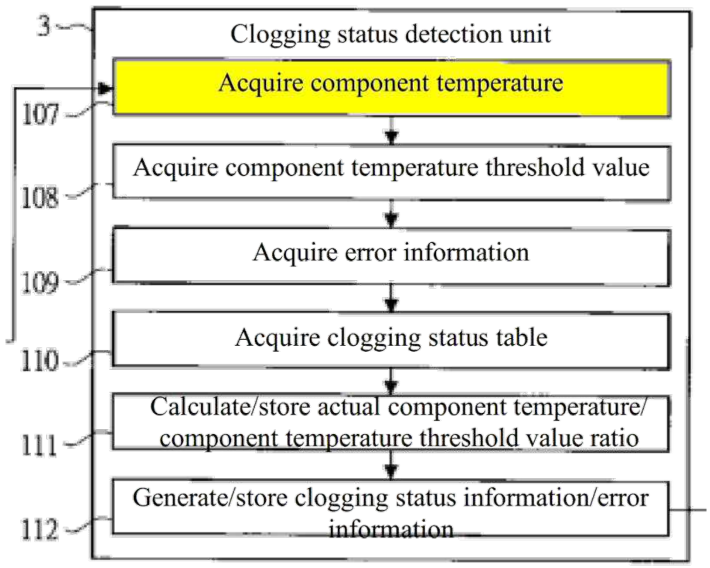
159. The clogging status detection unit 3 generates clogging status information/error information 22 based on the average ratio of actual component temperatures to component temperature threshold values. EX1005, [0034]. While the specific ratios indicating the "clogging status" are left to the system designer, a POSITA would know based on Hira's disclosure that actual temperatures in excess of component temperature threshold values indicate a clogged dust filter. EX1005, [0027].

160. The fact that Hira refers to temperature threshold value 19 as a "threshold" suggests to a POSITA that Hira's dust filter clogging status detection device detects clogging (*an abnormality is occurring*) when the actual component temperature (*a result of detection by a temperature sensor that detects a detected equipment temperature in the predetermined position*) exceeds the threshold temperature (*is beyond the upper limit estimated by the estimating unit*).

161. Thus, Hira discloses and suggests that "clogging status detection unit 3" (*determining unit*) "detects the clogging status of the dust filter" (*an abnormality is occurring*) when "component temperatures inside the information processing device" (*a result of detection by a temperature sensor that detects a detected equipment temperature in the predetermined position*) exceed "component temperature threshold values" (*the upper limit estimated by the estimating unit*). EX1005, [0008], [0034]

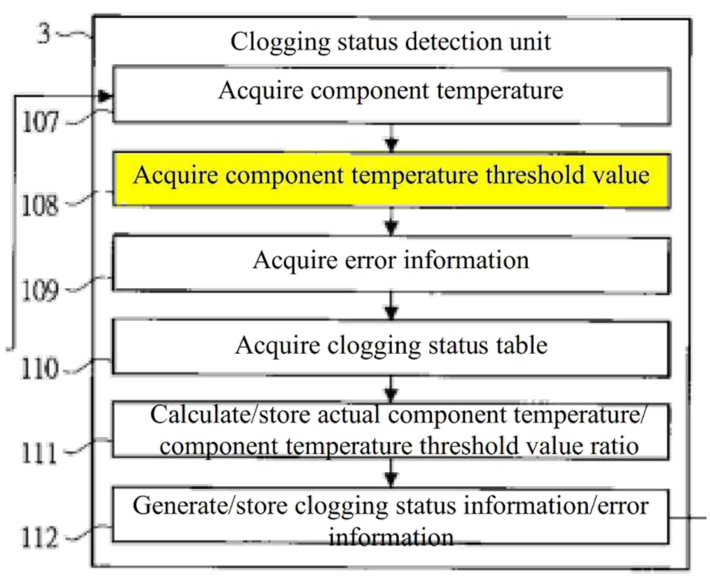
162. Thus, for the reasons stated above, Hira discloses limitation 1d. However, Hira provides additional disclosures that further confirm my opinion. I will discuss those additional disclosures next using a portion of the flow chart in Figure 8 as I did above for limitation 1b. Hira's Figure 8 flow chart further shows that clogging status detection unit 3 constitutes the claimed *determining unit* meeting this limitation.

163. In step 107, clogging status detection unit 3 acquires "component temperature," which constitutes *a result of detection by a temperature sensor that detects a detected equipment temperature in the predetermined position*. EX1005, [0031]-[0032].



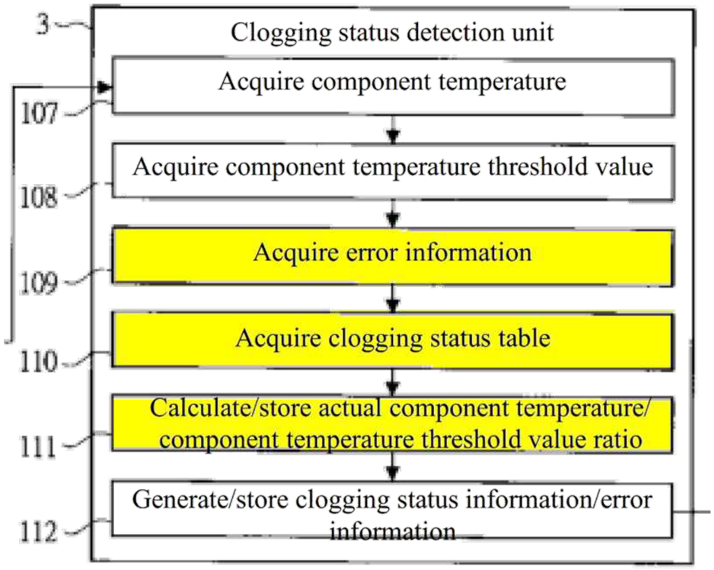
EX1005, Fig. 8 (partial view, highlighted).

164. In step 108, clogging status detection unit 3 acquires "component temperature threshold value[s]," which is *the upper limit estimated by the estimating unit*. EX1005, [0032].



