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

Case IPR2025-01286
Patent No. 9,482,632

PETITION FOR *INTER PARTES* REVIEW

TABLE OF CONTENTS

List of Exhibits vii
Mandatory Notices Under 37 C.F.R. § 42.8 ix
Real Party-in-Interest (37 C.F.R. § 42.8(b)(1)) ix
Related Matters (37 C.F.R. § 42.8(b)(2)) ix
Lead and Back-Up Counsel (37 C.F.R. § 42.8(b)(3)) ix
Service Information (37 C.F.R. § 42.8(b)(4)) ix
I. Introduction 1
II. Grounds for Standing 2
III. Identification of Challenge 2
IV. The Challenged Patent 3
  A. Patent Specification 3
  B. Prosecution History 7
  C. Patent Claims 8
  D. Person of Ordinary Skill in the Art 9
V. Construction of Terms in the Challenged Claims 10
  A. "in a case where a result of detection by the intake-air temperature sensor is equal" 10
  B. "estimating unit," "operational status detecting unit," "determining unit," "fan controlling unit" 12
VI. Prior Art References 15
  A. Hira (EX1005) 15
  B. Shiga (EX1007) 16
VII. The Challenged Claims Are Invalid As Obvious Based on the Combination of Hira and Shiga 17
  A. Overview of Hira 17
  B. Overview of Shiga 20
  C. Motivation to Combine 26
  D. Independent Claim 1 28

1. [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: 28
2. [1a] a hardware processor comprising: 29
3. [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, ...30
4. [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 43
5. [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. 46

E. Dependent Claims 2-7 51

1. 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. 51
2. Claim 3: The abnormality detection device according to claim 1, comprising 55
   a. 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 55

b. 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, ... 57

c. 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, frm the temperature range storing unit. 58

3. Claim 4: The abnormality detection device according to claim 1, wherein: 60

a. 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 detectingunit and a result of detection by the intake-air temperature sensor; and 60

b. 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 estiated by the estimating means. 61

4. 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........ 63

5. 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........ 65

6. Claim 7: The abnormality detection device according to claim 1, wherein the temperature sensor is configured to detect a temperature of exhaust air. 66

F. Independent Claim 8 67

1. [8pre] An Information and Communication Technology (ICT) equipment including a cooling fan, comprising: 67

2. [8a] an operational status detecting unit configured to detect an operational status of the ICT equipment; 68

3. [8b] an intake-air temperature sensor configured to detect an intake air temperature of intake air of the ICT equipment;....................69

4. [8c] an equipment temperature sensor configured to detect an equipment temperature in a predetermined position of the ICT equipment;....................69

5. [8d] a hardware processor including:....................70

6. [8e] an operational status detecting unit configured to detect an operational status of the ICT equipment; 70

7. [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,....................71

8. [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 72

9. [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.............................72

G. Independent Claim 9 73

1. An abnormality detection method of Information and Communication Technology (ICT) equipment including a cooling fan, the method comprising:....................73

2. detecting an operational status and an intake air temperature of the ICT equipment;....................73

3. 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; 74

4. determining a rotation speed of the cooling fan based on the detected operational status and the air intake temperature; and 75

5. 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. 75

VIII. Discretionary Denial Is Not Warranted 76

IX. Conclusion 76

TABLE OF AUTHORITIES

FEDERAL CASES

KSR Int'l Co. v. Teleflex Inc.,
550 U.S. 398 (2007)....................28

Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.,
868 F.3d 1013 (Fed Cir. 2017)....................10

Phillips v. AWH Corp.,
415 F.3d 1303 (Fed. Cir. 2005) (en banc)....................10

Sanofi-Aventis Deutschland GmbH v. Mylan Pharmaceuticals Inc.,
66 F.4th 1373 (Fed. Cir. 2023)....................20, 26

Williamson v. Citrix Online, LLC,
792 F.3d 1339 (Fed. Cir. 2015)....................12

FEDERAL STATUTES

35 U.S.C.
§ 102....................3, 16, 17
§ 103....................3
§ 112....................3

FEDERAL REGULATIONS

37 C.F.R.
§ 42.100....................10
§ 42.104....................2

LIST OF EXHIBITS

Exhibit	Description
1001	U.S. Patent No. 9,482,632 (the "'632 Patent")
1002	Prosecution history of U.S. Application No. 14/018,152, which led to the issuance of the '632 Patent
1003	Declaration of Himanshu Pokharna, Ph.D. in Support of *Inter Partes* Review of U.S. Patent No. 9,482,632
1004	*Curriculum vitae* for Himanshu Pokharna, Ph.D.
1005	English Translation of JP 2009-277053A ("Hira")
1006	Certificate of Translation for JP 2009-277053A
1007	English Translation of WO 2010/050080A1 ("Shiga")
1008	Certificate of Translation of WO 2010/050080A1
1009	U.S. Patent Application Publication No. 2011/0036554
1010	U.S. Patent Application Publication No. 2011/0240581
1011	U.S. Patent Application Publication No. 2011/0155675
1012	Random House Webster's Computer & Internet Dictionary (3d ed. 1999) (excerpt)
1013	Microsoft Computer Dictionary (5th ed. 2002) (excerpt)
1014	Complaint for Patent Infringement
1015	Cloud Byte's Preliminary Infringement Contentions with attached Exhibit 5
1016	U.S. District Court – Judicial Caseload Profiles (March 2025)
1017	Assignment (U.S. Patent No. 9,482,632)
1018	Lex Machina (U.S. Patent No. 9,482,632)

Exhibit	Description
1019	Cloud Byte's Disclosure of Proposed Claim Constructions and Extrinsic Evidence with attached Exhibit A
1020	Declaration of Victoria C. Huang

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

Real Party-in-Interest (37 C.F.R. § 42.8(b)(1))

The real parties-in-interest are petitioners Dell Technologies Inc. and Dell Inc. ("Petitioners"). No unnamed entity is funding, controlling, or directing this petition or has the ability to control or direct this petition or Petitioners' participation in any resulting *inter partes* review. Petitioners understand based on public information that the challenged patent, U.S. Patent No. 9,482,632 (the "'632 Patent"), is owned by Cloud Byte LLC ("Patent Owner").

Related Matters (37 C.F.R. § 42.8(b)(2))

Petitioners are aware of the following district court lawsuit involving the '632 Patent: *Cloud Byte LLC v. Dell Technologies Inc. and Dell Inc.*, Case No. 2:24-cv-00637-JRG (E.D. Tex.).

Lead and Back-Up Counsel (37 C.F.R. § 42.8(b)(3))

Petitioners appoint James L. Day (Reg. No. 72,681) of Farella Braun + Martel LLP as lead counsel and appoint the following attorneys as back-up counsel: Daniel Callaway (Reg. No. 74,267) and Winston Liaw (Reg. No. 78,766) of Farella Braun + Martel LLP.

Service Information (37 C.F.R. § 42.8(b)(4))

Service of any documents to lead and back-up counsel can be made via hand-delivery to Farella Braun + Martel LLP, One Bush Street, Suite 900, San Francisco, California, 94104. Petitioners consent to electronic service to the following email addresses: jday@fbm.com, dcallaway@fbm.com, wliaw@fbm.com, and calendar@fbm.com.

I. INTRODUCTION

Dell Technologies Inc. and Dell Inc. ("Petitioners") respectfully request *inter partes* review of claims 1-9 (the "challenged claims") of U.S. Patent No. 9,482,632 (the "'632 Patent") owned by Cloud Byte LLC ("Patent Owner").

The '632 Patent claims an approach to detecting an "abnormality," such as a clogged dust filter, in a server computer or other Information and Communication Technology (ICT) equipment by setting an expected temperature threshold under normal operating conditions in various different circumstances. The threshold is set based on the applicable "operational status" and "intake-air temperature" of the equipment, and when the actual temperature exceeds the expected temperature the claimed invention determines that an anomaly is occurring (e.g., the dust filter is clogged). But this technique for identifying a clogged dust filter was already known in the art. For example, Japanese Patent Application No. JP2009277053A ("Hira"), entitled "Dust filter clogging status detection method and dust filter clogging status detection device," describes the same approach to determining that a dust filter is clogged in ICT equipment.

Hira discloses every limitation of the challenged claims except the requirement that the server also use operational status information and air-intake temperature to control the speed of the cooling fan. But this was also known before the '632 Patent. International patent application publication number

WO2010050080A1 ("Shiga") described a fan control technique based on operational status—such as the CPU load—and intake-air temperature. Because a person of ordinary skill in the art would have been motivated to implement Shiga's cooling control functionality in Hira's server, and could have done so with a reasonable expectation of success, the combination of Hira and Shiga renders the challenged claims of the '632 Patent obvious and invalid.

Because the petition demonstrates a reasonable likelihood Petitioners will prevail on at least one—and indeed all—of the challenged claims, *inter partes* review should be instituted and the challenged claims of the '632 Patent should be canceled.

II. GROUNDS FOR STANDING

Petitioners certify pursuant to 37 C.F.R. § 42.104 that the '632 Patent is available for *inter partes* review and that Petitioners are not barred or estopped from requesting an *inter partes* review challenging the claims of the '632 Patent on the grounds identified in this petition.

III. IDENTIFICATION OF CHALLENGE

Pursuant to 37 C.F.R. § 42.104(b), Petitioners request *inter partes* review of the challenged claims of the '632 Patent and further request that the challenged claims be canceled as unpatentable for being obvious under 35 U.S.C. § 103[1] based on the following grounds:

Grounds	Claims	Prior Art
1	1-9	Hira (EX1005) and Shiga (EX1007)

Petitioners' proposed construction of terms, the evidence relied upon, and the precise reasons why the challenged claims are unpatentable are provided in the following sections of the petition. A List of Exhibits identifying the specific evidence relied upon is provided above.

IV. THE CHALLENGED PATENT

A. Patent Specification

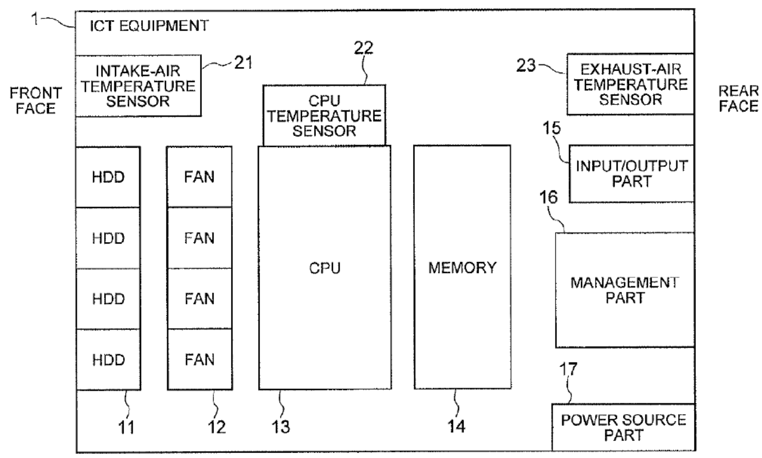
The '632 Patent is entitled "Abnormality Detection Device." EX1001, 1. It describes "an abnormality detection device that detects an abnormality of a cooling function of ICT (Information and Communication Technology) equipment such as a server…." EX1001, 1:13-16. The claimed invention "detect[s] an abnormality of a cooling function, such as clogging of a filter," in ICT equipment. *Id.*, 2:6-11.

