IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

CLOUD BYTE LLC, Plaintiff, v. DELL INC., and DELL TECHNOLOGIES, INC., Defendants.	Civil Action No. 2:24-cv-00637 **JURY TRIAL DEMANDED**

CLOUD BYTE'S PRELIMINARY INFRINGEMENT CONTENTIONS

Plaintiff Cloud Byte LLC ("Cloud Byte" or "Plaintiff") submits its Patent Rule ("P.R.") 3-1 and 3-2 Disclosures to Defendants Dell Inc. and Dell Technologies, Inc. (collectively "Dell") pursuant to the Court's Order granting the Joint Motion for Extension of Time to Serve Infringement and Invalidity Contentions (Dkt. 27).

Cloud Byte submits these Disclosures based upon information it has acquired to date, as it presently understands this information and the significance thereof, without yet having had the benefit of formal discovery, claims, or defenses from Dell. Accordingly, Cloud Byte reserves the right to modify, amend, retract, and/or further supplement the disclosures made herein as additional evidence and information becomes available, after the Court has construed the claim terms of the Asserted Patents and as otherwise allowed by the Local Rules and Federal Rules of Civil Procedure. Cloud Byte also reserves the right to accuse different instrumentalities or

alternative literal and/or equivalent infringing elements in Dell's Accused Instrumentalities as disclosed below.

Cloud Byte submits its P.R. 3-1 and 3-2 Disclosures to Dell with respect to U.S. Patent No. 7,739,544 ("the '544 Patent"), U.S. Patent No. 9,482,632 ("the '632 Patent"), U.S. Patent No. 9,560,177 ("the '177 Patent"), U.S. Patent No. 9,629,265 ("the '265 Patent"), U.S. Patent No. 9,651,320 ("the '320 Patent"), U.S. Patent No. 9,900,249 ("the '249 Patent"), and U.S. Patent No. 10,628,273 ("the '273 Patent") (collectively, the "Asserted Patents").

Although Cloud Byte is concurrently producing documents to Dell with its Infringement Contentions herewith, to date, Dell has not produced documents to Cloud Byte. Accordingly Cloud Byte's investigation regarding infringement is necessarily preliminary and ongoing, and these disclosures are therefore based on public information that Cloud Byte has been able to obtain to date regarding the function and operation of the Accused Instrumentalities (as defined in the attached P.R. 3-1(c) claim charts), together with Cloud Byte's present understanding of the meaning and scope of the asserted claims.[1] Cloud Byte reserves the right to supplement and/or amend its disclosures as additional information is ascertained through discovery and after the Court has construed the Asserted Patents.

A. CLOUD BYTE'S RULE 3-1 DISCLOSURES

(a) Each claim of each patent in suit that is allegedly infringed by each opposing party

[1] In many portions of Cloud Byte's 3-1 and 3-2 disclosures, Cloud Byte has gone beyond the disclosure requirements required by P.R. 3-1 and 3-2. These additional disclosures and citations are made for the benefit of Dell. Cloud Byte in no way confines its contentions to the specific citations of evidence and explicitly reserves the right to rely on additional or different evidence as the case moves forward through fact discovery, expert discovery, and trial. Furthermore, any omission of any other specific citation to the Accused Instrumentalities or documents related thereto does not constitute a waiver of Cloud Byte's right to raise any issues related to the Accused Instrumentalities or other documents related thereto at a later date.

Cloud Byte asserts that Dell has infringed and continues to infringe, has contributed to and continues to contribute to the infringement of, and/or has actively induced and continues to actively induce others to infringe at least the following claims of the Asserted Patents:

Claims 1-9, 11-20, 22 of the ’544 Patent (*see* Exs. 1–4);

Claims 1, 3, 5-9 of the ’632 Patent (*see* Ex. 5);

Claims 1-20 of the ’177 Patent (*see* Ex. 6);

Claims 1-8 of the ’265 Patent (*see* Exs. 7–8);

Claims 1-8 of the ’320 Patent (*see* Ex. 9);

Claims 1-27 of the ’249 Patent (*see* Ex. 10); and

Claims 1-21 of the ’273 Patent (*see* Ex. 11).

Cloud Byte reserves the right to supplement and/or amend its disclosures to identify additional claims infringed by Dell that are revealed through discovery, or in response to Dell’s P.R. 3-4 production, or as permitted under the Patent Rules.

(b) Separately for each asserted claim, each accused apparatus, product, device, process, method, act, or other instrumentality ("Accused Instrumentality") of each opposing party of which the party is aware. This identification shall be as specific as possible. Each product, device, and apparatus must be identified by name or model number, if known. Each method or process must be identified by name, if known, or by any product, device, or apparatus which, when used, allegedly results in the practice of the claimed method or process

Dell infringes Cloud Byte’s patented technologies across many different parts of its business, including in: all ethernet switches, SmartFabric services, and edge networking products and servers incorporating same (“Dell Networking Products”); all products and services relating to Redundant Array of Independent Disks (RAID) technology and servers incorporating same (“Dell RAID Products”); and all server systems supporting high availability or fault tolerance features, abnormality detection, airflow cooling, and/or temperature control (“Dell Server

Products"), that Dell makes, uses, sells, offers to sell, and/or imports into the United States and in the associated consulting and support services that it provides to its customers (as disclosed in the P.R. 3-1(c) claim charts) that are capable of and/or configured to perform the identified infringing functionalities.

The Accused Products for the '544 Patent include at least the Dell RAID Products and the following Dell products: Dell PowerEdge servers that use PowerEdge RAID Controllers, which include at least the 13th generation (C4130, C6300, C6320, C6320p, FC430, FC630, FC830, FD332, FM120x4 (for PE FX2/FX2s), FX2/FS2s, M630, M630 (for PE VRTX), M830, M830 (for PE VRTX), R230, R330, R430, R530, R530xd, R630, R730, R730xd, R830, R930, T30, T130, T330, T430, T630); the 14th generation (C4140, C6400, C6420, FC640, M640, M640 (for PE VRTX), MX5016s, MX7000, MX740c, MX840c, R240, R340, R440, R540, R640, R6415, R740, R740xd, R740xd2, R7415, R7425, R840, R940, R940xa, T40, T140, T340, T440, T640, XE2420, XE7100, XE7420, XE7440, XR2); the 15th generation (C6520, C6525, MX750c, R250, R350, R450, R550, R650, R650xs, R6515, R6525, R750, R750xa, R750xs, R7515, R7525, T150, T350, T550, XE8545, XR4000r, XR4000w, XR4000z, XR4510c, XR4520c, XR11, XR12); the 16th generation (C6600, C6615, C6620, HS5610, HS5620, MX760c, R260, R360, R660, R660xs, R6615, R6625, R760, R760xa, R760xd2, R760xs, R7615, R7625, R860, R960, T160, T360, T560, XE8640, XE9640, XE9680, XR5610, XR7620, XR8000r, XR8610t, XR8620t); and the 17th generation (R670 CSP Edition, R770 CSP Edition) of the PowerEdge servers, and all other Dell servers that use PowerEdge RAID Controllers with substantially similar functionality. The PowerEdge RAID Controllers can be either hardware or software based and include at least the following Dell products: Series 9 Family (H830 Adapter, H730P Adapter, H730P MX, H730P Mini Mono, H730P Mini Blade, H730 Adapter, H730 Mini Mono, H730 Mini Blade, H330

Adapter, H330 Mini Mono, H330 Mini Blade, S130 Software RAID); Series 10 Family (H840 Adapter, H745P MX Adapter, H740P Adapter, H740P Mini Mono, S150 Software RAID, S140 Software RAID, H745 Adapter, H745 Front, H345 Adapter, H345 Front); Series 11 Family (H755 Adapter, H750 Adapter, H755N Front (NVMe Only), H755 Front (SAS/SATA Only), HBA355 Adapter (internal), HBA355 Front (internal), HBA350 Adapter (internal), HBA355e Adapter (external), HBA350 MX (internal), H350 Adapter, H355 Adapter, H355 Front, S150 Software RAID); and Series 12 Family (PERC H965I Adapter, PERC H965I Front, PERC H965I MX, PERC H965E Adapter, HBA465I Adapter, HBA465I Front, S160 Software RAID). Other Dell PowerEdge RAID Controllers may also be used in conjunction with the Dell PowerEdge Rack Servers to infringe the '544 Patent. Charts establishing Dell's infringement, each of which show an exemplary PowerEdge RAID Controller compatible with each of the 13th, 14th, 15th, and 16th Generations of the Dell PowerEdge Rack Servers, have been provided herewith. *See* Ex. 1 (S130 Controller, which is compatible with 13th Generation PowerEdge servers); Ex. 2 (S140 Controller, which is compatible with 14th Generation PowerEdge servers); Ex. 3 (S150 Controller, which is compatible with 15th Generation PowerEdge servers); Ex. 4 (S160 Controller, which is compatible with 16th Generation PowerEdge servers). The S130, S140, S150, and S160 controllers are merely exemplary, as there are numerous PowerEdge RAID Controllers that are used by the Dell PowerEdge servers. *See* https://www.dell.com/support/kbdoc/en-us/000131648/list-ofpoweredge-raid-controller-perc-types-for-dell-emc-systemsand.

The Accused Products for the '632 Patent include at least the Dell Server Products and the following Dell products: Dell PowerEdge servers that use Integrated Dell Remote Access Controller ("iDRAC") 9 with firmware version 4.x through 7.x, which include at least the 14th generation (C4140, C6400, C6420, FC640, M640, M640 (for PE VRTX), MX5016s, MX7000,

MX740c, MX840c, R240, R340, R440, R540, R640, R6415, R740, R740xd, R740xd2, R7415, R7425, R840, R940, R940xa, T40, T140, T340, T440, T640, XE2420, XE7100, XE7420, XE7440, XR2), the 15th generation (C6520, C6525, MX750c, R250, R350, R450, R550, R650, R650xs, R6515, R6525, R750, R750xa, R750xs, R7515, R7525, T150, T350, T550, XE8545, XR4000r, XR4000w, XR4000z, XR4510c, XR4520c, XR11, XR12), the 16th generation (C6600, C6615, C6620, HS5610, HS5620, MX760c, R260, R360, R660, R660xs, R6615, R6625, R760, R760xa, R760xd2, R760xs, R7615, R7625, R860, R960, T160, T360, T560, XE8640, XE9640, XE9680, XR5610, XR7620, XR8000r, XR8610t, XR8620t), and the 17th generation (R670 CSP Edition, R770 CSP Edition) of the PowerEdge servers, and all other Dell servers that incorporate iDRAC 9 with firmware version 4.x through 7.x with substantially similar functionality.