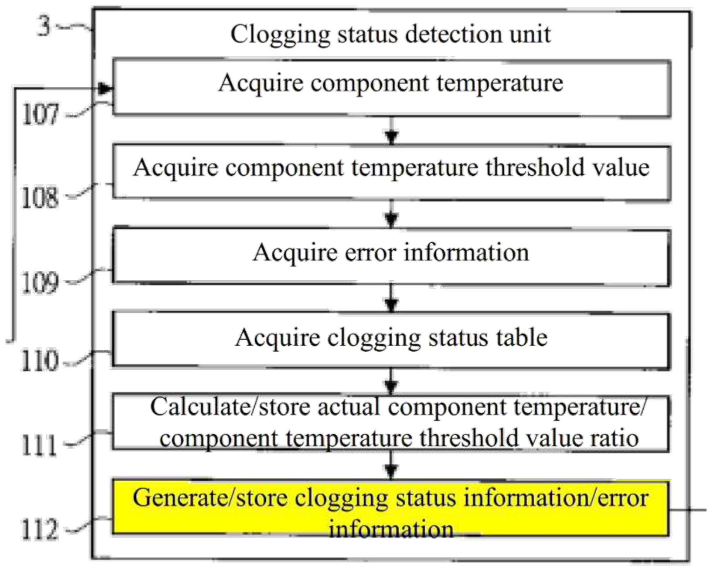
EX1005, Fig. 8 (partial view, highlighted).

165. In the next three steps, clogging status detection unit 3 acquires error information (109) and the clogging status table (110), and it then calculates the ratio of the actual component temperature to component temperature threshold value (111). EX1005, [0032]-[0033].



EX1005, Fig. 8 (partial view, highlighted).

166. Finally, in step 112, clogging status detection unit 3 generates the "clogging status information/error information" based on the ratio of the actual component temperature to the threshold temperature. EX1005, [0034].



EX1005, Fig. 8 (partial view, highlighted).

167. As discussed above, Hira's clogging status detection unit 3 detects a clogged dust filter (*determine[s] that an abnormality is occurring*) if the actual temperature exceeds the threshold temperature (*a result of detection by a temperature sensor that detects a detected equipment temperature in the predetermined position is beyond the upper limit estimated by the estimating unit*) as recited in limitation 1d.

168. In addition, I have considered whether limitation 1d is disclosed by Hira-Shiga if the limitation were to be construed as a means-plus-function limitation. See Section IV.E.2, above. It is disclosed by the prior art for the same reasons I have discussed in this section regarding limitation 1d. Hira's CPU functioning as clogging status detection unit 3 (*determining unit*) to perform the

functions described for this limitation is equivalent to a CPU functioning as determining unit 164 (EX1001, 5:15-21, 5:22-32, Fig. 2).

2. Dependent Claims 2-7

a. Claim 2. The abnormality detection device according to claim 1, wherein the estimating unit is configured to, in a case where a result of detection by the intake-air temperature sensor is equal, estimate a lower temperature value as the upper limit, as the operational status detected by the operational status detecting unit indicates a lower utilization rate

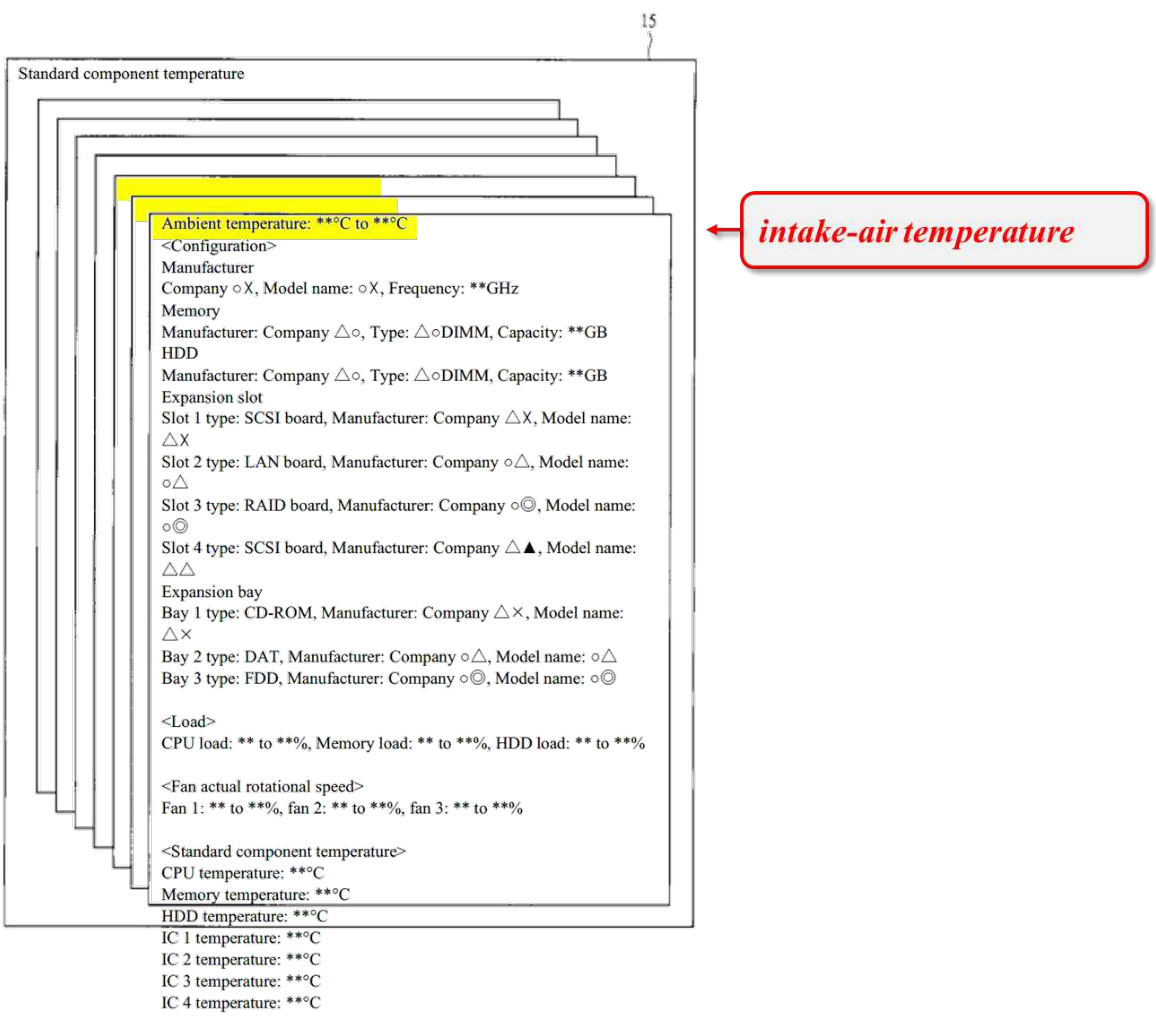
169. The combination of Hira and Shiga discloses claim 1 for the reasons I explained for that claim. The combination of Hira and Shiga also discloses the additional limitation of claim 2.