Figure 1 illustrates 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

[1] The pre-AIA version of Sections 102, 103, and 112 of the Patent Act apply.

CPU 13," and "a management part 16 that is realized by a chip set…." EX1001, 3:37-50.

FIG. 1

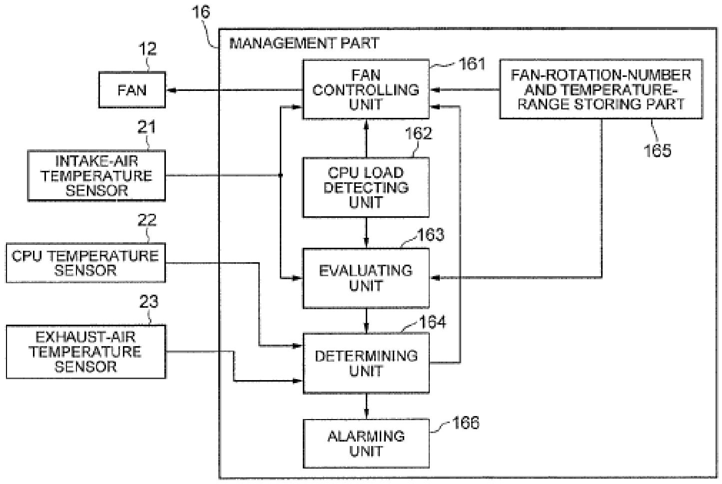


<u>'632 Patent, Fig. 1</u>

The 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…." *Id.*, 3:51-55. "A filter for excluding dust is attached to the inlet opening." *Id.*, 3:55-56.

Figure 2 shows 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



’632 Patent, Fig. 2

“The CPU load detecting unit 162 is used for detecting the operational status of the ICT equipment 1.” *Id*., 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.” *Id*., 3:62-66.

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. 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. *Id*., 4:6-35; EX1003, ¶45.

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'
⋮	⋮	⋮	⋮	⋮

<u>’632 Patent, Fig. 3</u>

The “estimating unit 163 has a 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.” *Id*., 5:7-13; *see also id*., 3:62-4:35, 4:59-66.

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; EX1003, ¶47.

B. Prosecution History

The ’632 Patent issued from 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.

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

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. For instance, 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….” *Id*., 123; *see also id.*, 125-127 (similar amendments to claims 8 and 9).

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….” EX1002, 128. According to the applicant, “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." *Id.*, 129. And, the applicant argued, "an air intake temperature sensor cannot be simply added to Urita." *Id*.

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. Patent Claims

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.

Independent claim 8 recites an "Information and Communication Technology (ICT) equipment including a cooling fan" that detects an abnormality as in claim 1, and independent claim 9 recites an "abnormality detection method of Information and Communication Technology (ICT) equipment including a cooling fan…." Dependent claims 2-7 depend from claim 1. The claim language for all challenged claims is provided in the attached Claim Appendix.

D. Person of Ordinary Skill in the Art

A person of ordinary skill in the art ("POSITA") would have had (i) 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, or (ii) 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. EX1003, ¶59. A POSITA would have been familiar with the thermal management technology used in electronic devices, such as servers and storage devices. *Id*.

V. CONSTRUCTION OF TERMS IN THE CHALLENGED CLAIMS

The claims of the ’632 Patent should be construed under the *Phillips* standard. 37 C.F.R. § 42.100(b); *see generally Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). The Board, however, need only construe claims when necessary to resolve the underlying controversy. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed Cir. 2017). Aside from the following terms, Petitioners believe that no express constructions are necessary to determine that the asserted prior art discloses the limitations of the challenged claims.[2]

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

Dependent claim 2 recites that “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.” EX1001, 8:33-38 (emphasis added). The ’632 Patent discusses this limitation in connection with Figure 3, which illustrates “an example of the stored content in the fan-rotation-

[2] Petitioners reserve the right to present other claim construction arguments in the related district court litigation as relevant and necessary in that proceeding.

number and temperature-range storing part 165." *Id.*, 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'
⋮	⋮	⋮	⋮	⋮

<u>'632 Patent, Fig. 3 (annotated)</u>

The patent states that, "in a case where an <u>intake-air temperature Ta is equal</u>, 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." *Id.*, 4:1-5 (emphasis added).

Based on the disclosure, claim 2's recitation 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. EX1003, ¶72. 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 is the same, the "estimating unit" will "estimate a lower temperature value as the upper limit" when the "utilization rate" is lower. *Id*., ¶73. 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 (i.e., if CPU load is low, the threshold temperature indicating an abnormality will be lower; if CPU load is high, the threshold temperature indicating an abnormality will be higher). *Id*.

B. "estimating unit," "operational status detecting unit," "determining unit," "fan controlling unit"

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." *Id*., 8:62-67. Petitioners construe these claims based on their plain meaning and <u>not</u> as means-plus-function limitations under Section 112 ¶6. There is a presumption against such treatment because the limitations do not recite a "means for" performing a function. *See Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1349 (Fed. Cir. 2015). The terms also were not construed as means-plus-function limitations during prosecution. EX1002, 86-95, 122-130. And Patent Owner does not contend that these terms are means-plus-function limitations. EX1015, 9, 7-187; EX1019, 15.

However, should the Board conclude that these terms are subject to Section 112 ¶6, Petitioners would propose the following means-plus-function constructions:

“estimating unit”

- Function: “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” (claim 1)[3]
- Structure: 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).

“operational status detecting unit”

- Function: “detect an operational status of the ICT equipment”

---

[3] The function is the language following the words “configured to” (i.e., “estimating unit configured to…”). Similarly, for claim 8, the function includes the claim language following the words “estimating unit configured to….” For claim 9, it is the language following “by an estimating unit” through the end of that limitation (i.e., “estimating…ICT equipment”).

(claim 1).[4]

- Structure: a CPU functioning as CPU load detecting unit 162 in Figure 2 (EX1001, 4:36-37, 5:22-32).

“determining unit”

- Function: “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” (claim 1)[5]
- Structure: a CPU functioning as determining unit 164 illustrated in Figure 2 (EX1001, 5:15-21, 5:22-32).

“fan controlling unit”

- Function: “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

---

4 The function is the same for claims 8 and 9.

5 In claim 8, the function includes the claim language following the words “determining unit is configured to.” For claim 9, it is the language following “by a determining unit” through the end of that limitation (i.e., “determining…by the estimating unit”).

estimating unit" (claim 4).

- Structure: a CPU functioning as fan controlling unit 161 illustrated in Figure 2 (EX1001, 4:45-58, 5:22-32).

The prior art cited herein meets these alternative constructions. *See* Sections VII.D, VII.E.1, VII.E.2, VII.E.3, VII.E.4, VII.E.5, VII.F, and VII.G, below; EX1003, ¶¶76-81.

VI. PRIOR ART REFERENCES

The '632 Patent issued from U.S. Patent Application No. 14/018,152, which was filed on September 4, 2013, claiming priority to a Japanese patent application filed on September 5, 2012. Patent Owner contends that the '632 Patent is entitled to the foreign application filing date. EX1015, 10.[6] Based on Patent Owner's contention, the '632 Patent is a pre-AIA patent. *See also* EX1002, 87 (examination was under pre-AIA statutes).

A. Hira (EX1005)

Hira is an English translation of Japanese Unexamined Patent Application Publication No. JP2009277053A entitled "Dust filter clogging status detection

---

[6] For purposes of this petition, Petitioners take no position on the patent's claim to the foreign priority date. The references discussed in this petition qualify as invalidating prior art even if the '632 Patent is entitled to that earlier filing date.

method and dust filter clogging status detection device." EX1005, 1. Petitioners provide a declaration certifying that Hira is a true and accurate translation of Japanese Unexamined Patent Application Publication No. JP2009277053A, which is also provided. EX1006. Hira was filed on May 15, 2008, and was published on November 26, 2009. EX1005, 1. Hira constitutes prior art to the '632 Patent under at least 35 U.S.C. § 102(a) and (b) (pre-AIA).[7] Hira was not cited during prosecution of the '632 Patent.

B. Shiga (EX1007)

Shiga is an English translation of international patent application publication number WO2010050080A1 entitled "Physical computer, method for controlling cooling device, and server system." EX1007, 1. Petitioners provide a declaration certifying that Shiga is a true and accurate translation of international patent application publication number WO2010050080A1, which is also provided. EX1008. Shiga was filed on February 24, 2009, and was published on May 6, 2010. EX1007, 1. Shiga constitutes prior are to the '632 Patent under at least

[7] If the '632 Patent were an AIA patent, Hira would constitute prior art under 35 U.S.C. § 102(a) (AIA).

35 U.S.C. § 102(a) and (b) (pre-AIA).[8] Shiga was not cited during prosecution of the ’632 Patent.

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

A. Overview of Hira

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 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….” *Id.*, [0008].

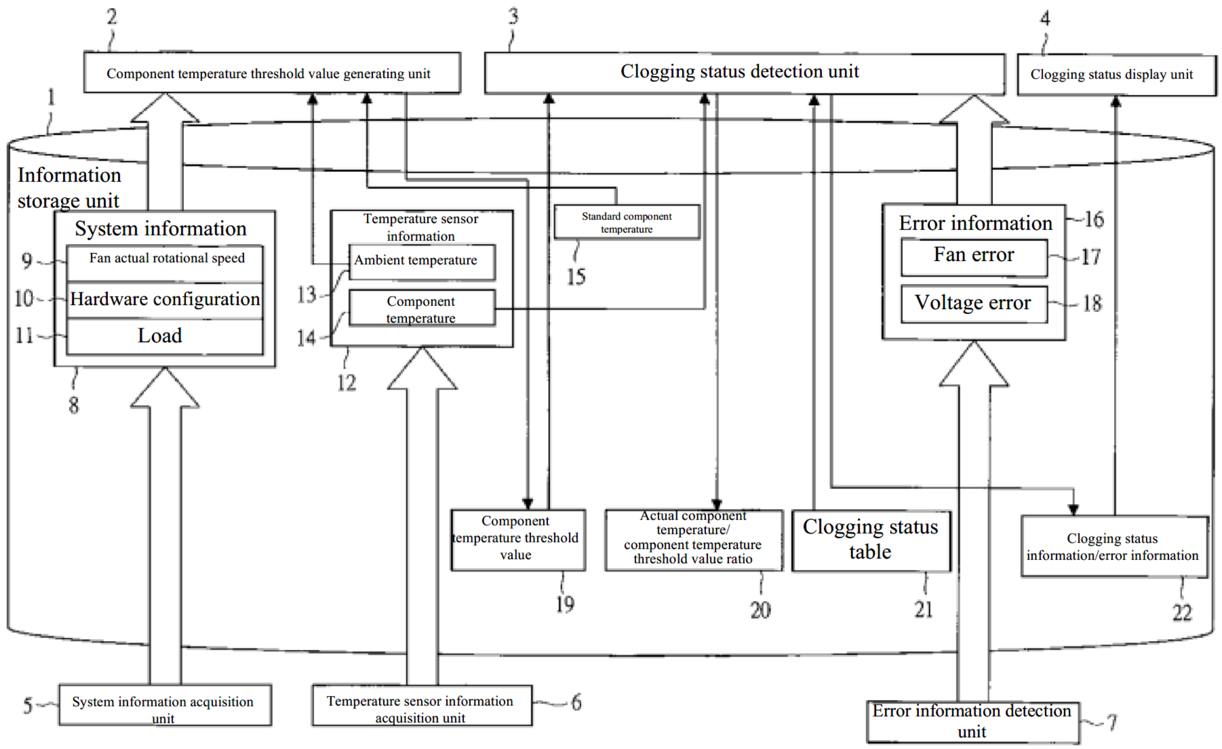
Hira’s Figure 1 is “a configuration diagram illustrating the configuration of a dust filter clogging status device according to one embodiment of the present invention.” EX1005, [0012]. Hira’s “dust filter clogging status detection device is configured as part of an information processing device such as a PC/server system….” *Id.*, [0014]. The device includes “information storage unit 1,” such as a hard disk drive, for storing information including “system information 8 (actual

---

[8] If the ’632 Patent were an AIA patent, Shiga would constitute prior art under 35 U.S.C. § 102(a) (AIA).

fan rotational speed 9, hardware configuration 10, load 11),” as illustrated within information storage unit 1 in the figure. *Id.*, [0015].