The Accused Products for the '177 Patent include at least the Dell Networking Products and the following Dell products: Dell switches that support OpenFlow (and server systems including same), which at least include Dell PowerSwitch S-series (S3048-ON, S3100, S3124F, S3124P, S3148P, S4048T-ON, S4048-ON, S4100-ON, S4112T-ON, S4128F-ON, S4128T-ON, S4147FE-ON, S4148U-ON, S4148T-ON, S4248FB-ON, F4248FBL-ON, S4180, S4820T, S5000, S5048F-ON, S5148F-ON, S5200-ON, S5212F-ON, S5232F-ON, S5224F-ON, S5296F-ON, S5448F-ON, S6000, S6000-ON, S6010-ON, S6100-ON); N-series (N1100-ON, N1108EP-ON, N1108T-ON, N1124P-ON, N1124T-ON, N1148P-ON, N1148T-ON, N1500, N1524, N1524P, N1548, N1548P, N2000, N2024, N2024P, N2048, N2048P, N2100-ON, N2128PX-ON, N2224PX-ON, N2224X-ON, N2248PX-ON, N2248X-ON, N3000, N3024, N3024EF-ON, N3024EP-ON, N3024ET-ON, N3024F, N3024P, N3048, N3048EP-ON, N3048ET-ON, N3048P, N3100-ON, N3132PX-ON, N3208PX-ON, N3224T-ON, N3224P-ON, N3224F-ON, N3224PX-ON, N3248P-ON, N3248X-ON, N3248PXE-ON, N3248TE-ON, N3248X-ON, N4000, N4032,

N4032F, N4064, N4064F); Z-series (Z9000, Z9100, Z9100-ON, Z9264F-ON, Z9332F-ON, Z9432F-ON, Z9500, Z9664F-ON, Z9864F-ON); E-series (E3224F-ON, E3248P-ON, and E3248PXE-ON); FN IOM; and M-series (MXL), and all other Dell switches with substantially similar functionality.

The Accused Products for the '265 Patent include at least the Dell Server Products and the following Dell products: Dell PowerEdge servers, which include at least the 14th Generation PowerEdge servers (R940); 15th Generation PowerEdge servers (R650, R6525, R750, R750xa, R7525); 16th Generation PowerEdge servers (R660, R960, R6615, R6625, R760, R7625, R860); and 17th Generation PowerEdge servers (R670 CSP Edition, R770 CSP Edition), and all other Dell servers with substantially the same internal layout as these systems.

The Accused Products for the '320 Patent include at least the Dell Server Products and the following Dell products: Dell PowerEdge servers, which include at least the 13th generation (C4130, C6300, C6320, C6320p, FC430, FC630, FC830, FD332, FM120x4 (for PE FX2/FS2s), FX2/FS2s, M630, M630 (for PE VRTX), M830, M830 (for PE VRTX), R230, R330, R430, R530, R530xd, R630, R730, R730xd, R830, R930, T30, T130, T330, T430, T630), the 14th generation (C4140, C6400, C6420, FC640, M640, M640 (for PE VRTX), MX5016s, MX7000, MX740c, MX840c, R240, R340, R440, R540, R640, R6415, R740, R740xd, R740xd2, R7415, R7425, R840, R940, R940xa, T40, T140, T340, T440, T640, XE2420, XE7100, XE7420, XE7440, XR2), the 15th generation (C6520, C6525, MX750c, R250, R350, R450, R550, R650, R650xs, R6515, R6525, R750, R750xa, R750xs, R7515, R7525, T150, T350, T550, XE8545, XR4000r, XR4000w, XR4000z, XR4510c, XR4520c, XR11, XR12), the 16th generation (C6600, C6615, C6620, HS5610, HS5620, MX760c, R260, R360, R660, R660xs, R6615, R6625, R760, R760xa, R760xd2, R760xs, R7615, R7625, R860, R960, T160, T360, T560, XE8640, XE9640, XE9680,

XR5610, XR7620, XR8000r, XR8610t, XR8620t), and the 17th generation (R670 CSP Edition, R770 CSP Edition) of the PowerEdge servers, and all other Dell servers with substantially similar functionality.

The Accused Products for the '249 Patent include at least the Dell Networking Products and the following Dell products: Dell switches that support OpenFlow (and server systems including same), which at least include Dell PowerSwitch E-series (E3224F-ON, E3248P-ON, E3248PXE-ON), FN-series (FN IOM), MX-series (MXL), N-series (N1108EP-ON, N1108T-ON, N1124P-ON, N1124T-ON, N1148P-ON, N1148T-ON, N1524, N1524P, N1548, N1548P, N2024, N2024P, N2048, N2048P, N2128PX-ON, N2224PX-ON, N2224X-ON, N2248PX-ON, N2248X-ON, N3024, N3024EF-ON, N3024EP-ON, N3024ET-ON, N3024F, N3024P, N3048, N3048EP-ON, N3048ET-ON, N3048P, N3132PX-ON, N3208PX-ON, N3224T-ON, N3224P-ON, N3224F-ON, N3224PX-ON, N3248P-ON, N3248X-ON, N3248PXE-ON, N3248TE-ON, N3248X-ON, N4032, N4032F, N4064, N4064F), S-series (S3048-ON, S3124, S3124F, S3124P, S3148, S3148P, S4048-ON, S4048T-ON, S4112F-ON, S4112T-ON, S4128F-ON, S4128T-ON, S4148F-ON, S4148FE-ON, S4148U-ON, S4148T-ON, S4248FB-ON, S4248FBL-ON, S4810, S4820T, S5000, S5048F-ON, S5148F-ON, S5212F-ON, S5232F-ON, S5224F-ON, S5248F-ON, S5296F-ON, S5448F-ON, S6000, S6000-ON, S6010-ON, S6100-ON), and Z-series (Z9000, Z9100-ON, Z9264F-ON, Z9332F-ON, Z9432F-ON, Z9500, Z9664F-ON, Z9864F-ON) switch models, and all other Dell switches with substantially similar functionality.

The Accused Products for the '273 Patent include at least the Dell Server Products and the following Dell products: Dell PowerEdge servers, which include at least the 14th generation (C4140, C6400, C6420, FC640, M640, M640 (for PE VRTX), MX5016s, MX7000, MX740c, MX840c, R240, R340, R440, R540, R640, R740, R740xd, R740xd2, R840, R940, R940xa,

R6415, R7415, R7425, T40, T140, T340, T440, T640, XE2420, XE7100, XE7420, XE7440, XR2), the 15th generation (C6520, C6525, MX750c, R250, R350, R450, R550, R650, R650xs, R750, R750xa, R750xs, R6515, R6525, R7515, R7525, T150, T350, T550, XE8545, XR4000r, XR4000w, XR4000z, XR11, XR12, XR4510c, XR4520c), the 16th generation (C6615, C6620, HS5610, HS5620, MX760c, R260, R360, R660, R660xs, R760, R760xa, R760xd2, R760xs, R860, R960, R7615, R7625, T160, T360, T560, XE8640, XE9640, XE9680, XR5610, XR7620, XR8000, XR8610t, XR8620t), and the 17th generation (R670 CSP Edition, R770 CSP Edition) of PowerEdge models, and all other Dell servers with substantially similar functionality.

Based on the information that it has been able to obtain to date, Cloud Byte separately identifies each Dell Accused Instrumentality for each Asserted Claim applicable to Dell in Cloud Byte's P.R. 3-1(c) claim charts attached as Exhibits 1 to 11.

Cloud Byte believes that discovery from Dell and others will provide additional evidence of the nature and/or scope of Dell's infringement. Accordingly, Cloud Byte reserves the right to supplement and/or amend this disclosure to identify and accuse additional Dell Accused Instrumentalities released, developed, or made available by Dell after the date on which these disclosures are served, or of which Cloud Byte was not aware at the time of these disclosures.

(c) A chart identifying specifically where each element of each asserted claim is found within each Accused Instrumentality, including for each element that such party contends is governed by 35 U.S.C. § 112 (¶ 6), the identity of the structure(s), act(s), or material(s) in the Accused Instrumentality that performs the claimed function

Pursuant to P.R. 3-1(c), claim charts for Dell's infringement of the Asserted Claims of the Patents-in-Suit are set forth as Exhibits 1 to 11. The charts are based on information currently known to Cloud Byte and contain illustrative (not exhaustive) examples of presently known infringement of the Asserted Claims.

As explained above, Cloud Byte believes that discovery from Dell and others will provide additional evidence of the nature and/or scope of Dell's infringement. Accordingly, Cloud Byte reserves the right to amend, supplement, or otherwise revise the Accused Instrumentalities and its infringement contentions and claim charts.

(d) Whether each element of each asserted claim is claimed to be literally present or present under the doctrine of equivalents in the Accused Instrumentality

Pursuant to P.R. 3-1(d), Cloud Byte asserts that, under the proper construction of the Asserted Claims and their claim terms, every limitation of the Asserted Claims of the Patents-in-Suit is literally present in Dell's instrumentalities accused of infringing the claims. However, to the extent any claim element or step is found to be not literally present in or performed by the Accused Instrumentalities, based on the Court's claim construction or Dell's arguments, such claim element or step is satisfied under the doctrine of equivalents because any difference between such claim element or step and the element or step of the Accused Instrumentalities is insubstantial. In other words, the element or step of the Accused Instrumentalities performs substantially the same function, in substantially the same way, to achieve substantially the same result. Further detail regarding the claim limitations Cloud Byte asserts that Dell infringes under the doctrine of equivalents can be found in Cloud Byte's P.R. 3-1(c) claim charts attached as Exhibits 1 to 11.