170. As I discussed above, this claim means when the ICT equipment is in multiple different operating conditions while the intake-air temperature is the same (*in a case where a result of detection by the intake-air temperature sensor is equal*), the *estimating unit* will *estimate a lower temperature value as the upper limit* as the *utilization rate* (e.g., CPU load) is *lower*. *See* Section IV.E.1, above. Hira and Shiga disclose, or at least suggest to a POSITA, the additional limitation of claim 2.

171. In Hira, component temperature threshold value generating unit 2 (*estimating unit*) "generates component temperature threshold values for multiple components making up the information processing device…." EX1005, [0013].

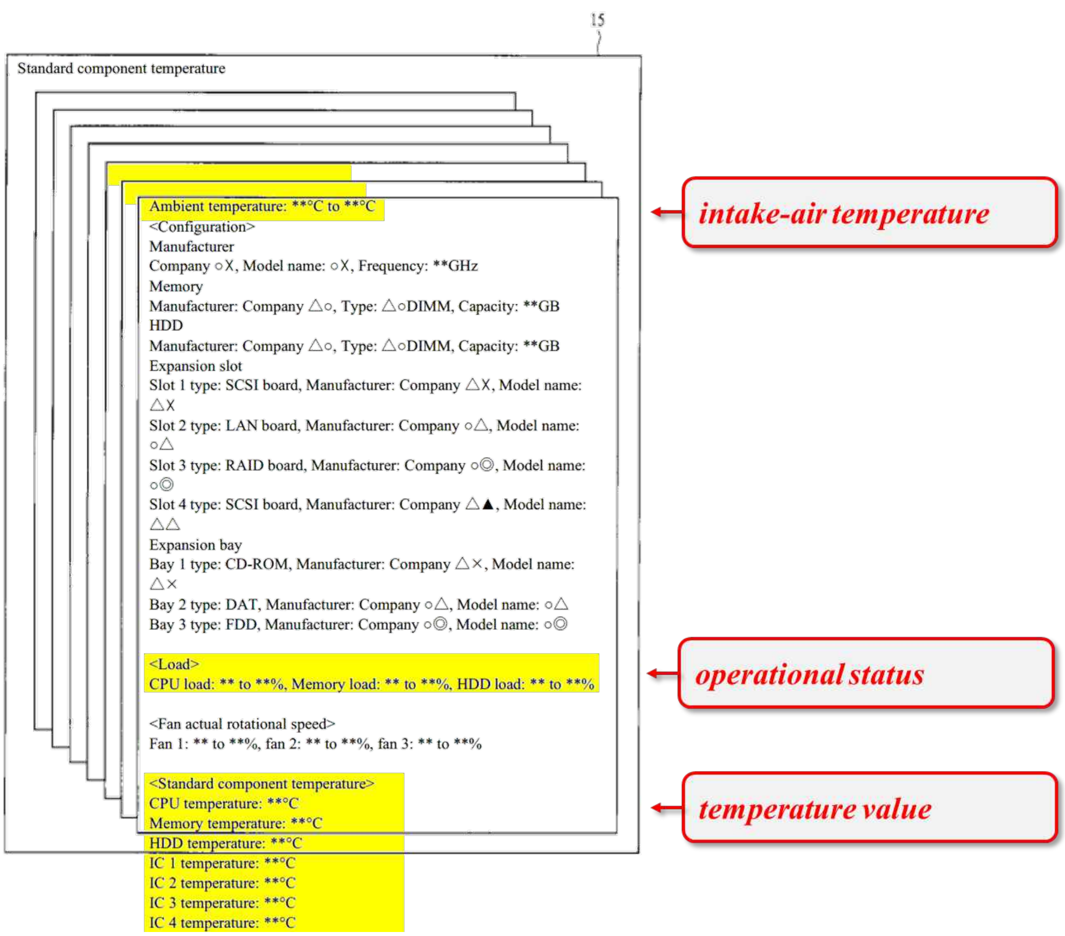
In particular, "component temperature threshold value 19" (*the upper limit*) "is obtained by extracting component temperatures applicable to the current system status from standard component temperature 15…." EX1005, [0025].

172. Hira's standard component temperature 15 (illustrated in Figure 3) "is multiple items of information prepared during the design/development phase and stored in the information storage unit 1…." EX1005, [0024]. The multiple pages in the illustration include "information consisting of all combinations of ambient temperature, configuration, load, and fan rotational speed." EX1005, [0024].



EX1005, Fig. 3 (annotated). A person of ordinary skill in the art would know that, because standard component temperature 15 includes “all combinations of ambient temperature, configuration, load, and fan rotational speed” (EX1005, [0024]), multiple pages in the set illustrated in Figure 3 would have the same “ambient temperature” (*intake-air temperature…is equal*).

173. Further, a person of ordinary skill in the art would know that the multiple pages with the same ambient temperature would vary the load information (e.g., CPU load) and the corresponding standard component temperature (e.g., CPU temperature). EX1005, [0024].



EX1005, Fig. 3 (annotated).

174. This is Hira's solution to the problem presented by prior systems that did not account for "differences in internal temperature change due to load and configuration differences of the CPU/memory/HDD, etc." when applied to "PC/server systems where loads and configurations differ depending on the time and user…." EX1005, [0004]. Hira's standard component temperature 15 accounts for such changes in ambient temperature, load, etc. by providing different standard component temperatures for different combinations of ambient temperature, load, etc.

175. A person of ordinary skill in the art would know that, *in a case where a result of detection by the intake-air temperature sensor is equal* (i.e., where ambient temperature is the same), Hira's standard component temperatures, which sets *the upper limit* when extracted as component temperature threshold value 19, is lower when load information such as CPU load is lower (i.e., when *the operational status detected by the operational status detecting unit indicates a lower utilization rate*). This relationship would be apparent and well-known to a POSITA.

176. In addition, Shiga confirms the obvious understanding that a lower CPU load, for example, leads to lower standard CPU temperature. For instance, Shiga's heat generation profile 122 (illustrated in Figure 8) shows that a lower

"CPU utilization rate" corresponds to lower "CPU heat generation." EX1007, [0047], Fig. 8; see also [0050], Fig. 9(a).