FIG. 1



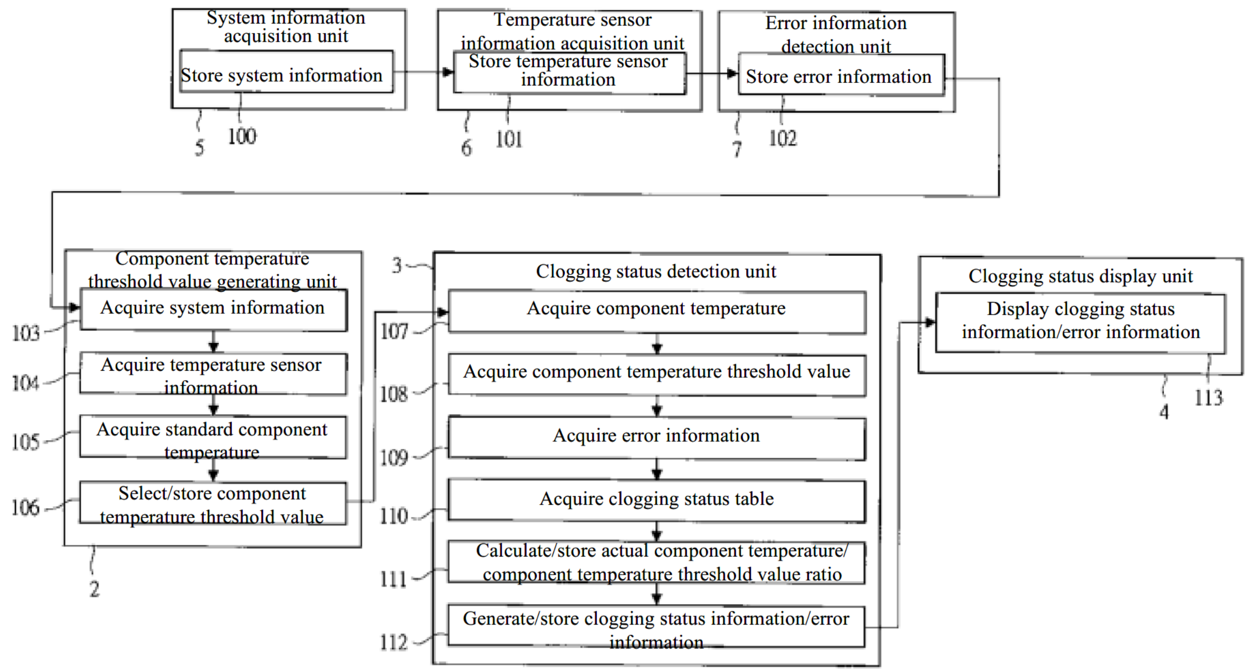
Hira, Fig. 1

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.” *Id.*, [0014]. Arrows indicate how the various units write to or read from information storage device 1. EX1003, ¶87.

Figure 8 is “a flowchart showing the dust filter clogging status detection operation of the dust filter clogging status detection device….” 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." *Id.*, [0030].

FIG. 8



Hira, Fig. 8

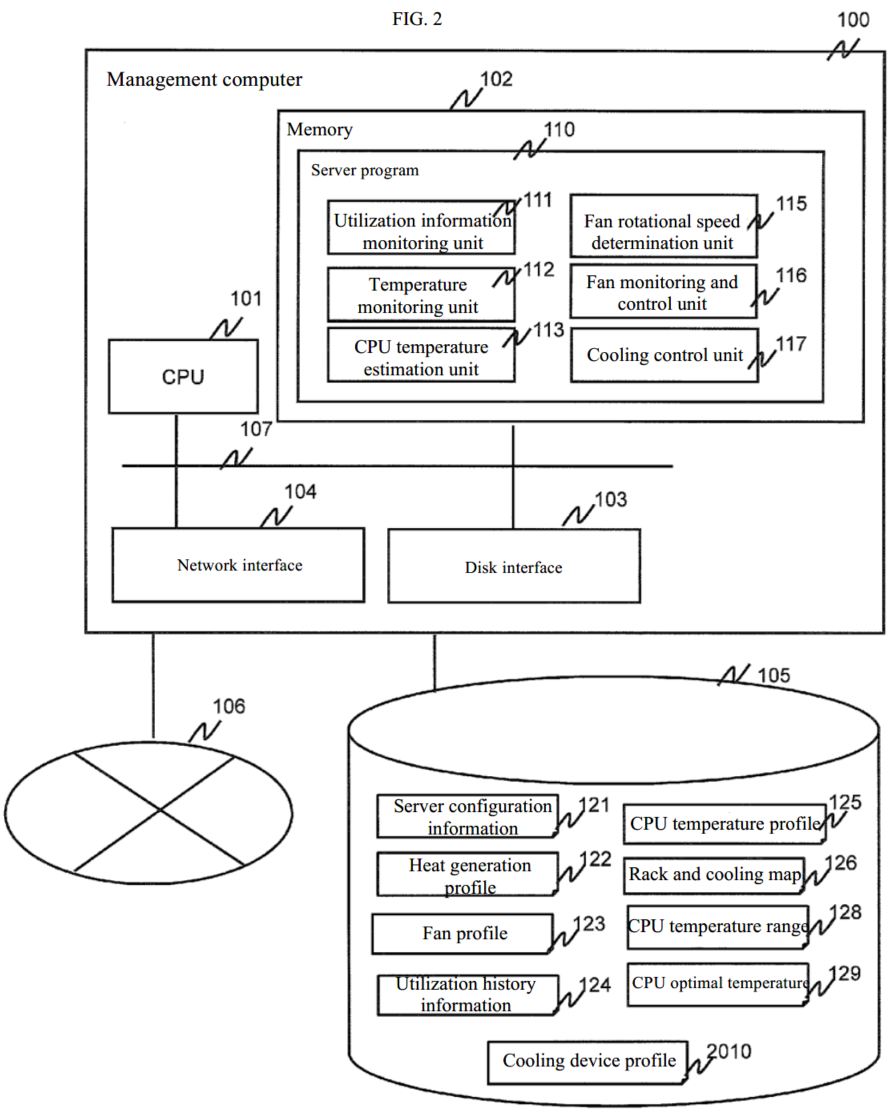
"Then, component temperature threshold value generating unit 2" acquires "system information 8" (step 103), "temperature sensor information 12" (step 104), and "standard component temperature 15" (step 105), and it uses the acquired information to generate and store the appropriate "component temperature threshold value 19" (step 106). *Id.*, [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). *Id*., [0032]-[0033]. "Then, clogging status information/error information 22 is generated" (step 112). *Id*., [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)." *Id*., [0035].

Hira is analogous prior art to the '632 Patent because it is in the same field of endeavor (i.e., electronic devices, such as server computers) and addresses the same problem of thermal management within electronic device enclosures. EX1003, ¶92; EX1005, [0001], [0008]; EX1001, 1 (Abstract), 1:12-17; *see also Sanofi-Aventis Deutschland GmbH v. Mylan Pharmaceuticals Inc.*, 66 F.4th 1373, 1377 (Fed. Cir. 2023). 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. EX1003, ¶92; EX1005, 1 (Abstract), [0001], [0004], [0008]-[0010]; EX1001, 2:6-11, 3:8-11.

B. Overview of Shiga

Shiga discloses a technique for "[c]ooling control for reducing overall power consumption of a system," such as a server computer, 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…." *Id*., [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). *Id*. If the estimated temperature exceeds a threshold, the system adjusts the "target rotational speed of the fan" to bring the estimated temperature down below the threshold. *Id*. 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." *Id*., [0014].

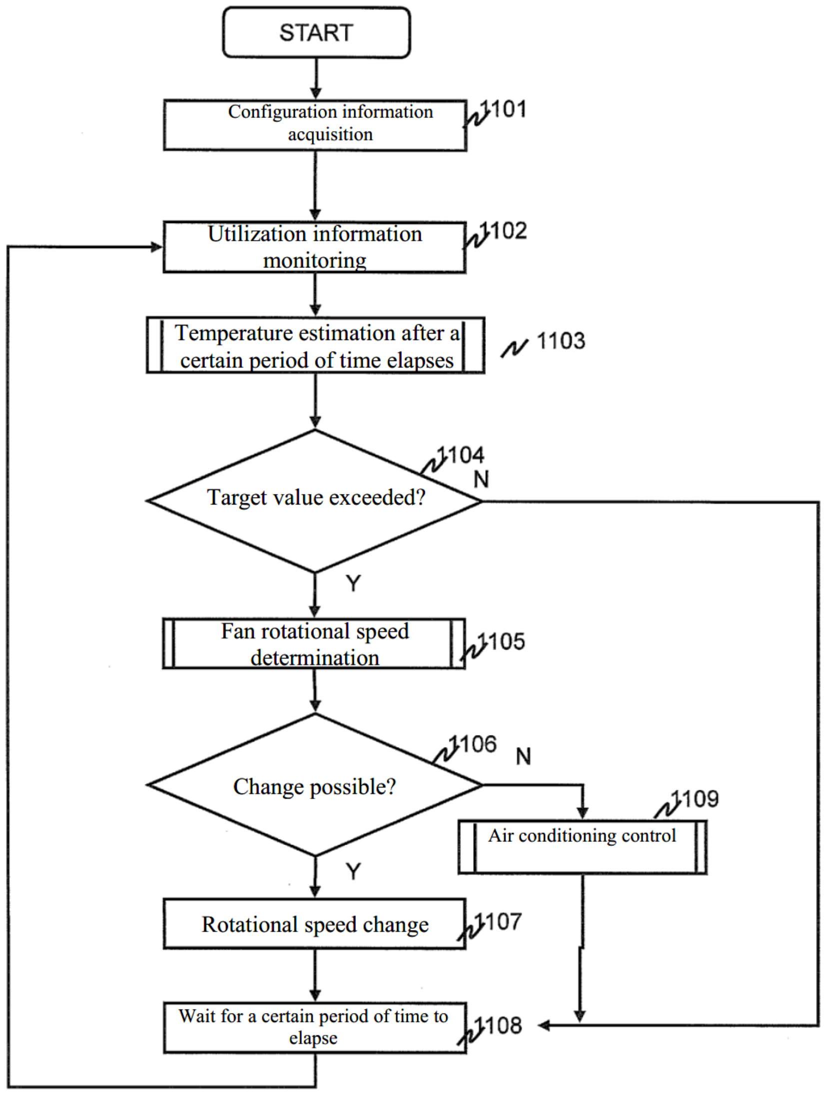
Shiga's Figure 2 illustrates a "management computer 100" that manages "one or more physical computers 200" (e.g., server computers). EX1007, [0018]. The management device is connected to and "detects the utilization status of the multiple physical computers 200." *Id*., [0020].