(e) For any patent that claims priority to an earlier application, the priority date to which each asserted claim allegedly is entitled

The Asserted Claims of the '544 Patent are entitled to a priority date no later than March 10, 2005. The Asserted Claims of the '632 Patent are entitled to a priority date no later than September 5, 2012. The Asserted Claims of the '177 Patent are entitled to a priority date no later than February 17, 2011. The Asserted Claims of the '265 Patent are entitled to a priority date no later than March 5, 2012. The Asserted Claims of the '320 Patent are entitled to a priority date no

later than March 2, 2012. The Asserted Claims of the '249 Patent are entitled to a priority date no later than September 14, 2009. The Asserted Claims of the '273 Patent are entitled to a priority date no later than January 30, 2015. For each Asserted Claim, Cloud Byte reserves the right to assert priority to earlier conception and reduction to practice dates earlier than the earliest priority date.

Cloud Byte may rely on additional evidence to demonstrate earlier dates of conception, reduction to practice, and/or diligence in reducing to practice. *See EMG Tech., LLC v. Chrysler Grp., LLC*, No. 6:12-CV-259, 2013 WL 12147662, at *2 (E.D. Tex. July 3, 2013).

(f) If a party claiming patent infringement wishes to preserve the right to rely, for any purpose, on the assertion that its own apparatus, product, device, process, method, act, or other instrumentality practices the claimed invention, the party must identify, separately for each asserted claim, each such apparatus, product, device, process, method, act, or other instrumentality that incorporates or reflects that particular claim

Cloud Byte is still investigating this matter, however, at this time Cloud Byte is not relying on the assertion that its own apparatus, product, device, process, method, act, or other instrumentality of its own practices the claimed inventions. Cloud Byte reserves the right to supplement and/or amend this disclosure to identify any apparatus, product, device, process, method, act, or other instrumentality of its own that practices the Asserted Claims of which Cloud Byte was not aware at the time of these disclosures.

B. CLOUD BYTE'S RULE 3-2 PRODUCTION OF DOCUMENTS

(a) Documents (e.g., contracts, purchase orders, invoices, advertisements, marketing materials, offer letters, beta site testing agreements, and third party or joint development agreements) sufficient to evidence each discussion with, disclosure to, or other manner of providing to a third party, or sale of or offer to sell, the claimed invention prior to the date of application for the patent in suit. A party's production of a document as required herein shall not constitute an admission that such document evidences or is prior art under 35 U.S.C. §102

Cloud Byte is not presently aware of documents responsive to P.R. 3-2(a). Cloud Byte's investigation is ongoing and Cloud Byte will supplement its document production in the event responsive documents are located.

(b) All documents evidencing the conception, reduction to practice, design, and development of each claimed invention, which were created on or before the date of application for the patent in suit or the priority date identified pursuant to P. R. 3-1(e), whichever is earlier

In addition to information included in the file histories noted below, documents responsive to P.R. 3-2(b) have been produced to Dell as follows: CLOUDBYTE0002647–CLOUDBYTE0002781. As discovery is ongoing and Cloud Byte's search for documents is ongoing, Cloud Byte reserves the right to supplement its production and disclosures as information is ascertained during discovery.

Cloud Byte's investigation is ongoing and Cloud Byte will supplement its document production in the event responsive documents are located.

(c) A copy of the file history for each patent in suit

Documents responsive to P.R. 3-2(c) have been produced to Dell as follows:

The '544 Patent file history: CLOUDBYTE0000691–CLOUDBYTE0000914;

The '632 Patent file history: CLOUDBYTE0000915–CLOUDBYTE0001190;

The '177 Patent file history: CLOUDBYTE0001191–CLOUDBYTE0001353;

The '265 Patent file history: CLOUDBYTE0001354–CLOUDBYTE0001672;

The '320 Patent file history: CLOUDBYTE0001673–CLOUDBYTE0001929;

The '249 Patent file history: CLOUDBYTE0001930–CLOUDBYTE0002646; and

The '273 Patent file history: CLOUDBYTE0000001–CLOUDBYTE0000690.

Cloud Byte's investigation is ongoing and Cloud Byte will supplement its document production in the event responsive documents are located.

Dated: November 21, 2024

/s/ Yury Kapgan

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CERTIFICATE OF SERVICE

I certify that a true and correct copy of the above document was served by email with exhibits served via FTP on counsel of record for Dell on November 21, 2024.

/s/ *Yury Kapgan*

Cloud Byte's Patent Initial Disclosures for Dell
Exhibit 5
UNITED STATES PATENT NO. 9,482,632
INFRINGEMENT CHART FOR CLAIMS 1, 3, 5, 6, 7, 8, 9[1]

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
1[pre] An abnormality detection device for	The Accused Dell '632 Products include an abnormality detection device for detecting an abnormality in information and communication technology ("ICT") equipment having a cooling fan.

[1] The infringement contentions provided herein are based on information obtained to date and may not be exhaustive. Cloud Byte's investigation of Dell's infringement is ongoing. Cloud Byte reserves the right to supplement and/or amend these disclosures to identify additional Asserted Claims (P.R. 3-1(a)), to identify additional Accused Instrumentalities (P.R. 3-1(b)), and to further identify where each element of each Asserted Claim is found in each Accused Instrumentality (P.R. 3-1(c)), including on the basis of discovery obtained from Dell and from third-parties during the course of this litigation.

[2] All infringement contentions set forth herein for any independent patent claims are hereby incorporated by reference into the infringement contentions alleged for any dependent patent claims that depend on such independent claims, as if fully set forth therein.

[3] The Accused Instrumentalities and associated exhibits discussed and/or cited for any claim herein are representative in all material respects of all other Accused Instrumentalities identified for that claim (*e.g.*, although various versions of the Accused Instrumentalities may have immaterial differences in their hardware, firmware, and/or software configuration, the cited references are believed to be illustrative of all such accused server controllers). For example, on information and belief, the controller of all Accused Instrumentalities, including in the 14th to 17th generation Dell PowerEdge servers implementing Integrated Dell Remote Access Controller ("iDRAC") 9, is substantially similar to the controller discussed herein. On information and belief, there are no material differences in the controller among the Accused Instrumentalities, including in the 14th to 17th generation Dell PowerEdge servers implementing iDRAC 9, that would substantially alter the infringement read shown here. *See, e.g.*, CLOUDBYTE0004144, CLOUDBYTE0005627, CLOUDBYTE0005734, CLOUDBYTE0005737, CLOUDBYTE0005738, CLOUDBYTE0020425-CLOUDBYTE0020521, CLOUDBYTE0020588 – CLOUDBYTE0021003; *see also* the 14th to 17th generation Dell PowerEdge servers identified in the cover pleading and documentation produced in the concurrent production. The illustrative documentation cited herein is for the Integrated Dell Remote Access Controller 9 with firmware version 4.x (hereinafter "iDRAC User's Guide"), which is dated December 2020, and can be found at the following URL: https://dl.dell.com/content/manual24574503-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us ("iDRAC User's Guide" or CLOUDBYTE0004521). Other versions of iDRAC (*e.g.*, firmware versions 5.x,

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
detecting an abnormality in Information and Communication Technology (ICT) equipment having a cooling fan, the abnormality detection device comprising:[4]	*See, e.g.*,  PowerEdge R6615 Powerful performance per investment dollar The new Dell PowerEdge R6615 is a 1U, single-socket rack server. Designed to be the best investment per dollar for your data center, this server provides performance and flexible, low-latency storage options in an air or Direct Liquid Cooling (DLC) configuration. Fans • Standard (STD) fans/High performance GOLD (VHP) fans • Up to 4 sets (dual fan module) hot plug fans https://www.delltechnologies.com/asset/en-us/products/servers/technical-support/poweredge-r6615-spec-sheet.pdf (“R6615 Spec Sheet” or CLOUDBYTE0005734), 1-2. The Integrated Dell Remote Access Controller (iDRAC) is embedded in every PowerEdge server to deliver remote server administration with a set of server management features.

6.x, 7.x) also infringe the claims of the ’632 Patent. *See, e.g.*, https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x) (CLOUDBYTE0004885); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x) (CLOUDBYTE0005253); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x) (CLOUDBYTE0004147).

[4] Cloud Byte’s inclusion of any claim preamble in this claim chart should not be interpreted as an admission that the preamble is limiting. Cloud Byte reserves the right to take the position that the claim preambles are limiting or not limiting on a claim-by-claim basis.

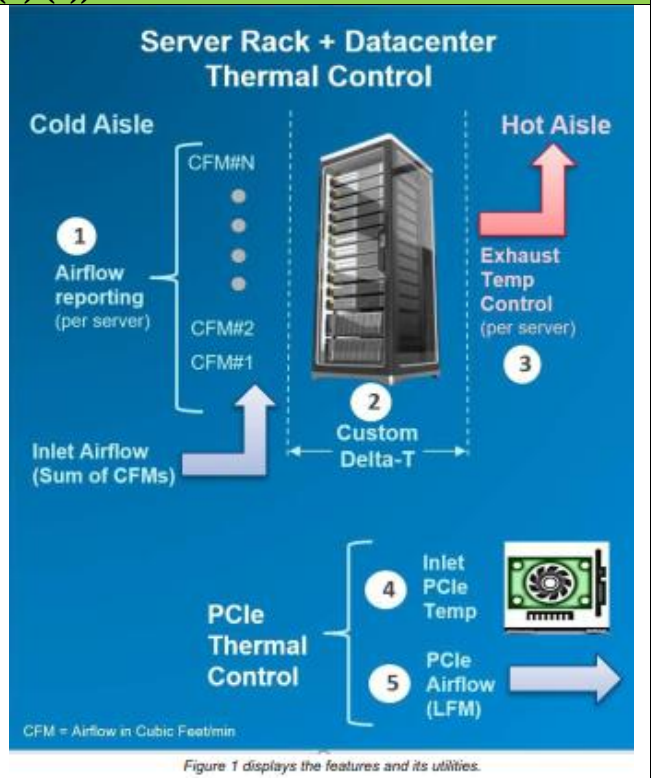
’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 Full Access Management of PowerEdge Servers Modernize with Dell PowerEdge portfolio The integrated Dell Remote Access Controller (iDRAC) delivers advanced, agent-free local and remote server administration. The iDRAC provides a secure means to automate a multitude of management tasks. Given that iDRAC is embedded in every PowerEdge server, there's no additional software to install. Once iDRAC has been enabled, you will have a complete set of server management features at your fingertips. https://www.delltechnologies.com/asset/en-us/solutions/infrastructure-solutions/briefs-summaries/integrated_dellemc_remote_access_controller.pdf?ref=cpcl_open-manage-idrac-cta-content-item-30_cta_link_readbrief (“iDRAC Solution Brief” or CLOUDBYTE0005625), 1.