177. Thus, the combination of Hira and Shiga discloses and suggests that Hira's *estimating unit* (component temperature threshold value generating unit 2) *is configured to, in a case where a result of detection by the intake-air temperature sensor is equal, estimate a lower temperature value as the upper limit, as the operational status detected by the operational status detecting unit indicates a lower utilization rate* as claimed.

b. Claim 3

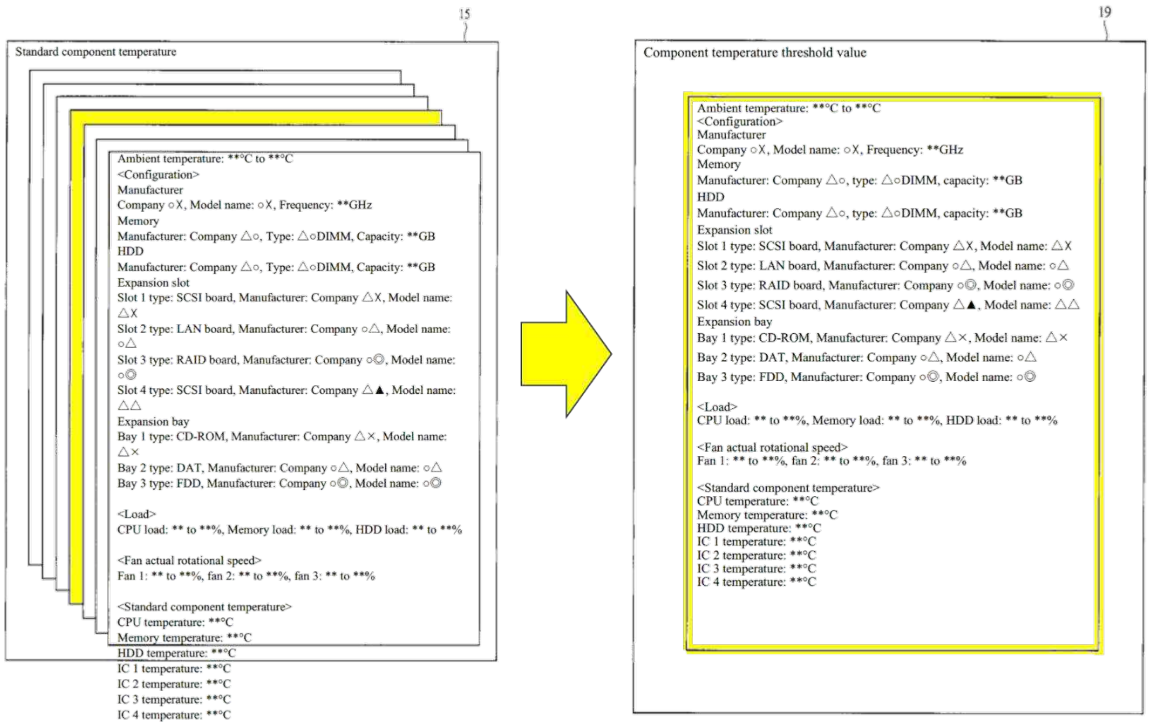
1. The abnormality detection device according to claim 1, comprising:

178. The combination of Hira and Shiga discloses claim 1 for the reasons I explained for that claim. The combination of Hira and Shiga also discloses the additional limitations of claim 3.

2. a temperature range storing part in which the upper limit of the possible temperatures in the predetermined position is recorded in association with each combination of a first utilization rate and a temperature of intake air, and

179. As I explained for limitation 1b, Hira's component temperature threshold value generating unit 2 "generates component temperature threshold values for multiple components making up the information processing device" (*the upper limit of the possible temperatures in the predetermined position*). EX1005,

[0013]. In particular, "component temperature threshold value 19, shown in FIG. 4, is obtained by extracting component temperatures applicable to the current system status from standard component temperature 15" (shown in Figure 3). EX1005, [0025].



EX1005, Figs. 3-4 (annotated). Hira's standard component temperature 15 (in Figure 3) includes "multiple items of information prepared during the design/development phase…being information consisting of all combinations of ambient temperature, configuration, load, and fan rotational speed" (*each combination of a first utilization rate and a temperature of intake air*). *Id.*, [0024]. Hira's standard component temperature 15 is "stored in the information storage unit 1" (*a temperature range storing part*).

180. Thus, Hira discloses *a temperature range storing part* (information storage unit 1) *in which the upper limit of the possible temperatures in the predetermined position is recorded in association with each combination of a first utilization rate and a temperature of intake air* (standard component temperature 15).

3. the upper limit of the possible temperatures in the predetermined position is recorded in association with each combination of a second utilization rate that is larger than the first utilization rate and a temperature of intake air,

181. In Hira, "component temperature threshold value 19" (*the upper limit of the possible temperatures in the predetermined position*) "is obtained by extracting component temperatures applicable to the current system status from standard component temperature 15…." EX1005, [0025]. Thus, *the upper limit of the possible temperatures in the predetermined position is recorded* in standard component temperature 15 (Figure 3), i.e., the source for the threshold values. Standard component temperature 15 includes "information consisting of all combinations of ambient temperature, configuration, load, and fan rotational speed." EX1005, [0024].

182. For example, Hira's claim 2 states that the dust filter status detection method includes "standard component temperature information for the multiple components making up the information processing device, corresponding to

combinations of system information of the information processing device and information indicating the internal status of the information processing device, is stored in advance in an information storage unit inside the information processing device….” EX1005, 2 (claim 2).

183. Thus, Hira discloses that *upper limit of the possible temperatures in the predetermined position is recorded* (in standard component temperature 15) for a variety of "load" conditions (*utilization rates*) and "ambient temperature" conditions (*temperature of intake air*).