Shiga, Fig. 2

As illustrated, management computer 100 includes "server program 110." *Id.*, [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." *Id.*, [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." *Id*. 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." *Id*., [0091].

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). *Id*., [0065].



<u>Shiga, Fig. 11</u>

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…." *Id.*, [0029].

Next, in step 1103, "the CPU temperature estimation unit 113 estimates the CPU temperature…after a certain period of time elapses" (i.e., at a future point in time). EX1007, [0066]; EX1003, ¶100. It does so by "referenc[ing] the server utilization history 124 and obtain[ing] the CPU utilization 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…, and obtains the current fan rotational speed…." *Id*., [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…." *Id*. "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…." *Id*., [0071].

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 id*., [0073]-[0075]. The "server program 110 verifies whether the physical computer 200 can modify the fan rotational speed to the calculated rotational speed" (step 1106). *Id*., [0078]. For instance, it determines whether the new speed "exceeds the maximum value." *Id*.

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). *Id*. 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. *Id*., [0079].

Shiga is analogous prior art to the '632 Patent because it is in the same field of endeavor (i.e., electronic devices, such as server computers) and addresses the same problem of thermal management within electronic device enclosures. EX1003, ¶102; EX1007, 1 (Abstract), [0001], [00012], [0091]; EX1001, 1 (Abstract), 1:12-17; *see also Sanofi-Aventis*, 66 F.4th at 1377.

C. Motivation to Combine

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]. Indeed, both 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 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]. And both disclose thermal management techniques using system parameters including component utilization rate and intake-air temperature. EX1003, ¶104.

While Hira's server computer includes variable speed cooling fans for thermal management, Hira does not disclose any particular technique for controlling them. EX1003, ¶¶105-106; EX1005, [0023]-[0025]. But Shiga does disclose a specific cooling technique that is readily applicable to the fans cooling Hira's server. EX1003, ¶106; 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 cooling fans. EX1003, ¶106. Such a person would recognize the benefit of using Shiga's technique as it provides "[c]ooling control for reducing overall power consumption" of a computer system. EX1007, 1 (Abstract); EX1003, ¶107. Further, Shiga explains 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 id.*, [0090]. These benefits would have motivated a POSITA to implement Shiga's cooling control method in Hira's server. EX1003, ¶107.

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. EX1003, ¶108. 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 (e.g., intake air temperature, CPU load, etc.). EX1003, ¶108. Thus, a POSITA could have readily implemented Shiga's server program 110 on Hira's server to be executed using Hira's CPU. *Id*. It would have been accomplished largely (or entirely) by simply modifying the programming of Hira's computer. *Id*. It would have been well within the skill level of a POSITA to modify Hira's server to implement Shiga's cooling control functionality. *Id*.

Modifying Hira based on Shiga would have involved no more than the use of prior art elements according to known methods to yield predictable results. EX1003, ¶109; *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007).

D. Independent Claim 1

1. [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:

To the extent the preamble is limiting, Hira discloses it. EX1003, ¶¶111-115. 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), and that an object of the claimed invention is to “detect an abnormality of a cooling function, such as clogging of a filter” (*id*., 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 a server system). EX1003, ¶¶112-113.

Further, Hira’s dust filter clogging status detection device is intended for use *in Information and Communication Technology (ICT) equipment having a cooling fan*. EX1003, ¶114. A POSITA would have known that “PCs and server systems,” as disclosed by Hira, have one or more *cooling fan[s]*. *Id*. Further, Hira’s device collects and saves information regarding cooling fans, including “actual fan rotational speed 9” and “fan error 17.” EX1005, [0015]; *see also id*., Figs. 1, 2(b), 3, 4, 7. Indeed, 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 therefore discloses [a]*n abnormality detection device for detecting an abnormality in Information and Communication Technology (ICT) equipment having a cooling fan* as recited in the preamble. EX1003, ¶115.

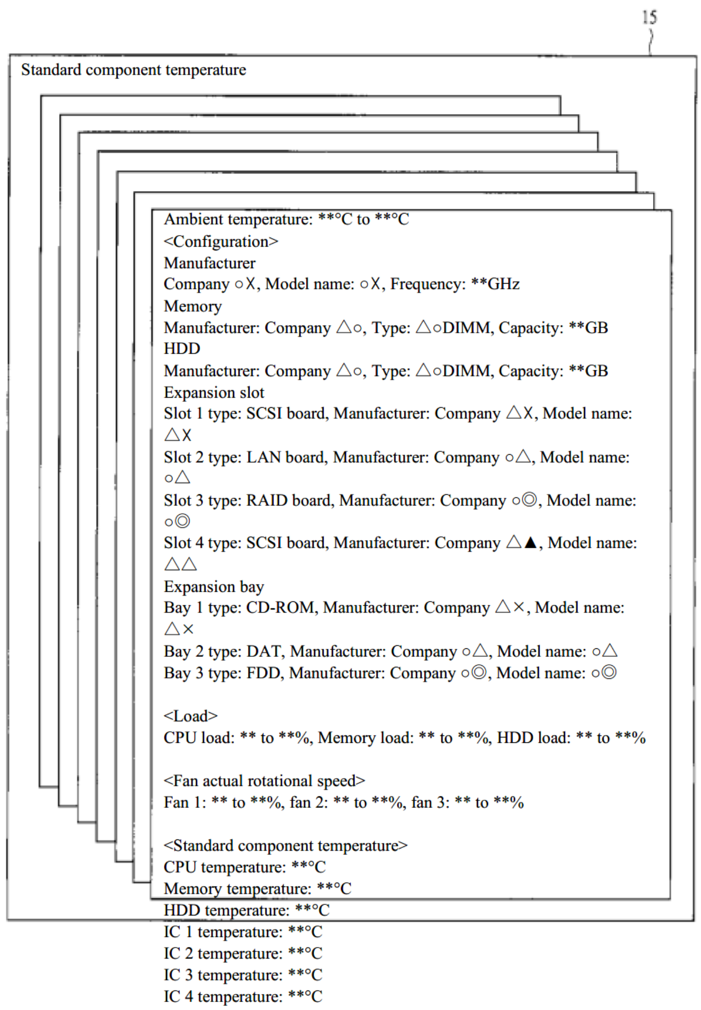
2. [1a] a hardware processor comprising:

Hira discloses *a hardware processor*. EX1003, ¶¶116-118. 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, is *a hardware processor*. EX1003, ¶117; 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"). Further, Hira's CPU is used to perform the functions discussed for the following limitations of claim 1. EX1003, ¶118.

3. [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,

Hira discloses this limitation. EX1003, ¶¶119-147. Hira's dust filter clogging status detection device includes "component temperature threshold value generating unit 2," which constitutes *an estimating unit* as claimed. *Id.*, ¶119.

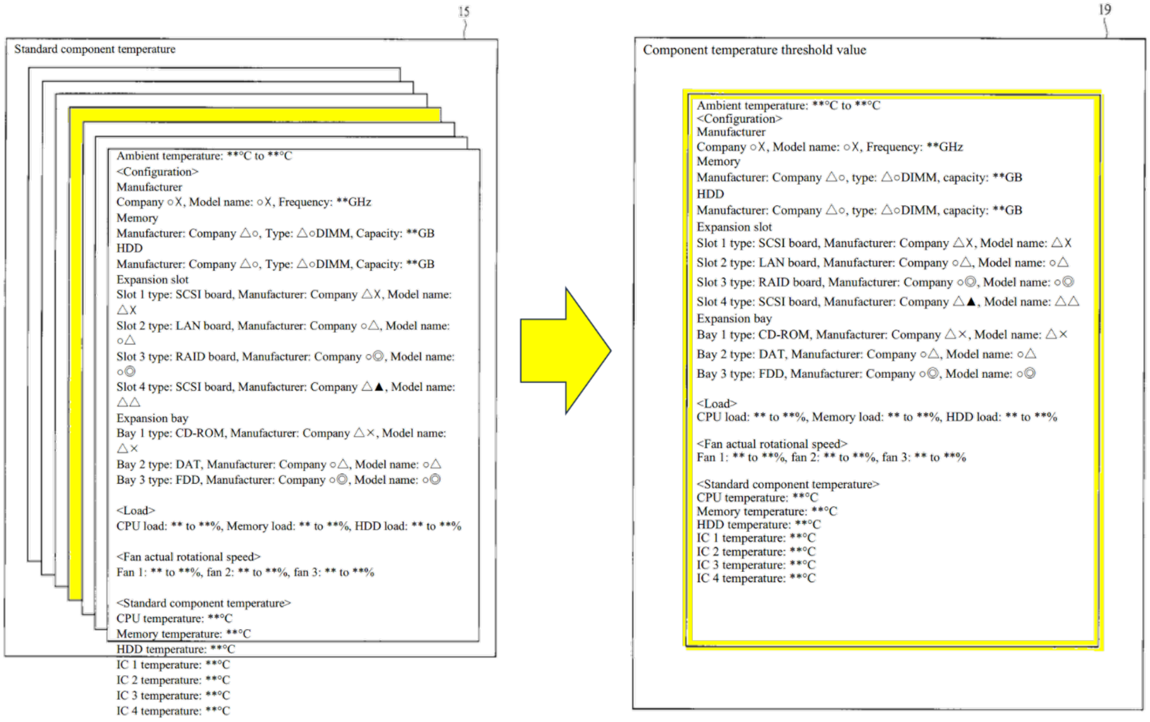
The claim initially recites *an estimating unit* that is *configured to estimate an* *upper limit of possible temperatures in a predetermined position of ICT equipment when a quantity of intake air into the ICT equipment is appropriate.* In Hira, standard component temperature 15 contains “information 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.



<u>Hira, Fig. 3</u>

As illustrated, 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." *Id*., [0024]. The figure presents 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. EX1003, ¶122. 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].