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

iDRAC9 Features and Benefits

Features	Benefits
Telemetry Streaming	Perform deep analysis of server telemetry including CPU, GPU, SFP IO, power, thermals storage, networking, memory and more. Requires iDRAC9 Datacenter license.
Thermal Manage	Customize thermal and airflow management at the rack and server level. Requires iDRAC9 Datacenter license.
Automatic Certificate Enrollment	Automatic SSL certificate enrollment and renewal of the iDRAC self-signed certificated with a trusted CA certificate. Requires iDRAC9 Datacenter license.
Zero touch deployment and provisioning	Automatically configure PowerEdge servers when they are initially connected to your network. This process uses a Server Configuration Profile to set hardware, update firmware, and install OS. Requires iDRAC9 Enterprise or Datacenter license.
Virtual Clipboard	Provides an easy to enter complex passwords and more in the HTML5 vConsole. Users can copy text/passwords to local clipboard and paste into remote console view. Requires iDRAC9 Datacenter license.
Connection View	iDRAC sends standard LLDP packets to external switches, which provides the option to discover iDRACs on the network. iDRAC sends two types of LLDP packets to the outbound network; Topology and Discovery. Also, iDRAC can also display switch and port information.
System Lockdown	Helps to prevent configuration or firmware changes to a server when using Dell tools and even vendor tools for selected network cards. Requires iDRAC Enterprise or Datacenter License.
RSA SecurID 2FA	Add the RSA SecurID client software into iDRAC to provide native support for RSA 2FA solutions. Requires Datacenter license.
DRAC RESTful API	With this API, iDRAC enables support for the Redfish standard and enhances it with Dell extensions.
Cipher Select	Cipher Select is an advanced user setting where the user can choose to block undesired ciphers negotiated by iDRAC, providing increased security.
Secured Component Verification	Secured Component Verification (SCV) is a Supply chain assurance offering that enables Dell customers to verify that a PowerEdge server received by the customer matches what was manufactured in the factory.
System Erase	With proper authentication, administrators can securely erase data from local storage (HDDs, SSDs, NVMes).
iDRAC Direct	Secure front-panel USB connection to iDRAC web interface, which eliminates the need for crash carts or a trip to the hot aisle of your data center. You can use the same port to insert a USB key to upload new system profile for secure, rapid system configuration.

iDRAC Solution Brief, 2.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Thermal Manage – Feature Overview Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits: • Optimize server-related power and cooling efficiencies across their datacenters. • Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience. • Provides a state-of-the-art PCIe cooling management dashboard. Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities. 1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. 2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. 3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. 4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. 5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.  *Figure 1 displays the features and its utilities.* https://infohub.delltechnologies.com/en-us/p/thermal-manage-features-and-benefits/ (“iDRAC Thermal Manage Features” or CLOUDBYTE0005738).
1[a] a hardware processor comprising:	The Accused Dell ’632 Products include a hardware processor. *See supra*, claim 1[pre]. *See, e.g.*,

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 Full Access Management of PowerEdge Servers Modernize with Dell PowerEdge portfolio The integrated Dell Remote Access Controller (iDRAC) delivers advanced, agent-free local and remote server administration. The iDRAC provides a secure means to automate a multitude of management tasks. Given that iDRAC is embedded in every PowerEdge server, there's no additional software to install. Once iDRAC has been enabled, you will have a complete set of server management features at your fingertips. iDRAC Solution Brief, 1. The iDRAC controller is a piece of hardware integrated on the motherboard of the server, and as well as other BMC solutions, has its own processor, memory, network connection, and access to the system bus. The iDRAC provides remote access to the system console (keyboard and screen), allowing the system BIOS to be accessed over the Internet when the server is rebooted. Key features of iDRAC include power management, virtual media access, and remote console capabilities. These features give administrators the ability to configure a machine as if they were sitting in front of the local console. https://www.storagereview.com/review/dell-emc-idrac-9-and-lifecycle-controller-review (“iDRAC Review” or CLOUDBYTE0004138); *see also* https://www.dell.com/support/kbdoc/en-us/000179517/dell-poweredge-how-to-configure-the-idrac-system-management-options-on-servers (“iDRAC Configuration” or CLOUDBYTE005737).

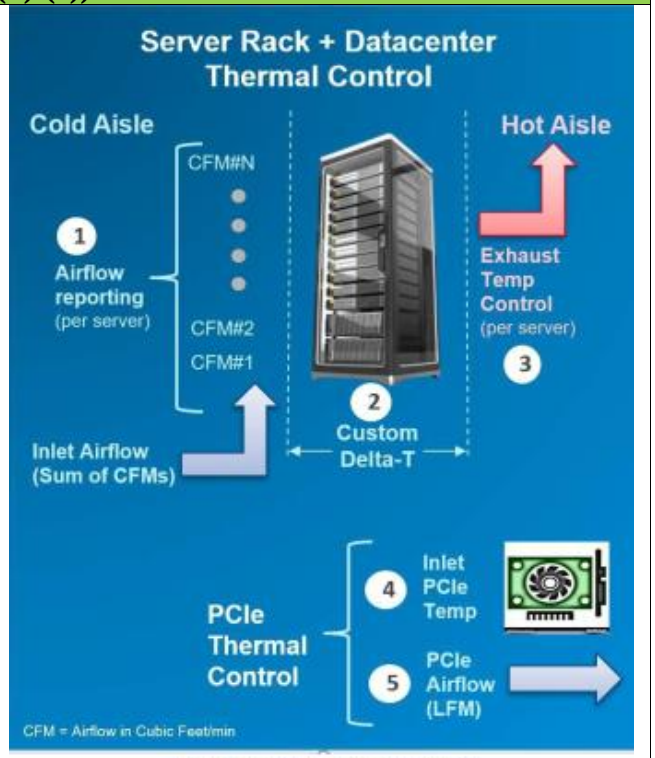
’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
1[b] an estimating unit configured to estimate an upper limit of possible temperatures in a predetermined position of ICT equipment when a quantity of intake air into the ICT equipment 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,	The Accused Dell ’632 Products include an estimating unit configured to estimate an upper limit of possible temperatures in a predetermined position of an ICT technology equipment when a quantity of intake air into the server 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. *See supra*, claim 1[a]. *See, e.g.*,

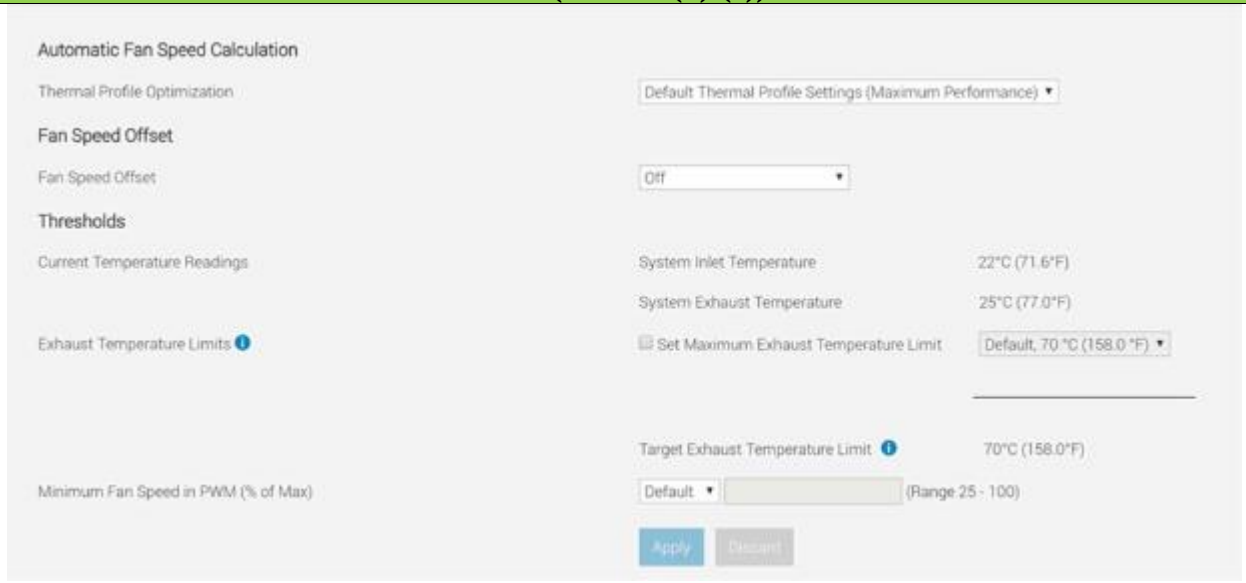
'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