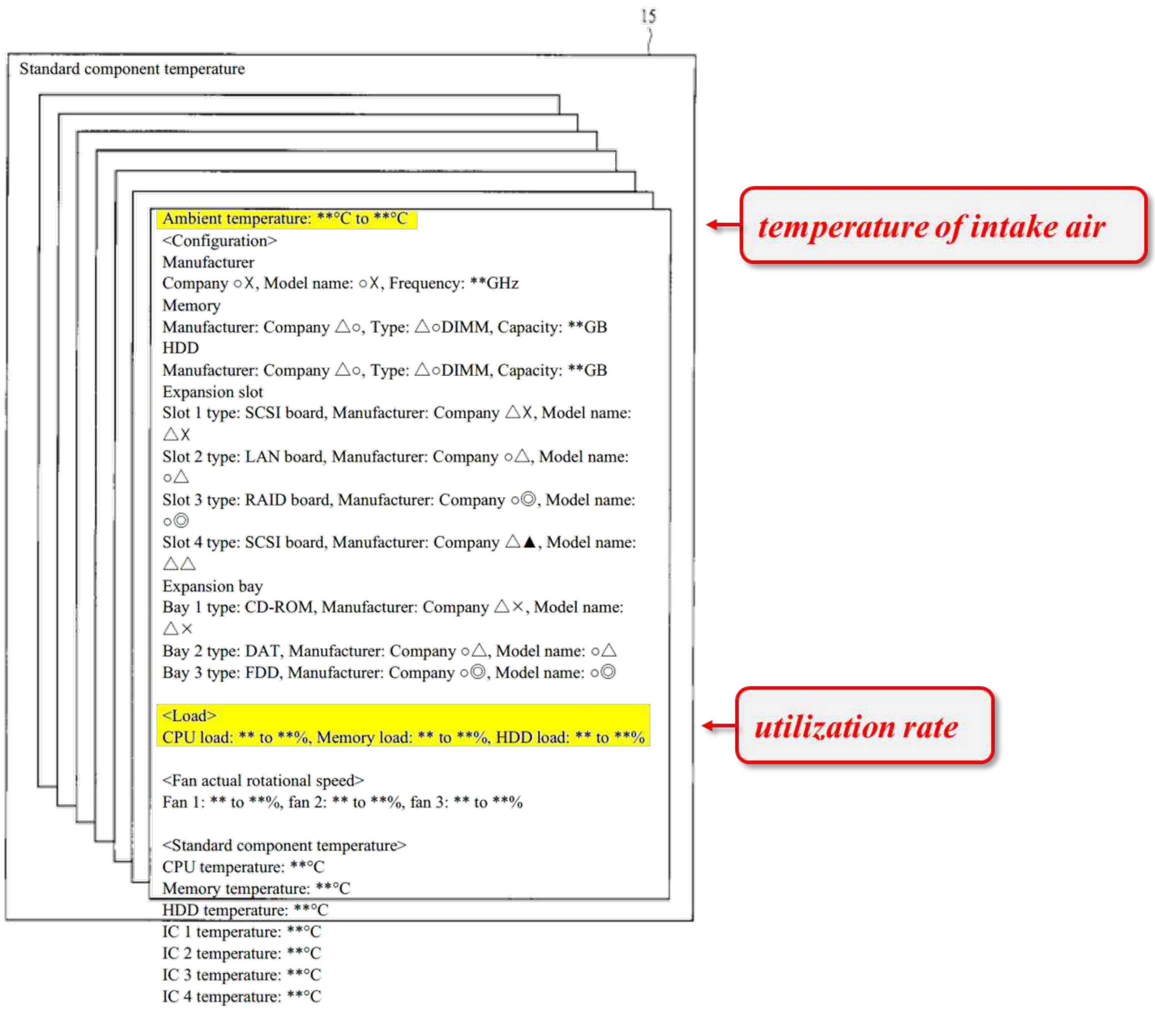
184. A POSITA would have known that because standard component temperature 15 includes "all combinations of ambient temperature, configuration, load, and fan rotational speed" (EX1005, [0024]), it includes *a second utilization rate* (e.g., CPU load) *that is larger than the first utilization rate* (e.g., a different CPU load). In other words, because standard component temperature 15 includes multiple different CPU loads (*utilization rate[s]*), one will be larger than another.

185. I do not understand the claim language to require *a second utilization rate that is larger than the first utilization rate* when the *temperature of intake air* is the same. However, if the claim were read in that manner, it would be disclosed for the reasons I discussed for claim 2. See Section VI.A.2.a, above.

4. wherein the estimating unit is configured to search an upper limit that is recorded in association with a temperature of intake air detected by the intake-air temperature sensor

and a utilization rate detected by the operational status detecting unit, from the temperature range storing unit.

186. In Hira, the "component temperature threshold value 19 [in Figure 4] is obtained by extracting component temperatures applicable to the current system status from standard component temperature 15…." EX1005, [0025]. The standard component temperature 15 (in Figure 3) "is multiple items of information prepared during the design/development phase…being information consisting of all combinations of ambient temperature, configuration, load, and fan rotational speed." EX1005, [0024].



EX1005, Fig. 3 (annotated).

187. Thus, in Hira, *the estimating unit* (component temperature threshold value generating unit 2) *search[es]* for *an upper limit* (standard component temperatures in Figures 3 and 4) based on the current status of the system including ambient temperature (*a temperature of intake air detected by the intake-air temperature sensor*) and load (*a utilization rate detected by the operational status detecting unit*).

c. Claim 4.

1. The abnormality detection device according to claim 1, wherein:

188. The combination of Hira and Shiga discloses claim 1 for the reasons I explained for that claim. The combination of Hira and Shiga also discloses the additional limitations of claim 4.

2. the estimating unit is configured to estimate a lower limit of the possible temperatures in the predetermined position when a quantity of intake air into the ICT equipment is appropriate, based on a result of detection by the operational status detecting unit and a result of detection by the intake-air temperature sensor; and

189. This limitation is similar to limitation 1b except that *the estimating unit is configured to estimate a* <u>*lower limit*</u> *of the possible temperatures* rather than an upper limit as in limitation 1b.

190. Shiga discloses and suggests to a POSITA estimating a lower temperature limit as an alternative to using only upper threshold values to control fan rotational speed as I have discussed above. In this alternative approach, "the temperature monitoring unit 112 obtains the intake air temperature, and determines the optimal CPU temperature 129, which is the value that minimizes the total of CPU leakage current and fan power consumption, from the obtained intake air temperature." EX1007, [0077]. A determination can be made regarding fan speed "based on whether the value is within the range between a value obtained by

subtracting a fixed temperature from the optimal CPU temperature and a value obtained by adding a fixed temperature to the optimal CPU temperature." EX1007, [0077].

191. A POSITA would recognize that Shiga's temperature "value obtained by subtracting a fixed temperature from the optimal CPU temperature" is an estimate of *a lower limit of the possible temperatures in the predetermined position when a quantity of intake air into the ICT equipment is appropriate*. It is the lower limit temperature, assuming normal operating conditions, below which the CPU temperature should not fall without the system taking some action to address it.

192. A POSITA would have been motivated to implement Shiga's alternative fan control approach because it would manage Hira's cooling fans in a manner that would effectively maintain CPU temperature near its optimum temperature, i.e., temperature that minimizes CPU leakage current and fan power consumption. EX1007, [0054]-[0055], [0077]. Shiga states that "maintaining optimal temperature" can minimize "power consumption due to leakage current" and increase "cooling efficiency." EX1007, [0014]. A POSITA would be motivated to implement Shiga's fan control in Hira's server to obtain these benefits.