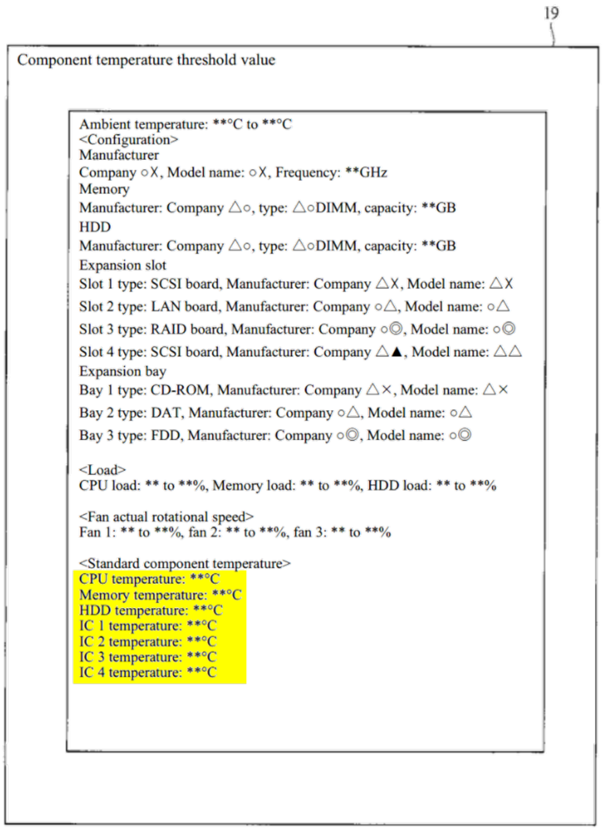
Hira's component temperature threshold value generating unit 2 "generates component temperature threshold values for multiple components making up the information processing device" (such as a server system). EX1005, [0013]. In particular, "component temperature threshold value 19, as shown in FIG. 4,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



<u>Hira, Figs. 3 and 4 (annotated)</u>

The 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. EX1003, ¶124. "The standard component temperature information within the component temperature threshold value 19 becomes the component temperature threshold value used when detecting dust filter clogging status." EX1005, [0025].

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. EX1003, ¶126.



<u>Hira, Fig. 4 (highlighted)</u>

Because the threshold temperatures in component temperature threshold value 19 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*). EX1003, ¶127. 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.[9] *Id*. 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*. EX1003, ¶129.

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,*

---

[9] 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 discussed for limitation 1d. EX1003, ¶128; *see* Section VII.D.5, below. 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*). EX1003, ¶128.

(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 id.*, [0036]; EX1003, ¶130.

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*. EX1003, ¶131. "[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]. Each is *an operational status of the ICT equipment*. *Id.*, [0016]; EX1003, ¶131. Indeed, load 11 includes the CPU load (EX1005, [0016]), which the '632 Patent confirms 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 detection unit" is "an operational status detecting unit"). 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). EX1003, ¶132.

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*. EX1003, ¶133. "[T]emperature 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. EX1003, ¶¶134-135 ("Ambient air temperature ***is*** intake air temperature.").[10] Thus, ambient temperature 13 is *a result of detection*

[10] *See, e.g.*, 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

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*. *Id*., ¶137.[11]

Hira's "component temperature 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*

---

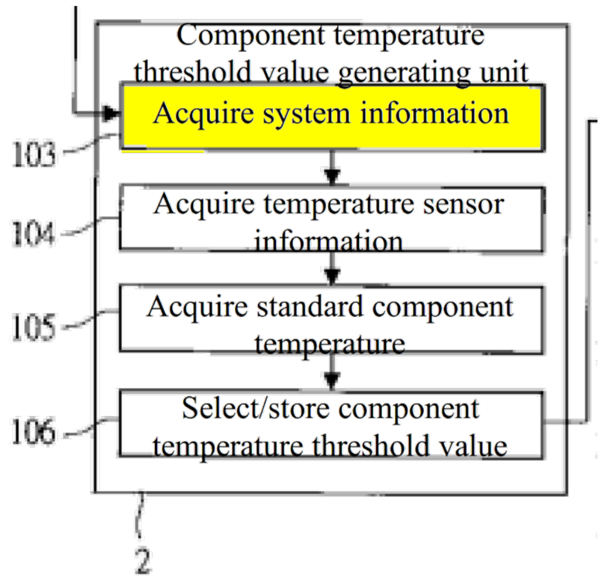
server."); EX1010, [0003] ("In order to prevent the server from overheating, internal fans are typically integrated into the server to provide both an intake of cooler air, which may be ambient or conditioned, and an output of hot air. Most commonly, the intake of cooler air occurs at the front of the 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 cooling purposes….").

[11] 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. EX1003, ¶136.

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]; EX1003, ¶138.

Indeed, Hira's *estimating unit…estimate[s] an upper limit of possible temperatures* in the same manner described in the '632 Patent. EX1003, ¶139. 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 id.*, 5:7-14. In other words, 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. EX1003, ¶139. In Hira, component temperature value generating unit 2 (*estimating unit*) searches through standard component temperature 15 based on CPU load and ambient (intake) air temperature. *Id.*; EX1005, [0025]. Hira discloses limitation 1b in the same way that the '632 Patent does. *Id.*

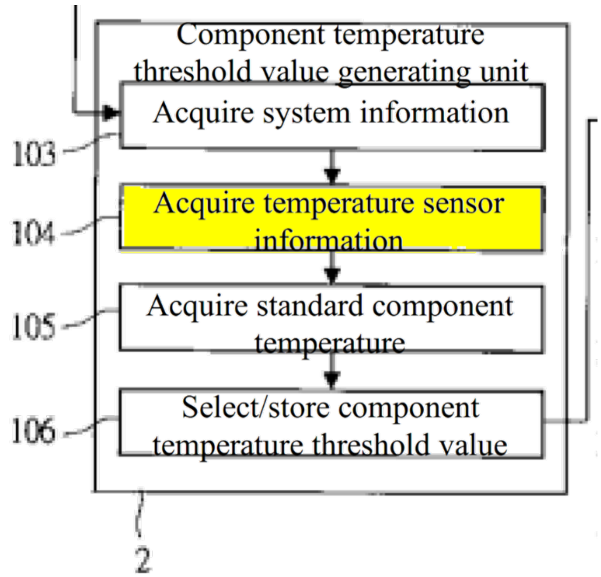
In addition to the analysis above showing that Hira discloses limitation 1b, Hira's Figure 8 flow chart further confirms that component temperature threshold value generating unit 2 constitutes the claimed *estimating unit* meeting this limitation. EX1003, ¶141.



Hira, Fig. 8 (excerpt, highlighted)

In step 103, component temperature threshold value generating unit 2 acquires "system information," which constitutes *a result of detection by an operational status detecting unit that detects an operational status of the ICT equipment*. *Id*., ¶143; EX1005, [0031].

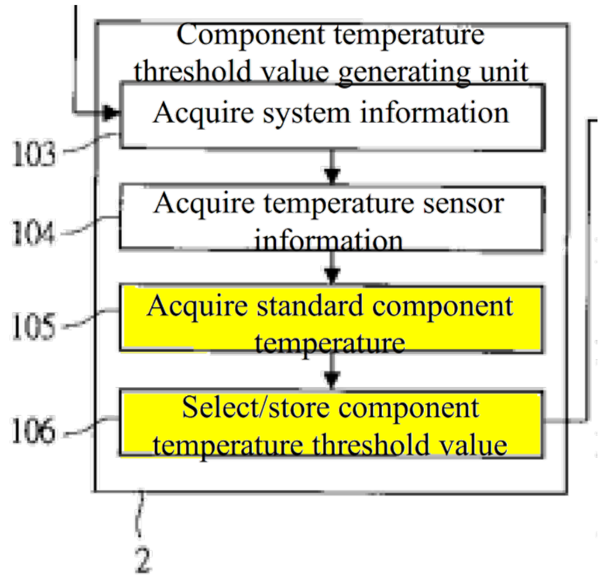
Next, in step 104, component temperature threshold value generating unit 2 acquires "temperature sensor information" including ambient temperature 13. EX1005, [0015], [0031].



Hira, Fig. 8 (excerpt, highlighted)

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*. EX1003, ¶144.

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*. EX1003, ¶145; EX1005, [0031].



<u>Hira, Fig. 8 (excerpt, highlighted)</u>

Finally, 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*. EX1003, ¶145.

Thus, Hira's component temperature threshold value generating unit 2 is the claimed *estimating unit* that *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). EX1003, ¶146.[12]

4. [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

The combination of Hira and Shiga discloses this limitation. EX1003, ¶¶148-155. Hira's dust filter clogging status device detects *the operational status of the ICT equipment* as discussed for 1b. *See* Section VII.D.3, above. For instance, 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

---

12 Hira also discloses limitation 1b should it be construed as a means-plus-function limitation. *See* Section V.B, above. 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), and 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). EX1003, ¶147.

the operational status of the ICT equipment. EX1003, ¶149. Hira's device also detects "ambient temperature 13," which is *the intake air temperature of the ICT equipment* as discussed for 1b. *See* Section VII.D.3, above; EX1005, [0015], [0017]. 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. EX1003, ¶¶150-151.

In particular, Shiga discloses "server program 110" that can be implemented on a server computer, like Hira's, to provide cooling control. EX1007, [0091] ("the server program 110 may 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. *Id*., [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. *Id*., [0029], [0043]-[0045]; EX1003, ¶152. Thus, like Hira, Shiga discloses monitoring *the operational status of the ICT equipment*. EX1003, ¶152; *see* Section VII.D.3, above. 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]; EX1003, ¶153.

Further, Shiga's server program uses *operational status information* and *intake air temperature* to *determines a rotation speed of the cooling fan*. EX1003, ¶154. 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*). *Id*., [0072]-[0076].

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]; EX1003, ¶155. Shiga discloses this limitation.

5. [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.

Hira discloses this limitation. EX1003, ¶¶156-167. Hira's dust filter clogging status detection device includes "clogging status detection unit 3," which constitutes *a determining unit* as claimed. *Id*., ¶156.

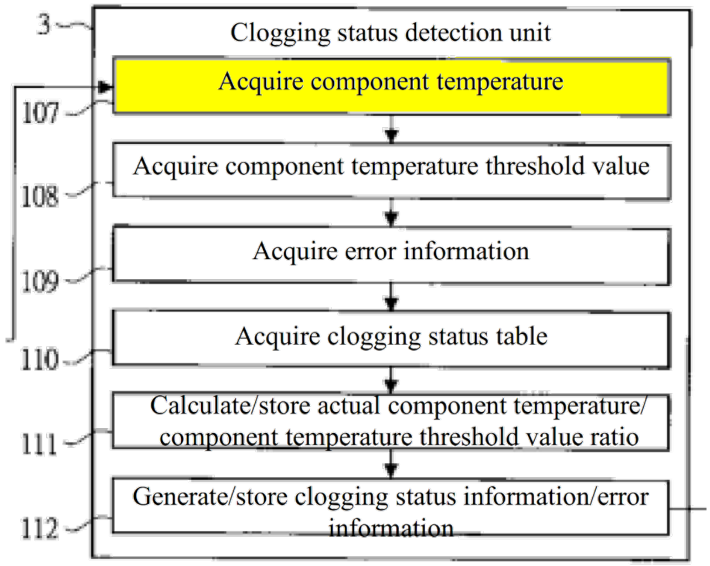
Hira's "clogging status detection unit 3…detects the clogging status of the dust filter on the basis of the component temperature threshold values 19 and component temperatures 14 inside the information processing device." EX1005, 1 (Abstract); *see also id*., 2 (claim 3), [0008], [0013], Fig. 1. Thus, clogging status detection unit 3 is *a determining unit configured to determine that an abnormality* (dust filter clog) *is occurring*. EX1003, ¶157.

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. *Id*., [0033]-[0034]. 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. *Id*., [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. EX1003, ¶159; EX1005, [0027]. Indeed, 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*). EX1003, ¶160.

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]; EX1003, ¶161.