iDRAC9 Features and Benefits

Features	Benefits
Telemetry Streaming	Perform deep analysis of server telemetry including CPU, GPU, SFP IO, power, thermals storage, networking, memory and more. Requires iDRAC9 Datacenter license.
Thermal Manage	Customize thermal and airflow management at the rack and server level. Requires iDRAC9 Datacenter license.
Automatic Certificate Enrollment	Automatic SSL certificate enrollment and renewal of the iDRAC self-signed certificated with a trusted CA certificate. Requires iDRAC9 Datacenter license.
Zero touch deployment and provisioning	Automatically configure PowerEdge servers when they are initially connected to your network. This process uses a Server Configuration Profile to set hardware, update firmware, and install OS. Requires iDRAC9 Enterprise or Datacenter license.
Virtual Clipboard	Provides an easy to enter complex passwords and more in the HTML5 vConsole. Users can copy text/passwords to local clipboard and paste into remote console view. Requires iDRAC9 Datacenter license.
Connection View	iDRAC sends standard LLDP packets to external switches, which provides the option to discover iDRACs on the network. iDRAC sends two types of LLDP packets to the outbound network; Topology and Discovery. Also, iDRAC can also display switch and port information.
System Lockdown	Helps to prevent configuration or firmware changes to a server when using Dell tools and even vendor tools for selected network cards. Requires iDRAC Enterprise or Datacenter License.
RSA SecurID 2FA	Add the RSA SecurID client software into iDRAC to provide native support for RSA 2FA solutions. Requires Datacenter license.
DRAC RESTful API	With this API, iDRAC enables support for the Redfish standard and enhances it with Dell extensions.
Cipher Select	Cipher Select is an advanced user setting where the user can choose to block undesired ciphers negotiated by iDRAC, providing increased security.
Secured Component Verification	Secured Component Verification (SCV) is a Supply chain assurance offering that enables Dell customers to verify that a PowerEdge server received by the customer matches what was manufactured in the factory.
System Erase	With proper authentication, administrators can securely erase data from local storage (HDDs, SSDs, NVMes).
iDRAC Direct	Secure front-panel USB connection to iDRAC web interface, which eliminates the need for crash carts or a trip to the hot aisle of your data center. You can use the same port to insert a USB key to upload new system profile for secure, rapid system configuration.

iDRAC Solution Brief, 2.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Thermal Manage – Feature Overview Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits: • Optimize server-related power and cooling efficiencies across their datacenters. • Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience. • Provides a state-of-the-art PCIe cooling management dashboard. Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities. 1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. 2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. 3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. 4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. 5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.  *Figure 1 displays the features and its utilities.* iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

Viewing sensor information

The following sensors help to monitor the health of the managed system:

- **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB).

  NOTE: The Storage ROMB battery settings are available only if the system has a ROMB with a battery.
- **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values.
- **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure.
- **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system.
- **Intrusion** — Provides information about the chassis.
- **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status.

  NOTE: If there is only one power supply in the system, the power supply redundancy is set to **Disabled**.
- **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM).
  - When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed.
  - If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted.
  - If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online.
  - During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off.

    NOTE: If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC.
  - System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively.

  NOTE: When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter.
- **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value.
- **Voltage** — Indicates the status and reading of the voltage sensors on various system components.

iDRAC User’s Guide, 116; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x);

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x). **Configuring warning threshold for inlet temperature** You can modify the minimum and maximum warning threshold values for the system board inlet temperature sensor. If reset to default action is performed, the temperature thresholds are set to the default values. You must have Configure user privilege to set the warning threshold values for the inlet temperature sensor. https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Optimizing system performance and power consumption** The power required to cool a server can contribute a significant amount to the overall system power. Thermal control is the active management of system cooling through fan speed and system power management to make sure that the system is reliable while minimizing system power consumption, airflow, and system acoustic output. You can adjust the thermal control settings and optimize against the system performance and performance-per-Watt requirements. Using the iDRAC Web interface, RACADM, or the iDRAC Settings Utility, you can change the following thermal settings: • Optimize for performance • Optimize for minimum power • Set the maximum air exhaust temperature • Increase airflow through a fan offset, if required • Increase airflow through increasing minimum fan speed Following are the list of features in thermal management: • **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. • **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. • **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. • **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. • **PCIe Airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards. iDRAC User’s Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Monitoring performance index of CPU, memory, and input output modules** In Dell's 14th generation Dell PowerEdge servers, Intel ME supports Compute Usage Per Second (CUPS) functionality. The CUPS functionality provides real-time monitoring of CPU, memory, and I/O utilization and system-level utilization index for the system. Intel ME allows out-of-band (OOB) performance monitoring and does not consume CPU resources. The Intel ME has a system CUPS sensor that provides computation, memory, and I/O resource utilization values as a CUPS Index. iDRAC monitors this CUPS index for the overall system utilization and also monitors the instantaneous utilization index of the CPU, Memory, and I/O. The CPU and chipset have dedicated Resource monitoring Counters (RMC). The data from these RMCs is queried to obtain utilization information of system resources. The data from RMCs is aggregated by the node manager to measure the cumulative utilization of each of these system resources that is read from iDRAC using existing intercommunication mechanisms to provide data through out-of-band management interfaces. The Intel sensor representation of performance parameters and index values is for complete physical system. Therefore, the performance data representation on the interfaces is for the complete physical system, even if the system is virtualized and has multiple virtual hosts. To display the performance parameters, the supported sensors must be present in the server. The four system utilization parameters are: • **CPU Utilization** — Data from RMCs for each CPU core is aggregated to provide cumulative utilization of all the cores in the system. This utilization is based on time spent in active and inactive states. A sample of RMC is taken every six seconds. • **Memory Utilization** — RMCs measure memory traffic occurring at each memory channel or memory controller instance. Data from these RMCs is aggregated to measure the cumulative memory traffic across all the memory channels on the system. This is a measure of memory bandwidth consumption and not amount of memory utilization. iDRAC aggregates it for one minute, so it may or may not match the memory utilization that other OS tools, such as **top** in Linux, show. Memory bandwidth utilization that the iDRAC shows is an indication of whether workload is memory intensive or not. • **I/O Utilization** — There is one RMC per root port in the PCI Express Root Complex to measure PCI Express traffic emanating from or directed to that root port and the lower segment. Data from these RMCs is aggregated for measuring PCI express traffic for all PCI Express segments emanating from the package. This is measure of I/O bandwidth utilization for the system.

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	• **System Level CUPS Index** — The CUPS index is calculated by aggregating CPU, Memory, and I/O index considering a predefined load factor of each system resource. The load factor depends on the nature of the workload on the system. CUPS Index represents the measurement of the compute headroom available on the server. If the system has a large CUPS Index, then there is limited headroom to place more workload on that system. As the resource consumption decreases, the system's CUPS index decreases. A low CUPS index indicates that there is a large compute headroom and the server can receive new workloads and the server is in a lower power state to reduce power consumption. Workload monitoring can then be applied throughout the data center to provide a high-level and holistic view of the data center's workload, providing a dynamic data center solution. iDRAC User's Guide, 117-118; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Monitoring power** iDRAC monitors the power consumption in the system continuously and displays the following power values: • Power consumption warning and critical thresholds. • Cumulative power, peak power, and peak amperage values. • Power consumption over the last hour, last day or last week. • Average, minimum, and maximum power consumption. • Historical peak values and peak timestamps. • Peak headroom and instantaneous headroom values (for rack and tower servers). iDRAC User's Guide, 197; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Modifying thermal settings using iDRAC web interface To modify the thermal settings: 1. In the iDRAC Web interface, go to **Configuration** > **System Settings** > **Hardware Settings** > **Cooling Configuration**. 2. Specify the following: • **Thermal Profile Optimization** — Select the thermal profile: ○ **Default Thermal Profile Settings (Minimum Power)** — Implies that the thermal algorithm uses the same system profile settings that is defined under **System BIOS** > **System BIOS Settings** > **System Profile Settings** page. By default, this option is set to **Default Thermal Profile Settings**. You can also select a custom algorithm, which is independent of the BIOS profile. The options available are: ○ **Maximum Performance (Performance Optimized)** : ▪ Reduced probability of memory or CPU throttling. ▪ Increased probability of turbo mode activation. ▪ Generally, higher fan speeds at idle and stress loads. ○ **Minimum Power (Performance per Watt Optimized)**: ▪ Optimized for lowest system power consumption based on optimum fan power state. ▪ Generally, lower fan speeds at idle and stress loads. ○ **Sound Cap** — Sound Cap provides reduced acoustical output from a server at the expense of some performance. Enabling Sound Cap may include temporary deployment or evaluation of a server in an occupied space, but it should not be used during benchmarking or performance sensitive applications. **NOTE:** Selecting **Maximum Performance** or **Minimum Power**, overrides thermal settings associated to System Profile setting under **System BIOS** > **System BIOS Settings.System Profile Settings** page. • **Maximum Exhaust Temperature Limit** — From the drop-down menu, select the maximum exhaust air temperature. The values are displayed based on the system. The default value is **Default, 70°C (158 °F)**. This option allows the system fans speeds to change such that the exhaust temperature does not exceed the selected exhaust temperature limit. This cannot always be guaranteed under all system operating conditions due to dependency on system load and system cooling capability. iDRAC User’s Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

	• **Thresholds**
	  ○ **Maximum PCIe Inlet Temperature Limit** — Default value is 55°C. Select the lower temperature of 45°C for third party PCIe cards which require lower inlet temperature.
	  ○ **Exhaust Temperature Limits** — By modifying the values for the following you can set the exhaust temperature limits:
	  ▪ **Set Maximum Exhaust Temperature Limit**
	  ▪ **Set Air Temperature Rise Limit**
	  ○ **Minimum Fan Speed in PWM (% of Max)** — Select this option to fine tune the fan speed. Using this option, you can set a higher baseline system fan speed or increase the system fan speed if other custom fan speed options are not resulting in the required higher fan speeds.
	  ▪ **Default** — Sets minimum fan speed to default value as determined by the system cooling algorithm.
	  ▪ **Custom** — Enter the percentage by which you want to change the fan speed. Range is between 9-100.
	  The allowable range for minimum fan speed PWM is dynamic based on the system configuration. The first value is the idle speed and the second value is the configuration max (Depending on the system configuration, the maximum speed may be up to 100%.).
	  System fans can run higher than this speed as per thermal requirements of the system but not lower than the defined minimum speed. For example, setting Minimum Fan Speed at 35% limits the fan speed to never go lower than 35% PWM.
	  NOTE: 0% PWM does not indicate fan is off. It is the lowest fan speed that the fan can achieve.
	The settings are persistent, which means that once they are set and applied, they do not automatically change to the default setting during system reboot, power cycling, iDRAC, or BIOS updates. The custom cooling options may not be supported on all servers. If the options are not supported, they are not displayed or you cannot provide a custom value.
	iDRAC User's Guide, 65; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

Multi-Vector Cooling

Multi-Vector Cooling implements multi-prong approach to Thermal Controls in Dell EMC Server Platforms. You can configure multi-vector cooling options through iDRAC web interface by navigating to **Configuration** > **System Settings** > **Hardware Settings** > **Fan Configuration**. It includes (but not limited to):

- Large set of sensors (thermal, power, inventory etc.) that allows accurate interpretation of real-time system thermal state at various locations within the server. It displays only a small subset of sensors that are relevant to users need based on the configuration.
- Intelligent and adaptive closed loop control algorithm optimizes fan response to maintain component temperatures. It also conserves fan power, airflow consumption, and acoustics.