193. A POSITA would have been able to implement Shiga's fan control functionality in Hira's server without undue experimentation and with a reasonable

expectation of success as I discussed previously. See Section VI.A, above. The alternative technique would require only basic programming changes to Shiga's server program implemented on Hira's server computer. It would have been well within the skill level of a person of ordinary skill in the art.

3. the determining unit is configured to instruct a fan controlling unit that controls a number of rotations of cooling fans to reduce a number of rotations of the cooling fans when a result of detection by the temperature sensor is below a lower limit estimated by the estimating means.

194. As explained for the prior limitation of claim 4, Shiga discloses an alternative approach in which fan speed is determined based on "whether the [CPU temperature] value is within the range between a value obtained by subtracting a fixed temperature from the optimal CPU temperature and a value obtained by adding a fixed temperature to the optimal CPU temperature." EX1007, [0077].

195. A POSITA would understand from Shiga that if the CPU temperature is below the lower limit (*when a result of detection by the temperature sensor is below a lower limit estimated by the estimating means*), "server program 110" would "modify the fan rotational speed" accordingly. EX1007, [0078]. The program would adjust the fan rotational speed to a lower setting (*instruct a fan controlling unit that controls a number of rotations of cooling fans to reduce a number of rotations of the cooling fans*).

196. Shiga's Figure 10 illustrating "fan profile 123" confirms that as the fan speed is reduced it leads to less cooling, which would tend to bring the CPU temperature closer to the optimal temperature. EX1007, [0057], [0081], Fig. 10. A person of ordinary skill in the art would have understood this based on common sense and experience as well as from Shiga's disclosure.

197. I will note that this limitation of claim 4 refers to *a lower limit estimated by <u>the estimating means</u>*. Neither claim 4 nor claim 1 recites "an estimating means," but both claims recite "an estimating unit." Claim 4's reference to *the estimating means* appears to refer to the estimating unit and that is how I have understood the claim language.

198. In addition, I have considered whether this limitation of claim 4 is disclosed by Hira-Shiga if the limitation were to be construed as a means-plus-function limitation. See Section IV.E.2, above. It is disclosed by the prior art for the same reasons I have discussed in this section regarding this limitation. Shiga's fan control technique implemented in Hira's server (*fan controlling unit*) to perform the functions described for this limitation is equivalent to a CPU functioning as fan controlling unit 161 (EX1001, 4:45-58, 5:22-32, Fig. 2).

d. Claim 5. The abnormality detection device according to claim 1, wherein the operational status detecting unit is configured to detect a load on a CPU mounted in the ICT equipment as an operational status of the ICT equipment.

199. The combination of Hira and Shiga discloses claim 1 for the reasons I explained for that claim. The combination of Hira and Shiga also discloses the additional limitation of claim 5.

200. In Hira, "system information acquisition unit 5" (*the operational status detecting unit*) acquires "system information from the operating system, etc. and stores system information 8 in the information storage unit 1…." EX1005, [0030]. The acquired system information 8 includes "load 11 information," which "represents the ratio of actual load to maximum load" for components in the computer including the CPU. EX1005, [0023]; see also [0016] ("Load 11 is load information for CPU/memory/HDD/expansion drives.").

201. Thus, Hira discloses that *the operational status detecting unit* (system information acquisition unit 5) *is configured to detect a load on a CPU mounted in the ICT equipment* (load 11 information) *as an operational status of the ICT equipment.*

202. In Shiga, "utilization information and power monitoring unit 111 collects utilization information…from the physical computer[]." EX1007, [0022]. The collected utilization information including "CPU utilization rate." EX1007,

[0029] ("The measurement agent 223 is a software program that runs on the computer 200 and collects utilization information such as CPU utilization rate…of the device on which the program runs"), [0044] ("The unit for CPU utilization rate is %.").

203. Much as in Hira, Shiga discloses that *the operational status detecting unit* (utilization information and power monitoring unit 111) *is configured to detect a load on a CPU mounted in the ICT equipment* (CPU utilization rate) *as an operational status of the ICT equipment*.

e. Claim 6. The abnormality detection device according to claim 1, wherein the operational status detecting unit is configured to detect power consumption of the ICT equipment as an operational status of the ICT equipment.

204. The combination of Hira and Shiga discloses claim 1 for the reasons I explained for that claim. The combination of Hira and Shiga also discloses the additional limitation of claim 6.

205. As I discussed for limitation 1b, Shiga's "utilization information and power monitoring unit 111 collects utilization information and power consumption information" from the computer. EX1007, [0022]. Thus, Shiga's *operational status detecting unit* (utilization information and power monitoring unit 111) *is configured to detect power consumption of the ICT equipment* (power consumption information) *as an operational status of the ICT equipment*.

206. While the claim language does not appear to require it, Shiga further discloses using the detected power consumption information (*an operational status of the ICT equipment*) to control fan speed. Shiga states that power consumption information is collected and stored in "server utilization history 124." EX1007, [0065]. Shiga's "CPU temperature estimation unit 113 estimates the CPU temperature of each physical computer 200 after a certain period of time elapses based on the stored utilization history," which includes power consumption information" EX1007, [0066]. This estimated future temperature is used to set the appropriate fan rotational speed. EX1007, [0072]-[0075].

f. Claim 7. The abnormality detection device according to claim 1, wherein the temperature sensor is configured to detect a temperature of exhaust air.

207. The combination of Hira and Shiga discloses claim 1 for the reasons I explained for that claim. The combination of Hira and Shiga also discloses the additional limitation of claim 7.

208. Shiga's server program includes "temperature monitoring unit 112," which "acquires…exhaust temperature of the physical computer[]." EX1007, [0022]; see also [0026], [0090]. A person of ordinary skill in the art would know that Shiga's server program acquires exhaust temperature from a temperature sensor. EX1005, [0014] ("the dust filter clogging status detection device" includes

"temperature sensor information acquisition unit 6"). Thus, Shiga teaches a *temperature sensor* that *is configured to detect a temperature of exhaust air*.