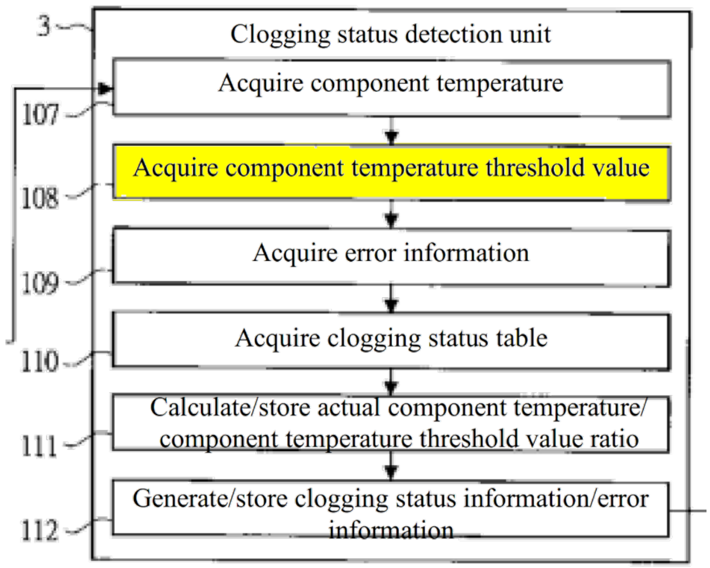
In addition to the analysis above, Hira's Figure 8 flow chart also confirms that clogging status detection unit 3 constitutes the claimed *determining unit* meeting this limitation. EX1003, ¶162. In step 107, clogging status detection unit

3 acquires "component temperature," which constitutes *a result of detection by a temperature sensor that detects a detected equipment temperature in the predetermined position*. *Id*., ¶163; EX1005, [0031]-[0032].



<u>Hira, Fig. 8 (excerpt, highlighted)</u>

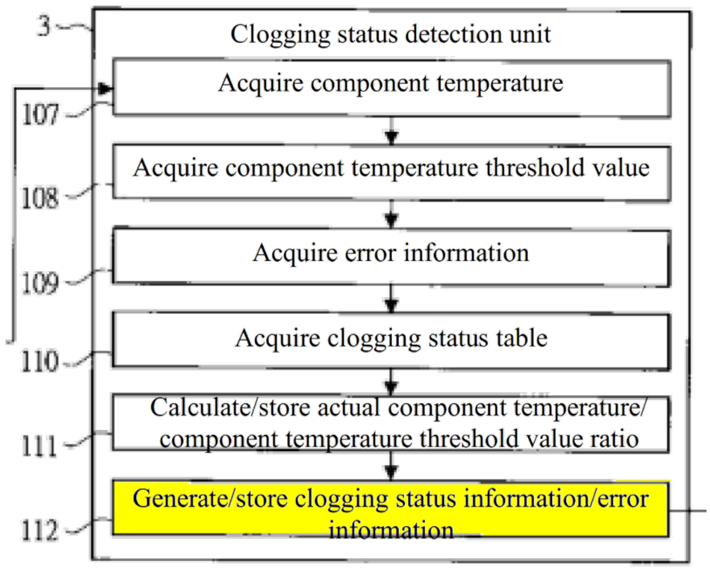
Next, in step 108, clogging status detection unit 3 acquires "component temperature threshold value[s]," which is *the upper limit estimated by the estimating unit*. EX1003, ¶164; EX1005, [0032].



Hira, Fig. 8 (excerpt, highlighted)

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].

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. *Id*., [0034].



Hira, Fig. 8 (excerpt, highlighted)

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. EX1003, ¶167.[13]

---

[13] The Hira-Shiga combination also discloses limitation 1d should it be construed as a means-plus-function limitation. *See* Section V.B, above. 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). EX1003, ¶168.

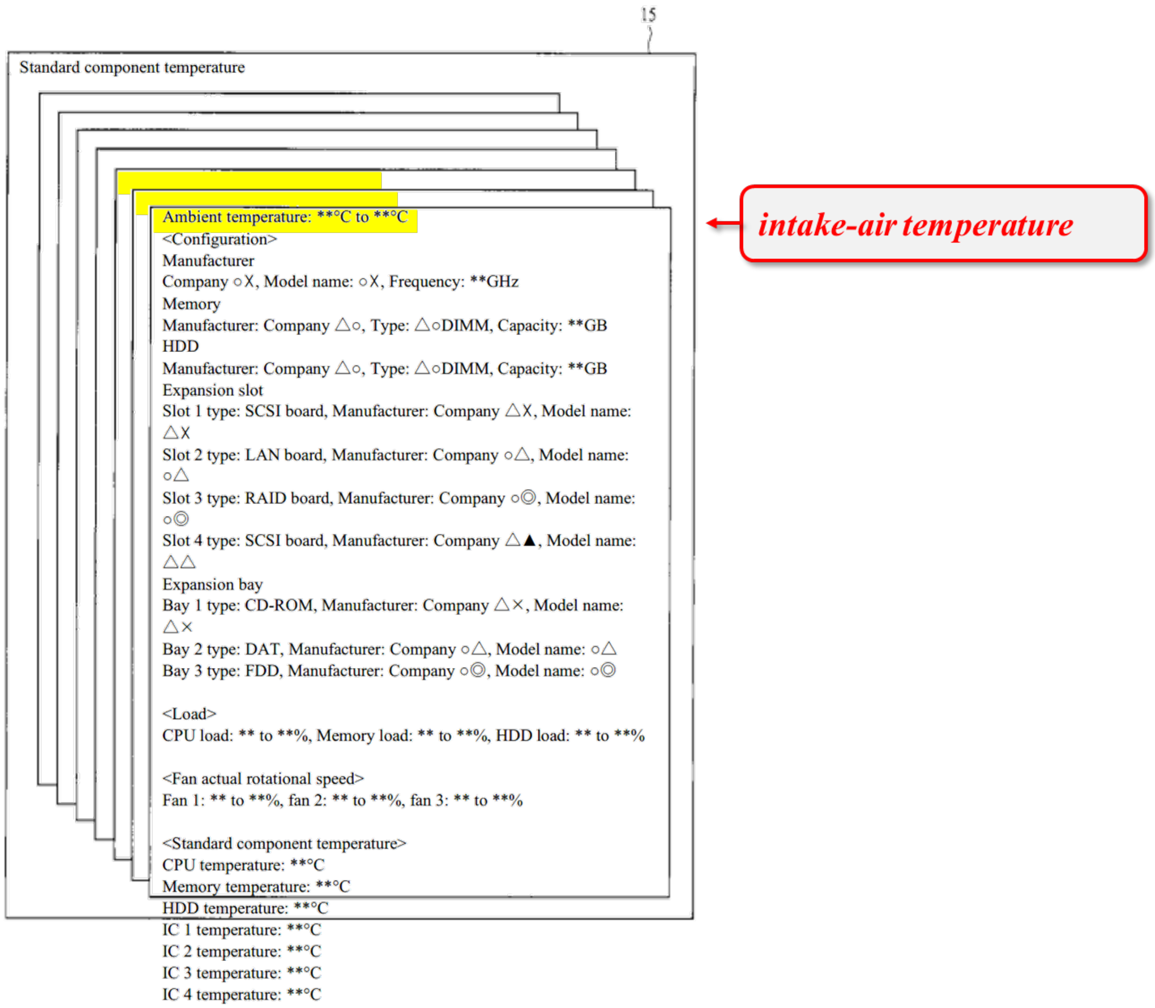
E. Dependent Claims 2-7

1. 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.

The combination of Hira and Shiga discloses claim 1. *See* Section VII.D, above. As discussed above, this claim means that in multiple circumstances in which 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 V.A, above. Hira and Shiga disclose, or at least suggest to a POSITA, the additional limitation of claim 2. EX1003, ¶¶169-177.

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…." *Id*., [0025].

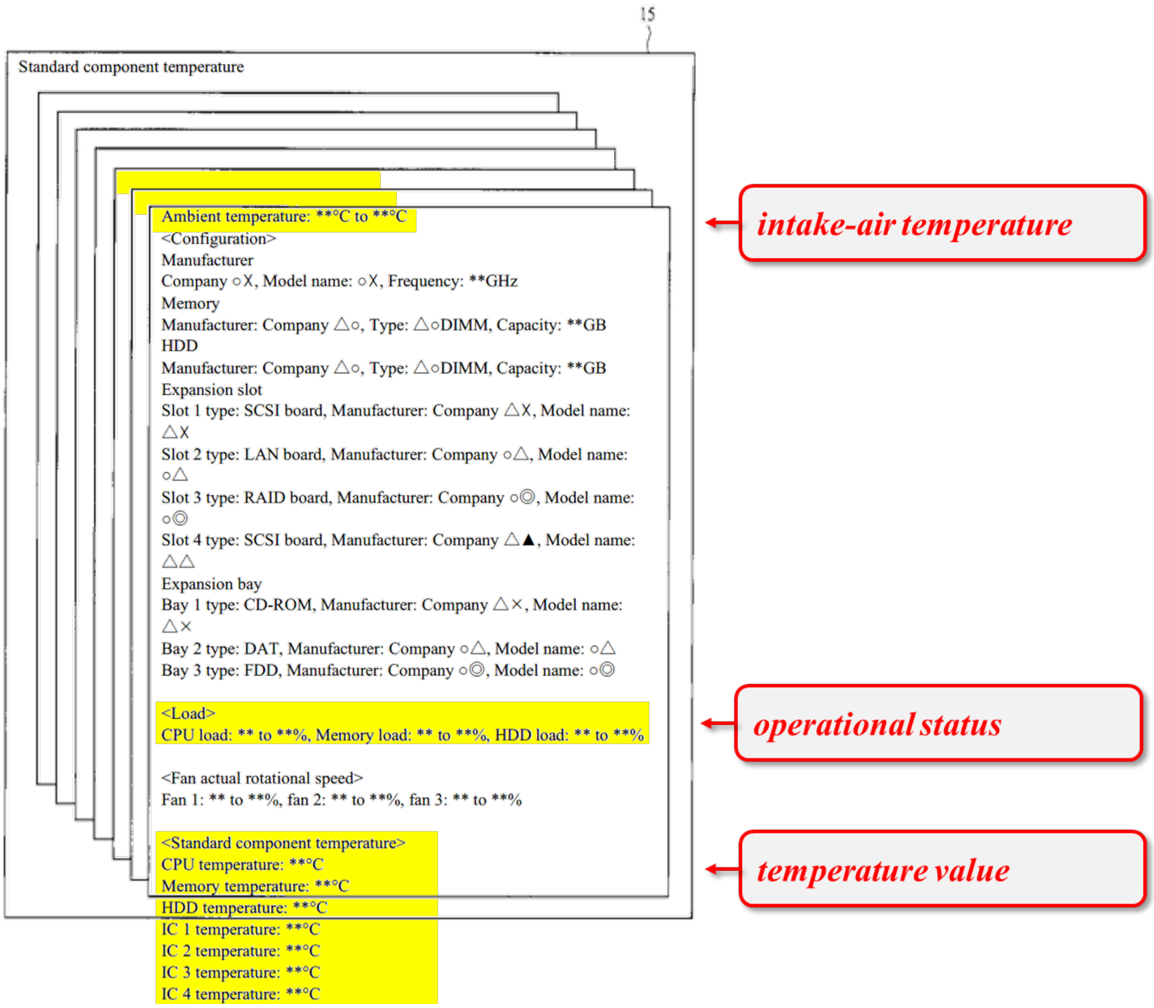
Standard component temperature 15 (illustrated in Figure 3) "is multiple items of information prepared during the design/development phase and stored in the information storage unit 1….” EX1005, [0024]. The multiple pages in the illustration include “information consisting of all combinations of ambient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



Hira, Fig. 3 (annotated)

A POSITA would know that, because standard component temperature 15 includes “all combinations of ambient temperature, configuration, load, and fan rotational speed” (*id*.), multiple pages in the set illustrated in Figure 3 would have the same “ambient temperature” (*intake-air temperature…is equal*). EX1003, ¶172.