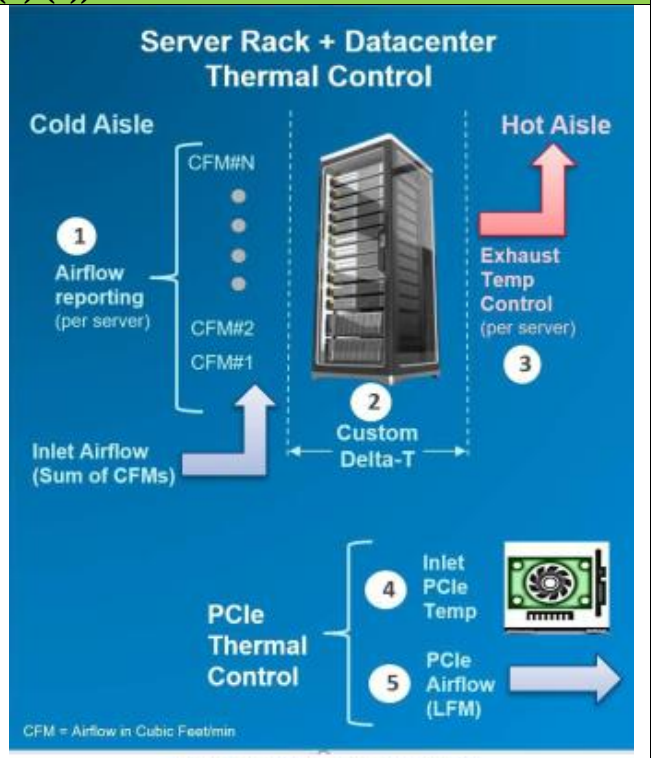
- Using fan zone mapping, cooling can be initiated for the components when it requires. Thus, it results maximum performance without compromising the efficiency of power utilization.
- Accurate representation of slot by slot PCIe airflow in terms of LFM metric (Linear Feet per Minute - an accepted industry standard on how PCIe card airflow requirement is specified). Display of this metric in various iDRAC interfaces allows user to:
  1. know the maximum LFM capability of each slot within the server.
  2. know what approach is being taken for PCIe cooling for each slot (airflow controlled, temperature controlled).
  3. know the minimum LFM being delivered to a slot, if the card is a 3rd Party Card (user defined custom card).
  4. dial in custom minimum LFM value for the 3rd Party Card allowing more accurate definition of the card cooling needs for which the user is better aware of through their custom card specification.
- Displays real-time system airflow metric (CFM, cubic feet per minute) in various iDRAC interfaces to the user to enable datacenter airflow balancing based on aggregation of per server CFM consumption.
- Allows custom thermal settings like Thermal Profiles (Maximum Performance vs. Maximum Performance per Watt, Sound Cap), custom fan speed options (minimum fan speed, fan speed offsets) and custom Exhaust Temperature settings.
  1. Most of these settings allow additional cooling over the baseline cooling generated by thermal algorithms and do not allow fan speeds to go below system cooling requirements.

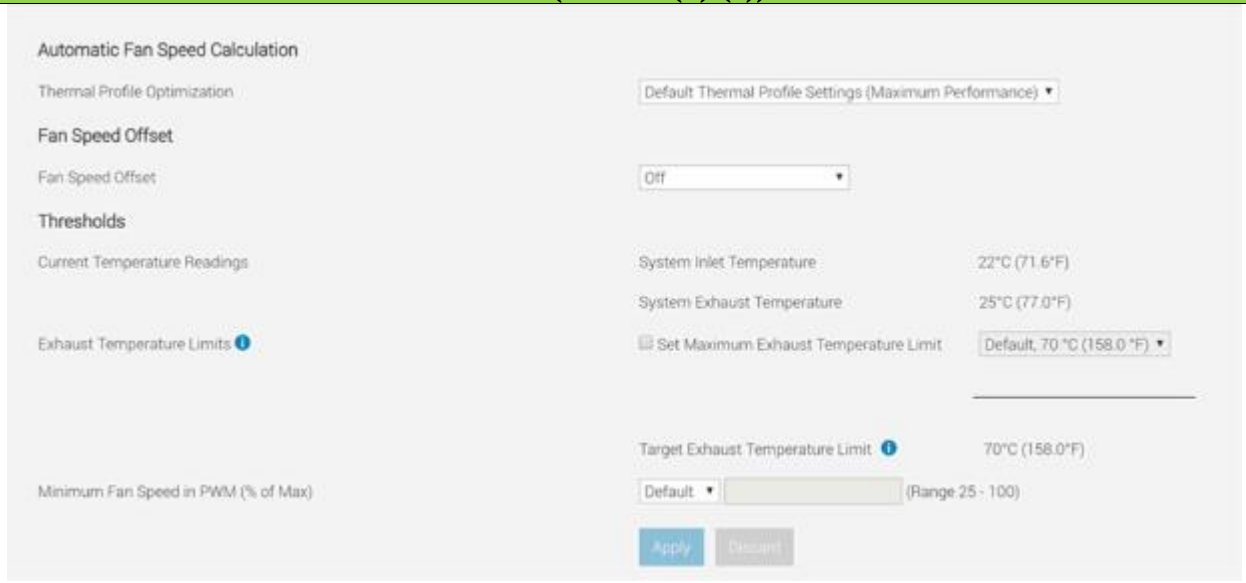
     NOTE: One exception to above statement is for fan speeds that are added for 3rd Party PCIe cards. The thermal algorithm provision airflow for 3rd party cards may be more or less than the actual card cooling needs and customer may fine tune the response for the card by entering the LFM corresponding to the 3rd Party Card.
  2. Custom Exhaust Temperature option limits exhaust temperature to customer desired settings.

     NOTE: It is important to note that with certain configurations and workloads, it may not be physically possible to reduce exhaust below a desired set point (e.g. Custom exhaust setting of 45C with a high inlet temp {e.g. 30C} and a loaded config {high system power consumption, low airflow}).
  3. Sound Cap option is new in the 14th generation of PowerEdge server. It limits CPU power consumption and controls fan speed and acoustical ceiling. This is unique for acoustical deployments and may result in reduced system performance.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User’s Guide, 201-202; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). This is a software limitation that may require access to the underlying source code. Accordingly, pursuant to Paragraph 3(a)(i) of the Discovery Order, Cloud Byte may supplement these contentions with additional information after Dell’s source code has been produced. In addition and/or in the alternative to literally infringing this claim element, the Accused Dell ’632 Products also infringe under the doctrine of equivalents. The Accused Dell ’632 Products are at least equivalent to and insubstantially different from the claimed limitation where an estimating unit 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, 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 to perform substantially the same function (e.g., estimating an upper limit of temperature for the ICT equipment) in substantially the same way (e.g., based at least on the operational status and temperature of the ICT equipment), to achieve substantially the same result (e.g., identifying a threshold temperature in which the ICT equipment should not exceed).
1[c] 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	In the Accused Dell ’632 Products, the operational status of the ICT equipment and the intake air temperature of the ICT equipment determines a rotation speed of the cooling fan. *See supra*, claim 1[b]. *See, e.g.*,

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 PowerEdge R6615 Powerful performance per investment dollar The new Dell PowerEdge R6615 is a 1U, single-socket rack server. Designed to be the best investment per dollar for your data center, this server provides performance and flexible, low-latency storage options in an air or Direct Liquid Cooling (DLC) configuration. Fans: • Standard (STD) fans/High performance GOLD (VHP) fans • Up to 4 sets (dual fan module) hot plug fans R6615 Spec Sheet, 1-2.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Thermal Manage – Feature Overview Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits: • Optimize server-related power and cooling efficiencies across their datacenters. • Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience. • Provides a state-of-the-art PCIe cooling management dashboard. Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities. 1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. 2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. 3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. 4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. 5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.  *Figure 1 displays the features and its utilities.* iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 iDRAC Thermal Manage Features.