209. In addition, Shiga describes an exemplary embodiment including "cooling control rules" identifying "conditions that can determine when abnormal temperature rise has started…." EX1007, [0110]. One such rule is illustrated in Figure 18 and "assumes that heat accumulation occurs at the rear surface of the rack where exhaust from the physical computers 200 exits when the CPU temperature of all physical computers 200 stored in a rack exceeds 60°C, and the exhaust temperature exceeds 40°C, and the fan rotational speed exceeds 10,000 revolutions/second." EX1007, [0111]. When these conditions are met, the rule indicates an "abnormal temperature rise," which is exactly what Hira's clogging status detection unit 3 is intended to detect.

210. A POSITA would have known to implement Shiga's rule in the combination of Hira and Shiga by modifying Hira's standard component temperature 15 (i.e., the set of predefined standard temperatures in multiple different configurations) to include standard exhaust temperature in addition to the standard temperatures illustrated in Hira's Figure 3. EX1005, [0024] ("Standard component temperature 15…is multiple items of information prepared during the design/development phase…."); EX1007, [0110] (Shiga's "cooling control rules…are defined in advance" by an administrator).

211. A POSITA would have been motivated to implement Shiga's cooling control rules with standard exhaust temperatures in Hira's server as they would provide a further indication of a clogged dust filter, i.e., when the exhaust temperature threshold is exceeded. It would have been a simple matter for a POSITA to do so requiring only basic programming modifications.

212. Thus, in the combination of Hira and Shiga, Shiga's *temperature sensor* would be implemented in Hira's server, and it would be *configured to detect a temperature of exhaust air*. That would be *the sensor* recited in claim 1.

3. Independent Claim 8

a. [8pre] An Information and Communication Technology (ICT) equipment including a cooling fan, comprising:

213. Hira discloses the preamble of claim 8 for the same reasons I discussed for 1pre.

214. Hira discloses a "dust filter clogging status detection device for detecting clogging status of dust filters inside information processing devices such as PCs and server systems…." EX1005, [0001]. The '320 Patent confirms that "ICT equipment" can be a "server device." EX1001, 1:19-22. Hira therefore discloses *Information and Communication Technology (ICT) equipment*.

215. Hira's "PCs and server systems" include *a cooling fan*. EX1005, [0016] ("The actual fan rotational speed 9 is the actual rotational speed of each fan installed in the system.").

216. Thus, Hira discloses *[a]n Information and Communication Technology (ICT) equipment including a cooling fan*.

b. [8a] an operational status detecting unit configured to detect an operational status of the ICT equipment;

217. Hira discloses this limitation of claim 8.

218. As I discussed for limitation 1b, Hira's "system information acquisition unit 5 acquires system information from the operating system, etc…." EX1005, [0030], Figs. 1, 8. The acquired system information 8 includes "actual fan rotational speed 9, hardware configuration 10, [and] load 11" (EX1005, [0015]), which are each *an operational status of the ICT equipment*.

219. Thus, Hira's "system information acquisition unit 5" constitutes *an operational status detecting unit configured to detect an operational status of the ICT equipment*.

c. [8b] an intake-air temperature sensor configured to detect an intake air temperature of intake air of the ICT equipment;

220. Hira discloses this limitation of claim 8.

221. As discussed for limitation 1b, Hira's "temperature sensor information acquisition unit 6 acquires temperature sensor information from temperature

sensors….” EX1005, [0030]. This includes “ambient temperature 13” (*id*., [0015]), which is the *intake air temperature of intake air of the ICT equipment* as I explained for limitation 1b. See Section VI.A.1.c, above.

222. Thus, Hira discloses *an intake-air temperature sensor configured to detect an intake air temperature of intake air of the ICT equipment*.

d. [8c] an equipment temperature sensor configured to detect an equipment temperature in a predetermined position of the ICT equipment;

223. Hira discloses this limitation of claim 8.

224. As I discussed for limitation 1d, Hira’s “temperature sensor information acquisition unit 6” detects “component temperature 14” including “temperature information for main components such as CPU, memory/HDD/ICs, etc.” EX1005, [0015]-[0017]. Hira states that temperature sensor information acquisition unit 6 “acquires temperature sensor information from temperature sensors….” EX1005, [0030]. As I explained for 1d, Hira’s temperature sensors detect equipment temperature in a predetermined position of the ICT equipment. See Section VI.A.1.e, above.

225. Thus, Hira discloses *an equipment temperature sensor configured to detect an equipment temperature in a predetermined position of the ICT equipment*.

e. [8d] a hardware processor including:

226. This limitation is identical to limitation 1a. It is disclosed for the reasons I provided for that limitation. See Section VI.A.1.b, above. Further, Hira's *hardware processor* is used to perform the functions discussed for the following limitations of claim 8.

f. [8e] an operational status detecting unit configured to detect an operational status of the ICT equipment;

227. This limitation is identical to limitation 8a. As I explained for limitation 8a, Hira's "system information acquisition unit 5" constitutes *an operational status detecting unit configured to detect an operational status of the ICT equipment*.

228. This duplicate language in claim 8 does not appear to add a further limitation to the claim. If so, it is disclosed for the reasons I provided for limitation 8a above.

229. To the extent this limitation could be read to require a second *operational status detecting unit* (because the limitation is repeated), Shiga discloses a second *operational status detecting unit* that would be combined with Hira's *operational status detecting unit*.

230. As I discussed for limitation 1c, Shiga's "utilization information and power monitoring unit 111 collects utilization information and power consumption information from the" computer. EX1007, [0022]. This collected information

includes “CPU utilization rate” (which a POSITA would understand to be the CPU load), “memory utilization rate, and network interface utilization rate of the device” and “power consumption status” of the computer. EX1007, [0029], [0043]-[0045]. Each of these is *an operational status of the ICT equipment*.

231. Thus, Shiga discloses a different, additional *operational status detecting unit* (utilization information and power monitoring unit 111) *configured to detect an operational status of the ICT equipment*. When combined with Hira, this would constitute a second *operational status detecting unit*.

g. [8f] an estimating unit configured to estimate an upper value limit of possible temperatures in a predetermined position of the ICT equipment when a quantity of intake air into the ICT equipment is appropriate, based on a result of detection by the operational status detecting unit and a result of detection by the intake-air temperature sensor, an operational status of the ICT equipment, and an intake air temperature,

232. This limitation is similar to limitation 1b. It is worded differently, but limitation 8f (like 1b) recites *an estimating unit* that *estimate[s] an upper value limit of possible temperatures* based on the same two things: (i) *an operational status of the ICT equipment*, which is *a result of detection by the operational status detecting unit*, and (ii) *an intake air temperature*, which is *a result of detection by the intake-air temperature sensor*.