Further, a POSITA 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). EX1003, ¶173; EX1005, [0024].



<u>Higa, Fig. 3 (annotated)</u>

Indeed, 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 load and configurations differ depending on the time and user…." *Id*., [0004]. Hira's standard component temperature 15 accounts for such changes in load, ambient temperature, etc. by providing different standard component temperatures for different combinations of load, ambient temperature, etc. EX1003, ¶174.

Finally, a POSITA would know that*, in a case where a result of detection by the intake-air temperature sensor is equal* (i.e., 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*). EX1003, ¶175. This relationship would be apparent and well-known to a POSITA. *Id*. Further, Shiga confirms the obvious understanding that a lower CPU load, for example, leads to lower standard CPU temperature. *Id*., ¶176. 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 id*., [0050], Fig. 9(a).

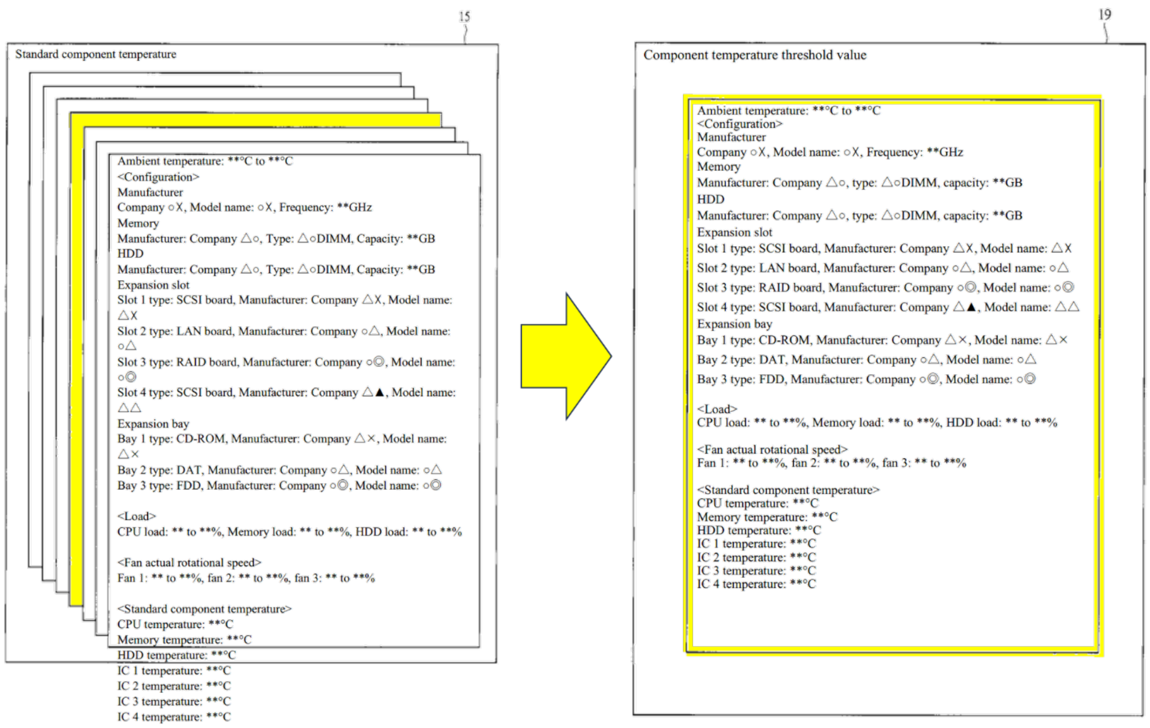
Thus, the combination of Hira and Shiga discloses and suggests that Hira's *estimating unit* (component temperature threshold value generating unit 2) *is configured to, in a case where a result of detection by the intake-air temperature* *sensor is equal, estimate a lower temperature value as the upper limit, as the operational status detected by the operational status detecting unit indicates a lower utilization rate* as claimed. EX1003, ¶177.

2. Claim 3: The abnormality detection device according to claim 1, comprising

The combination of Hira and Shiga discloses claim 1. *See* Section VII.D, above. The Hira-Shiga combination also discloses the additional limitations of claim 3. EX1003, ¶¶178-187.

a. 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

As explained for 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]; *see* Section VII.D.3, above. 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" (shown in Figure 3). *Id*., [0025].



<u>Hira, Figs. 3 and 4 (annotated)</u>

Hira's standard component temperature 15 (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]; EX1003, ¶179. Hira's standard component temperature 15 is "stored in the information storage unit 1" (*a temperature range storing part*). EX1003, ¶179.

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). EX1003, ¶180; *see also* Sections VII.D.3-VII.D.4, above.

b. 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,

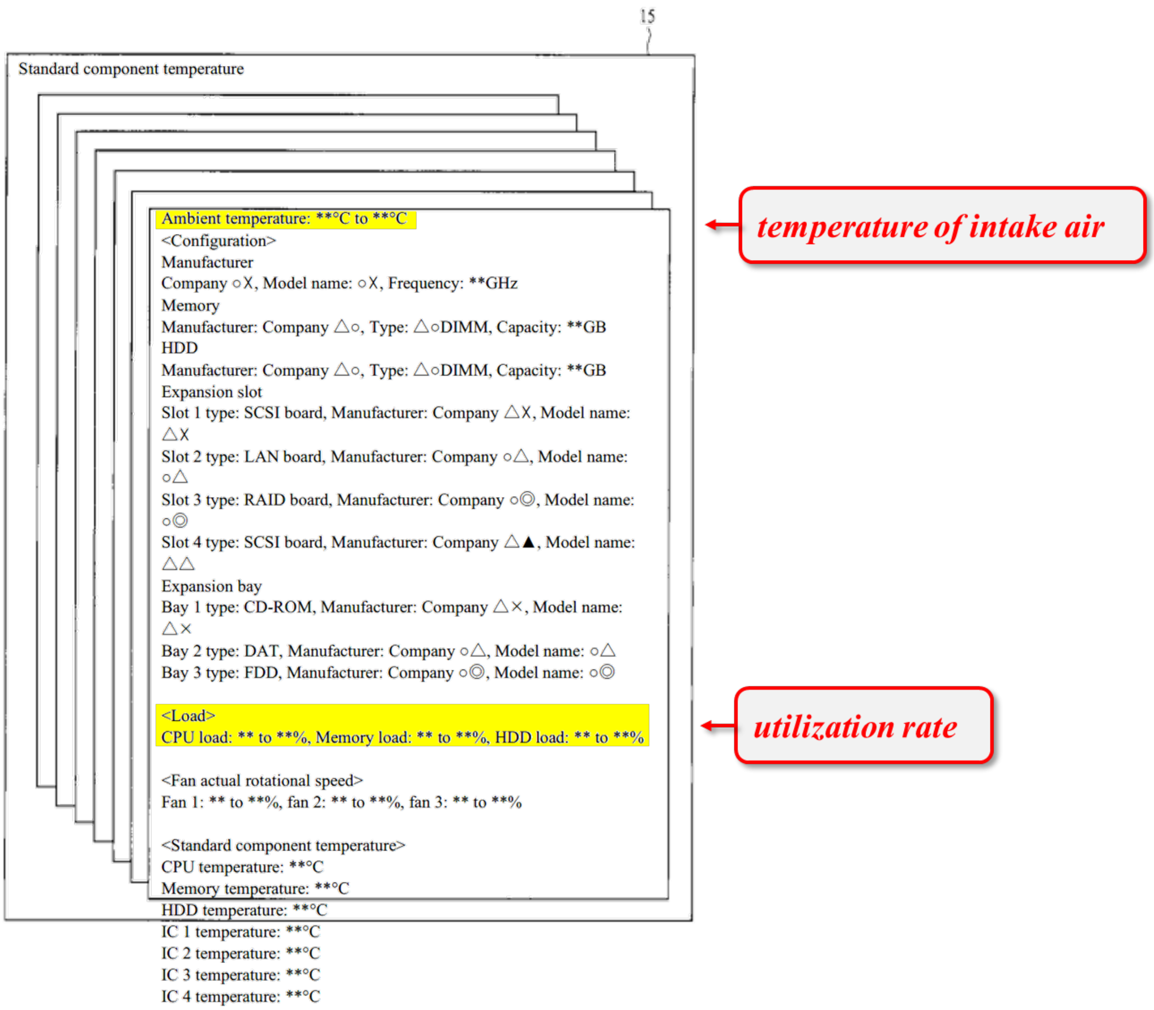
In Hira, "component temperature threshold value 19" (*the upper limit of the possible temperatures in the predetermined position*) "is obtained by extracting component temperatures applicable to the current system status from standard component temperature 15…." EX1005, [0025]. Thus, *the upper limit of the possible temperatures in the predetermined position is recorded* in standard component temperature 15 (Figure 3). EX1003, ¶181. And standard component temperature 15 includes "information consisting of all combinations of ambient temperature, configuration, load, and fan rotational speed." *Id*., [0024]; *see also id*., 2 (claim 2). Hira therefore 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*). EX1003, ¶183.

Further, a POSITA would know 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). EX1003, ¶184. In other words, because standard component temperature 15 includes multiple different CPU loads (*utilization rate[s]*), one will be larger than another. *Id*.

To the extent the claim is read to require *a second utilization rate that is larger than the first utilization rate* when the *temperature of intake air* is the same, this is disclosed for the reasons explained for claim 2. *See* Section VII.E.1, above.

c. 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.

In Hira, the "component temperature threshold value 19, as shown in FIG. 4, is obtained by extracting component temperatures applicable to the current status from standard component temperature 15…." EX1005, [0025]. Standard component temperature 15 "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." *Id*., [0024].



<u>Hira, Fig. 3 (annotated)</u>

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*). EX1003, ¶¶186-187; *see also* Section VII.D.3, above.

3. Claim 4: The abnormality detection device according to claim 1, wherein:

The combination of Hira and Shiga discloses claim 1. *See* Section VII.D, above. The Hira-Shiga combination also discloses the additional limitations of claim 4. EX1003, ¶¶188-199.

a. 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

This limitation is similar to 1b except that it contemplates *the estimating unit…estimat[ing] a lower limit of the possible temperatures* rather than an upper limit as in 1b. EX1003, ¶189. Shiga discloses and suggests estimating a lower temperature limit as an alternative to using only upper threshold values to control fan rotational speed. EX1007, [0077]. 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." *Id*. 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." *Id*.

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*. EX1003, ¶191. It is the lower limit temperature, assuming normal operating conditions, below which the CPU temperature should not fall without the system taking action to address it. *Id*.