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Viewing sensor information The following sensors help to monitor the health of the managed system: • **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB). ⓘ **NOTE:** The Storage ROMB battery settings are available only if the system has a ROMB with a battery. • **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values. • **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure. • **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system. • **Intrusion** — Provides information about the chassis. • **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status. ⓘ **NOTE:** If there is only one power supply in the system, the power supply redundancy is set to **Disabled**. • **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM). ○ When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed. ○ If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted. ○ If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online. ○ During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off. ⓘ **NOTE:** If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC. ○ System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively. ⓘ **NOTE:** When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter. • **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value. • **Voltage** — Indicates the status and reading of the voltage sensors on various system components. iDRAC User's Guide, 116; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x);

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x). **Configuring warning threshold for inlet temperature** You can modify the minimum and maximum warning threshold values for the system board inlet temperature sensor. If reset to default action is performed, the temperature thresholds are set to the default values. You must have Configure user privilege to set the warning threshold values for the inlet temperature sensor. https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Optimizing system performance and power consumption** The power required to cool a server can contribute a significant amount to the overall system power. Thermal control is the active management of system cooling through fan speed and system power management to make sure that the system is reliable while minimizing system power consumption, airflow, and system acoustic output. You can adjust the thermal control settings and optimize against the system performance and performance-per-Watt requirements. Using the iDRAC Web interface, RACADM, or the iDRAC Settings Utility, you can change the following thermal settings: • Optimize for performance • Optimize for minimum power • Set the maximum air exhaust temperature • Increase airflow through a fan offset, if required • Increase airflow through increasing minimum fan speed Following are the list of features in thermal management: • **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. • **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. • **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. • **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. • **PCIe Airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards. iDRAC User's Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Monitoring performance index of CPU, memory, and input output modules** In Dell's 14th generation Dell PowerEdge servers, Intel ME supports Compute Usage Per Second (CUPS) functionality. The CUPS functionality provides real-time monitoring of CPU, memory, and I/O utilization and system-level utilization index for the system. Intel ME allows out-of-band (OOB) performance monitoring and does not consume CPU resources. The Intel ME has a system CUPS sensor that provides computation, memory, and I/O resource utilization values as a CUPS Index. iDRAC monitors this CUPS index for the overall system utilization and also monitors the instantaneous utilization index of the CPU, Memory, and I/O. The CPU and chipset have dedicated Resource monitoring Counters (RMC). The data from these RMCs is queried to obtain utilization information of system resources. The data from RMCs is aggregated by the node manager to measure the cumulative utilization of each of these system resources that is read from iDRAC using existing intercommunication mechanisms to provide data through out-of-band management interfaces. The Intel sensor representation of performance parameters and index values is for complete physical system. Therefore, the performance data representation on the interfaces is for the complete physical system, even if the system is virtualized and has multiple virtual hosts. To display the performance parameters, the supported sensors must be present in the server. The four system utilization parameters are: • **CPU Utilization** — Data from RMCs for each CPU core is aggregated to provide cumulative utilization of all the cores in the system. This utilization is based on time spent in active and inactive states. A sample of RMC is taken every six seconds. • **Memory Utilization** — RMCs measure memory traffic occurring at each memory channel or memory controller instance. Data from these RMCs is aggregated to measure the cumulative memory traffic across all the memory channels on the system. This is a measure of memory bandwidth consumption and not amount of memory utilization. iDRAC aggregates it for one minute, so it may or may not match the memory utilization that other OS tools, such as **top** in Linux, show. Memory bandwidth utilization that the iDRAC shows is an indication of whether workload is memory intensive or not. • **I/O Utilization** — There is one RMC per root port in the PCI Express Root Complex to measure PCI Express traffic emanating from or directed to that root port and the lower segment. Data from these RMCs is aggregated for measuring PCI express traffic for all PCI Express segments emanating from the package. This is measure of I/O bandwidth utilization for the system.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	• **System Level CUPS Index** — The CUPS index is calculated by aggregating CPU, Memory, and I/O index considering a predefined load factor of each system resource. The load factor depends on the nature of the workload on the system. CUPS Index represents the measurement of the compute headroom available on the server. If the system has a large CUPS Index, then there is limited headroom to place more workload on that system. As the resource consumption decreases, the system's CUPS index decreases. A low CUPS index indicates that there is a large compute headroom and the server can receive new workloads and the server is in a lower power state to reduce power consumption. Workload monitoring can then be applied throughout the data center to provide a high-level and holistic view of the data center's workload, providing a dynamic data center solution. iDRAC User's Guide, 117-118; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Monitoring power** iDRAC monitors the power consumption in the system continuously and displays the following power values: • Power consumption warning and critical thresholds. • Cumulative power, peak power, and peak amperage values. • Power consumption over the last hour, last day or last week. • Average, minimum, and maximum power consumption. • Historical peak values and peak timestamps. • Peak headroom and instantaneous headroom values (for rack and tower servers). iDRAC User's Guide, 197; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Modifying thermal settings using iDRAC web interface To modify the thermal settings: 1. In the iDRAC Web interface, go to **Configuration** > **System Settings** > **Hardware Settings** > **Cooling Configuration**. 2. Specify the following: • **Thermal Profile Optimization** — Select the thermal profile: ○ **Default Thermal Profile Settings (Minimum Power)** — Implies that the thermal algorithm uses the same system profile settings that is defined under **System BIOS** > **System BIOS Settings** > **System Profile Settings** page. By default, this option is set to **Default Thermal Profile Settings**. You can also select a custom algorithm, which is independent of the BIOS profile. The options available are: ○ **Maximum Performance (Performance Optimized)** : ▪ Reduced probability of memory or CPU throttling. ▪ Increased probability of turbo mode activation. ▪ Generally, higher fan speeds at idle and stress loads. ○ **Minimum Power (Performance per Watt Optimized)**: ▪ Optimized for lowest system power consumption based on optimum fan power state. ▪ Generally, lower fan speeds at idle and stress loads. ○ **Sound Cap** — Sound Cap provides reduced acoustical output from a server at the expense of some performance. Enabling Sound Cap may include temporary deployment or evaluation of a server in an occupied space, but it should not be used during benchmarking or performance sensitive applications. **NOTE:** Selecting **Maximum Performance** or **Minimum Power**, overrides thermal settings associated to System Profile setting under **System BIOS** > **System BIOS Settings.System Profile Settings** page. • **Maximum Exhaust Temperature Limit** — From the drop-down menu, select the maximum exhaust air temperature. The values are displayed based on the system. The default value is **Default, 70°C (158 °F)**. This option allows the system fans speeds to change such that the exhaust temperature does not exceed the selected exhaust temperature limit. This cannot always be guaranteed under all system operating conditions due to dependency on system load and system cooling capability. iDRAC User’s Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

	• **Thresholds**
	  ○ **Maximum PCIe Inlet Temperature Limit** — Default value is 55°C. Select the lower temperature of 45°C for third party PCIe cards which require lower inlet temperature.
	  ○ **Exhaust Temperature Limits** — By modifying the values for the following you can set the exhaust temperature limits:
	  ▪ **Set Maximum Exhaust Temperature Limit**
	  ▪ **Set Air Temperature Rise Limit**
	  ○ **Minimum Fan Speed in PWM (% of Max)** — Select this option to fine tune the fan speed. Using this option, you can set a higher baseline system fan speed or increase the system fan speed if other custom fan speed options are not resulting in the required higher fan speeds.
	  ▪ **Default** — Sets minimum fan speed to default value as determined by the system cooling algorithm.
	  ▪ **Custom** — Enter the percentage by which you want to change the fan speed. Range is between 9-100.
	The allowable range for minimum fan speed PWM is dynamic based on the system configuration. The first value is the idle speed and the second value is the configuration max (Depending on the system configuration, the maximum speed may be up to 100%.).
	System fans can run higher than this speed as per thermal requirements of the system but not lower than the defined minimum speed. For example, setting Minimum Fan Speed at 35% limits the fan speed to never go lower than 35% PWM.
	NOTE: 0% PWM does not indicate fan is off. It is the lowest fan speed that the fan can achieve.
	The settings are persistent, which means that once they are set and applied, they do not automatically change to the default setting during system reboot, power cycling, iDRAC, or BIOS updates. The custom cooling options may not be supported on all servers. If the options are not supported, they are not displayed or you cannot provide a custom value.
	iDRAC User's Guide, 65; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

Multi-Vector Cooling

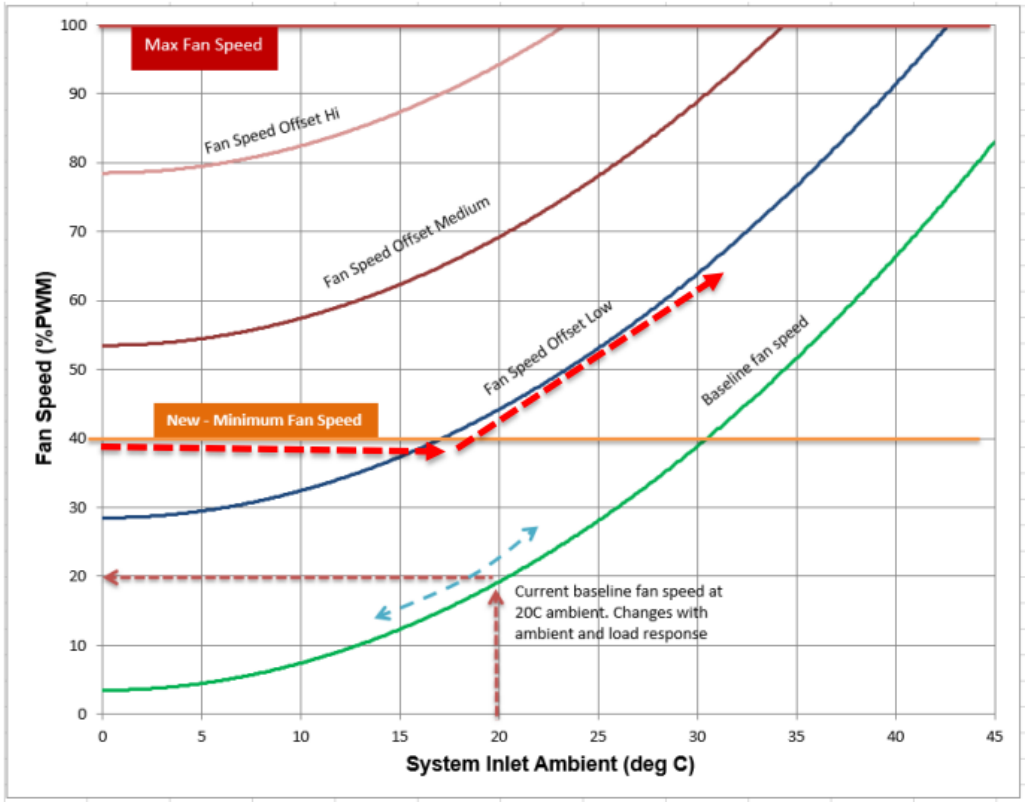
Multi-Vector Cooling implements multi-prong approach to Thermal Controls in Dell EMC Server Platforms. You can configure multi-vector cooling options through iDRAC web interface by navigating to **Configuration** > **System Settings** > **Hardware Settings** > **Fan Configuration**. It includes (but not limited to):