233. This limitation is disclosed for the reasons I discussed for limitation 1b. See Section VI.A.1.c, above.

234. In addition, I have considered whether this limitation of claim 8 is disclosed by Hira-Shiga if the limitation were to be construed as a means-plus-function limitation. See Section IV.E.2, above. It is disclosed by the prior art for the same reasons I have discussed in this section regarding limitation 1b. Hira's CPU functioning as component temperature threshold value generating unit 2 (*estimating unit*) to perform the functions described for this limitation is equivalent to a CPU functioning as evaluating unit 163/estimating unit 163 (EX1001, 4:59-5:14, 5:22-32, Fig. 2). Hira's CPU functioning as system information acquisition unit 5 (*operational status detecting unit*) to perform the functions described for this limitation is equivalent to a CPU functioning as CPU load detecting unit 162 (EX1001, 4:36-37, 5:22-32, Fig. 2).

h. [8g] wherein the operational status of the ICT equipment and the intake air temperature of the ICT equipment determines a rotation speed of the cooling fan; and

235. This limitation is identical to limitation 1c. It is disclosed for the reasons I provided for that limitation. See Section VI.A.1.d, above.

i. [8h] a determining unit configured to determine that an abnormality is occurring when a result of detection by the detected equipment temperature sensor is beyond the upper limit estimated by the estimating unit.

236. This limitation is similar to limitation 1d. It is disclosed for the reasons I provided for limitation 1d. See Section VI.A.1.e, above.

237. In addition, I have considered whether this limitation of claim 8 is disclosed by Hira-Shiga if the limitation were to be construed as a means-plus-function limitation. See Section IV.E.2, above. It is disclosed by the prior art for the same reasons I have discussed in this section regarding this limitation. Hira's CPU functioning as clogging status detection unit 3 (*determining unit*) to perform the functions described for this limitation is equivalent to a CPU functioning as determining unit 164 (EX1001, 5:15-21, 5:22-32, Fig. 2).

4. Independent Claim 9

a. An abnormality detection method of Information and Communication Technology (ICT) equipment including a cooling fan, the method comprising:

238. Hira discloses the preamble of claim 9.

239. Hira discloses an *abnormality detection method* as I explained for claim 1. The *abnormality detection method* can be used in *Information and Communication Technology (ICT) equipment including a cooling fan* as I explained for 1pre.

b. detecting an operational status and an intake air temperature of the ICT equipment;

240. Hira discloses *detecting an operational status…of the ICT equipment* for the reasons provided for limitation 1b and limitation 8a. See Sections VI.A.1.c and VI.A.3.b, above.

241. Hira discloses detecting *an intake air temperature of the ICT equipment* for the reasons provided for limitation 1b and limitation 8b. See Sections VI.A.1.c and VI.A.3.c, above.

c. by an estimating unit, estimating an upper limit of possible temperatures in a predetermined position of the ICT equipment when a quantity of intake air into the ICT equipment is appropriate, based on the detected operational status and the air intake temperature, a result of detection by an operational status detecting unit that detects an operational status of the ICT equipment and a result of detection by an intake-air temperature sensor that detects a temperature of intake air of the ICT equipment;

242. This limitation is similar to limitation 1b. It is worded differently, but this limitation of claim 9 (like 1b) recites *an estimating unit* that *estimate[s] an upper limit of possible temperatures* based on the same two things: : (i) *the detected operational status*, which is *a result of detection by an operational status detecting unit that detects an operational status of the ICT equipment*, and (ii) *the intake air temperature*, which is *a result of detection by an intake-air temperature sensor that detects a temperature of intake air of the ICT equipment*.

243. This limitation is disclosed for the reasons I discussed for limitation 1b. See Section VI.A.1.c, above.

244. In addition, I have considered whether this limitation of claim 9 is disclosed by Hira-Shiga if the limitation were to be construed as a means-plus-function limitation. See Section IV.E.2, above. It is disclosed by the prior art for the same reasons I have discussed in this section regarding limitation 1b. Hira's CPU functioning as component temperature threshold value generating unit 2 (*estimating unit*) to perform the functions described for this limitation is equivalent to a CPU functioning as evaluating unit 163/estimating unit 163 (EX1001, 4:59-5:14, 5:22-32, Fig. 2). Hira's CPU functioning as system information acquisition unit 5 (*operational status detecting unit*) to perform the functions described for this limitation is equivalent to a CPU functioning as CPU load detecting unit 162 (EX1001, 4:36-37, 5:22-32, Fig. 2).

d. determining a rotation speed of the cooling fan based on the detected operational status and the air intake temperature; and

245. This limitation is similar to limitation 1c. It is disclosed for the reasons I provided for that limitation. *See* Section VI.A.1.d, above.

e. by a determining unit, determining that an abnormality is occurring when a result of detection by a detected equipment temperature sensor that detects a temperature in the predetermined position is beyond the upper limit estimated by the estimating unit.

246. This limitation is similar to limitation 1d. It is disclosed for the reasons I provided for that limitation. *See* Section VI.A.1.e, above.

247. In addition, I have considered whether this limitation of claim 9 is disclosed by Hira-Shiga if the limitation were to be construed as a means-plus-function limitation. See Section IV.E.2, above. It is disclosed by the prior art for the same reasons I have discussed in this section regarding this limitation. Hira's CPU functioning as clogging status detection unit 3 (*determining unit*) to perform the functions described for this limitation is equivalent to a CPU functioning as determining unit 164 (EX1001, 5:15-21, 5:22-32, Fig. 2).

VII. SECONDARY CONSIDERATIONS

248. I have considered the impact of secondary considerations of obviousness, but I am not aware of any relevant information related to secondary considerations of obviousness that would impact my opinions at this time. To the extent the Patent Owner comes forward with any such information, I will consider it.

VIII. AVAILABILITY FOR CROSS-EXAMINATION

249. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during a time as mutually agreed between the parties.

IX. RIGHT TO SUPPLEMENT

250. I reserve the right to supplement my opinions in the future to respond to any arguments that the Patent Owner raises. This declaration represents only those opinions that I have formed to date. I reserve the right to revise, supplement, and/or amend my opinions stated herein based on new information that becomes available to me and on my continuing analysis of the materials already provided.

X. CONCLUSION

251. For the reasons discussed in this declaration, it is my opinion that the challenged claims of the ’632 Patent are unpatentable in view of the prior art I have discussed above.

Acknowledgement of Oath

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1101 of Title 18 of the United States Code.

Respectfully submitted,

____

Himanshu Pokharna, Ph.D.

Dated: July 9, 2025