A POSITA would be motivated to implement this fan control approach taught be Shiga 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). EX1003, ¶192; EX1007, [0054]-[0055], [0077]. This benefit identified by Shiga (EX1007, [0014]) would motivate a POSITA implementing Shiga's fan control in Hira's server. EX1003, ¶192. Further, 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. *Id*., ¶193.

b. 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.

As explained for the prior limitation of claim 4, Shiga discloses an embodiment 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]. 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. *Id*., [0078]; EX1003, ¶196.[14] It 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*

---

[14] This limitation of claim 4 recites *a lower limit estimated by the estimating means*. The term *the estimating means* has no antecedent basis, but—for purposes of this petition—Petitioners understand it to refer to the *estimating unit*.

the cooling fans).[15] EX1003, ¶195; *see also* Section VII.E.3.a, above.[16]

4. 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.

The combination of Hira and Shiga discloses claim 1. *See* Section VII.D, above. The Hira-Shiga combination also discloses the additional limitation of claim 5. EX1003, ¶¶199-203.

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].

---

15 Shiga's "fan profile 123" illustrated in Figure 10 confirms the unremarkable point 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; EX1003, ¶196.

16 The combination of Hira and Shiga also discloses this limitation should it be construed as a means-plus-function limitation. *See* Section V.B, above. 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). EX1003, ¶198.

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. *Id*., [0023]; *see also id*., [0016] ("Load 11 is load information for CPU/memory/HDD/expansion drives."); EX1003, ¶200. 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*. EX1003, ¶201; *see also* Section VII.D.3, above.

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." *Id*., [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 %."). Like 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*. EX1003, ¶¶202-203.

5. 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.

The combination of Hira and Shiga discloses claim 1. *See* Section VII.D, above. The Hira-Shiga combination also discloses the additional limitation of claim 6. EX1003, ¶¶204-206.

As discussed for 1b, Shiga's "utilization information and power monitoring unit 111 collects utilization information and power consumption information" from the computer. EX1007, [0022]; *see* Section VII.D.3, above. 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*. EX1003, ¶205.

Further, Shiga uses the detected power consumption information (*an operational status of the ICT equipment*) to control fan speed. EX1003, ¶206. 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 history 124" (including power consumption information) "after a certain period of time elapses" (*id*.,[0066]), and this estimated further temperature is used to set the appropriate fan rotational speed. *Id*., [0072]-[0075].

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

The combination of Hira and Shiga discloses claim 1. *See* Section VII.D, above. The Hira-Shiga combination also discloses the additional limitation of claim 7. EX1003, ¶¶207-212.

Shiga's server program includes "temperature monitoring unit 112," which "acquires…exhaust temperature of the physical computer[]." EX1007, [0022]; *see also id.*, [0026], [0090]. A POSITA would know that Shiga's server program acquires exhaust temperature from a temperature sensor. EX1007, [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*. EX1003, ¶208.

Further, 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." *Id.*, [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. EX1003, ¶209. A POSITA would have known to implement Shiga's rule in the Hira-Shiga combination 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. *Id*., ¶210; *see also id*., [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).

A POSITA would have been motivated to implement Shiga's cooling control rules with standard exhaust temperatures as they would provide a further indication of a clogged dust filter (i.e., when the exhaust temperature threshold is exceeded). EX1003, ¶211. And it would have been a simple matter for a POSITA to do so. *Id*. Thus, in the Hira-Shiga combination, Shiga's *temperature sensor…configured to detect a temperature of exhaust air* constitutes *the sensor* of claim 1. EX1003, ¶212; *see* Section VII.D.5, above.

F. Independent Claim 8

1. [8pre] An Information and Communication Technology (ICT) equipment including a cooling fan, comprising:

To the extent the preamble is limiting, Hira discloses it for reasons discussed for 1pre. *See* Section VII.D.1, above; EX1003, ¶¶213-216. 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 confirms that "ICT equipment" can be a "server device." EX1001, 1:19-22. Hira therefore discloses *Information and Communication Technology (ICT) equipment*. EX1003, ¶214. Further, 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.").

2. [8a] an operational status detecting unit configured to detect an operational status of the ICT equipment;

Hira discloses this limitation. EX1003, ¶¶217-219. As discussed for 1b (see Section VII.D.3, above), 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*. EX1003, ¶218. Thus, Hira's "system information acquisition unit 5" constitutes *an operational status detecting unit configured to detect an operational status of the ICT equipment*.

3. [8b] an intake-air temperature sensor configured to detect an intake air temperature of intake air of the ICT equipment;

Hira discloses this limitation. EX1003, ¶¶220-222. As discussed for 1b (see Section VII.D.3, above), 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 explained for 1b. EX1003, ¶221; Section VII.D.3, above. Thus, Hira discloses *an intake-air temperature sensor configured to detect an intake air temperature of intake air of the ICT equipment*. EX1003, ¶222.

4. [8c] an equipment temperature sensor configured to detect an equipment temperature in a predetermined position of the ICT equipment;

Hira discloses this limitation. EX1003, ¶¶223-225. As discussed for 1d (*see* Section VII.D.5, above), 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]-[0016]. Hira states that temperature sensor information acquisition unit 6 "acquires temperature sensor information from temperature sensors…." *Id*., [0030]. As explained for 1d, Hira's temperature sensors detect equipment temperature in a predetermined position of the ICT equipment. *See* Section VII.D.5, above. Thus, Hira discloses *an equipment temperature sensor configured to detect an equipment temperature in a predetermined position of the ICT equipment*. EX1003, ¶225.

5. [8d] a hardware processor including:

This limitation is identical to 1a and disclosed for the reasons provided for that limitation. *See* Section VII.D.2, above. Further, Hira's *hardware processor* is used to perform the functions discussed for the following limitations of claim 8. EX1003, ¶226.

6. [8e] an operational status detecting unit configured to detect an operational status of the ICT equipment;

This limitation is identical to 8a, and as explained for that limitation Hira's "system information acquisition unit 5" constitutes *an operational status detecting unit configured to detect an operational status of the ICT equipment*. *See* Section VII.F.2, above. To the extent this limitation is read as a (possibly inadvertent) duplicate of 8a, it is disclosed for the reasons discussed for that limitation. EX1003, ¶228.

To the extent this limitation is read to require a second *operational status detecting unit* (because the limitation is repeated), Shiga discloses another *operational status detecting unit*. EX1003, ¶229. As discussed for 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" (i.e., CPU load), "memory utilization rate, and network interface utilization rate of the device" and "power consumption status" of the computer. *Id*., [0029], [0043]-[0045]. Each is *an operational status of the ICT equipment*. EX1003, ¶230. 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*. *Id*., ¶231.

Thus, whether 8e is read to duplicate 8a or to require a separate *operational status unit*, this limitation is discloses by the combination of Hira and Shiga.

7. [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,

This limitation is similar to 1b. While worded differently, this limitation—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*. EX1003, ¶232. Thus, this limitation is disclosed for the reasons provided for 1b. *See* Section VII.D.3, above.[17]

8. [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

This limitation is identical to 1c and is disclosed for the reasons provided for that limitation. *See* Section VII.D.4, above.

9. [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.

This limitation is similar to 1d. It is disclosed for the reasons provided for

---

[17] Hira also discloses this limitation should it be construed as a means-plus-function limitation. *See* Section V.B, above. 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), and 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). EX1003, ¶234.

that limitation. EX1003, ¶236; *see* Section VII.D.5, above.[18]

G. Independent Claim 9

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

Hira discloses an *abnormality detection method* as explained for claim 1. *See* Section VII.D, above. The *abnormality detection method* can be used in *Information and Communication Technology (ICT) equipment including a cooling fan* as discussed for 1pre. *See* Section VII.D.1, above. Thus, to the extent the preamble is limiting, Hira discloses it. EX1003, ¶¶238-239.

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

Hira discloses *detecting an operational status…of the ICT equipment* for the reasons provided for 1b and 8a. *See* Sections VII.D.3 and VII.F.2, above. Hira discloses detecting *an intake air temperature of the ICT equipment* for the reasons provided for 1b and 8b. *See* Sections VII.D.3 and VII.F.3, above.

---

[18] Hira-Shiga also discloses this limitation should it be construed as a means-plus-function limitation. *See* Section V.B, above. 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). EX1003, ¶237.

3. 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;

This limitation is similar to 1b. While worded differently, this limitation—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*. EX1003, ¶242. Thus, this limitation is disclosed for the reasons provided for 1b. *See* Section VII.D.3, above.[19]

---

[19] Hira also discloses this limitation should it be construed as a means-plus-function limitation. *See* Section V.B, above. 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,

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

This limitation is similar to 1c. It is disclosed for the reasons provided for that limitation. EX1003, ¶245; *see* Section VII.D.4, above.

5. 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.

This limitation is similar to 1d. It is disclosed for the reasons provided for that limitation. EX1003, ¶246; *see* Section VII.D.5, above.[20]

5:22-32, Fig. 2), and 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). EX1003, ¶244.

[20] Hira also discloses this limitation should it be construed as a means-plus-function limitation. *See* Section V.B, above. 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). EX1003, ¶247.

VIII. DISCRETIONARY DENIAL IS NOT WARRANTED

Pursuant to the Interim Processes for PTAB Workload Management Memorandum (March 26, 2025), discretionary denial issues (if any) will be raised in a separate brief by Patent Owner. If Patent Owner files such a brief, Petitioners will respond in an opposition brief as provided in the Interim Processes for PTAB Workload Management Memorandum.

IX. CONCLUSION

The Board should institute review and cancel the challenged claims of the ’632 Patent.

Respectfully submitted,

/*James L. Day*/

James L. Day
Registration No. 72,681
FARELLA BRAUN + MARTEL LLP
One Bush Street, Suite 900
San Francisco, California 94104
jday@fbm.com

CLAIM APPENDIX

[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.

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.

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

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.

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

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

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.

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.

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.

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

[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.

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.

CERTIFICATE OF COMPLIANCE

This petition complies with the 14,000 word-count limit under 37 C.F.R. § 42.24(a)(1)(i). The petition contains 13,271 words, excluding the parts exempted by 37 C.F.R. § 42.24(a)(1) (i.e., table of contents, table of authorities, mandatory notices under § 42.8, certificate of service, word count certificate, and appendix of exhibits), as determined by the word count feature of Microsoft Word, which was used to prepare this petition.

/*James L. Day*/
James L. Day
Registration No. 72,681
Farella Braun + Martel LLP

CERTIFICATE OF SERVICE

I hereby certify that on July 14, 2025, I caused a complete and entire copy of this Petition for *Inter Partes* Review and all supporting exhibits to be served by express mail, or means at least as fast and reliable as express mail, on the following correspondence address identified using the USPTO Patent Center:

24395-WILMERHALE/DC (Wilmer Hale Cutler Pickering Hale and Dorr LLP)
c/o David Cavanaugh, Thomas Anderson, or Grant Rowan
2100 Pennsylvania Ave. NW
Washington, DC 20037

In addition, courtesy copies were sent by electronic means to the Patent Owner's litigation counsel at the following addresses:

yurykapgan@quinnemanuel.com
brianmack@quinnemanuel.com
claire@millerfairhenry.com
jonathantse@quinnemanuel.com
melissaneri@quinnemanuel.com
ryangoldstein@quinnemanuel.com
andrea@millerfairhenry.com

/*James L. Day*/
James L. Day
Registration No. 72,681
Farella Braun + Martel LLP