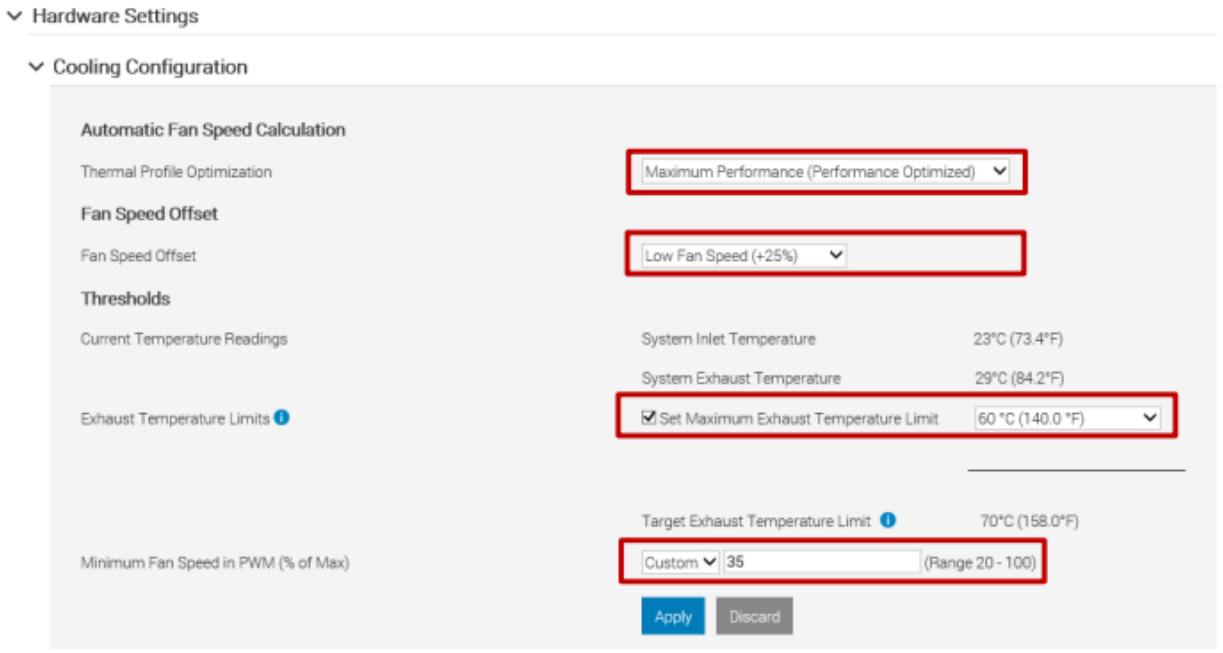
- Large set of sensors (thermal, power, inventory etc.) that allows accurate interpretation of real-time system thermal state at various locations within the server. It displays only a small subset of sensors that are relevant to users need based on the configuration.
- Intelligent and adaptive closed loop control algorithm optimizes fan response to maintain component temperatures. It also conserves fan power, airflow consumption, and acoustics.

- Using fan zone mapping, cooling can be initiated for the components when it requires. Thus, it results maximum performance without compromising the efficiency of power utilization.
- Accurate representation of slot by slot PCIe airflow in terms of LFM metric (Linear Feet per Minute - an accepted industry standard on how PCIe card airflow requirement is specified). Display of this metric in various iDRAC interfaces allows user to:
  1. know the maximum LFM capability of each slot within the server.
  2. know what approach is being taken for PCIe cooling for each slot (airflow controlled, temperature controlled).
  3. know the minimum LFM being delivered to a slot, if the card is a 3rd Party Card (user defined custom card).
  4. dial in custom minimum LFM value for the 3rd Party Card allowing more accurate definition of the card cooling needs for which the user is better aware of through their custom card specification.
- Displays real-time system airflow metric (CFM, cubic feet per minute) in various iDRAC interfaces to the user to enable datacenter airflow balancing based on aggregation of per server CFM consumption.
- Allows custom thermal settings like Thermal Profiles (Maximum Performance vs. Maximum Performance per Watt, Sound Cap), custom fan speed options (minimum fan speed, fan speed offsets) and custom Exhaust Temperature settings.
  1. Most of these settings allow additional cooling over the baseline cooling generated by thermal algorithms and do not allow fan speeds to go below system cooling requirements.

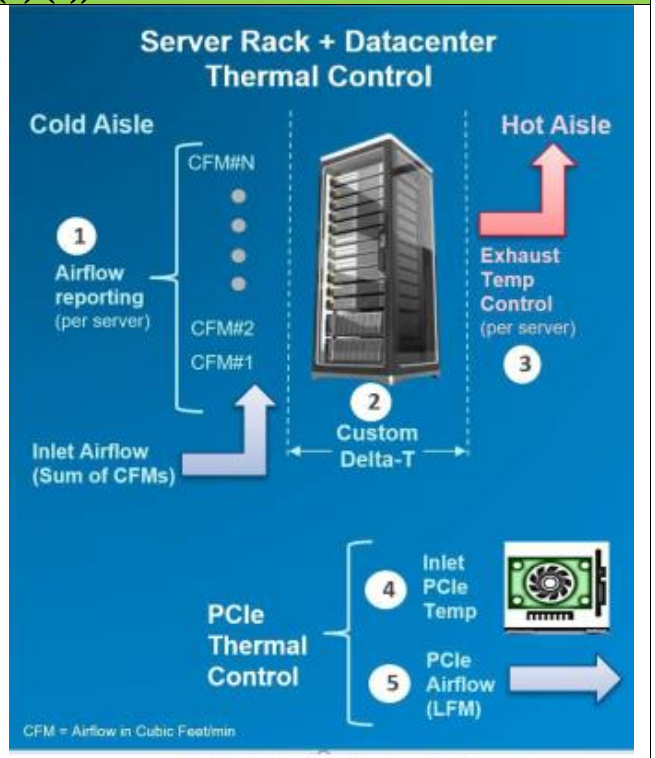
     NOTE: One exception to above statement is for fan speeds that are added for 3rd Party PCIe cards. The thermal algorithm provision airflow for 3rd party cards may be more or less than the actual card cooling needs and customer may fine tune the response for the card by entering the LFM corresponding to the 3rd Party Card.
  2. Custom Exhaust Temperature option limits exhaust temperature to customer desired settings.

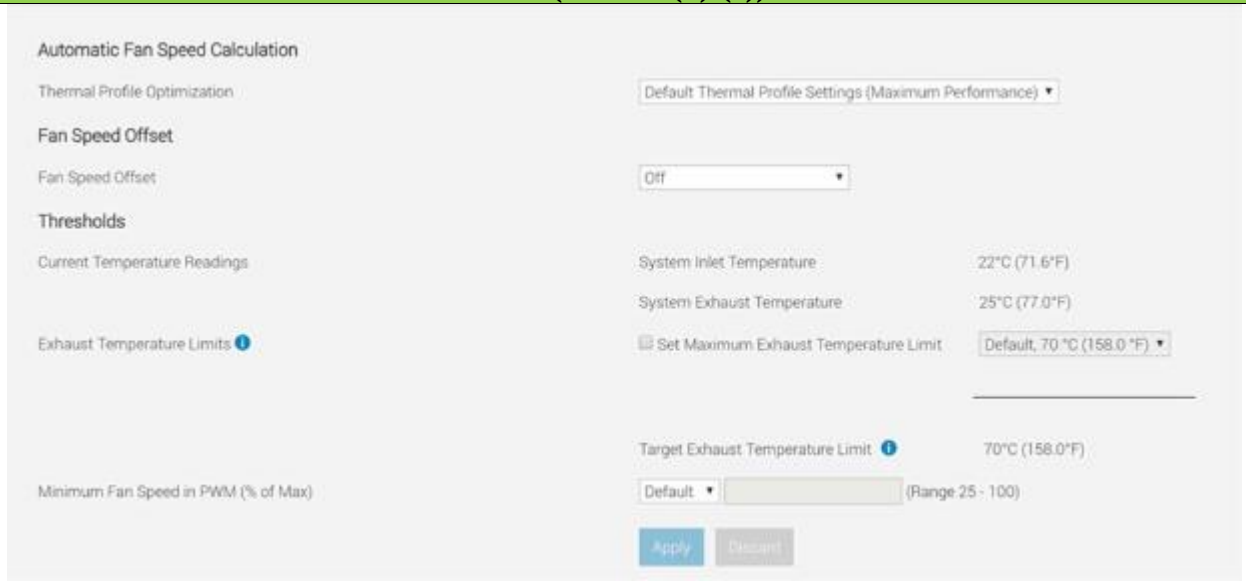
     NOTE: It is important to note that with certain configurations and workloads, it may not be physically possible to reduce exhaust below a desired set point (e.g. Custom exhaust setting of 45C with a high inlet temp {e.g. 30C} and a loaded config {high system power consumption, low airflow}).
  3. Sound Cap option is new in the 14th generation of PowerEdge server. It limits CPU power consumption and controls fan speed and acoustical ceiling. This is unique for acoustical deployments and may result in reduced system performance.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User’s Guide, 201-202; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).  Figure 3 How options can be combined with MFS and Offset set simultaneously If Low Offset and 40% MFS are applied, Fan Speed follows the red dotted line based on Inlet Ambient.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	https://dl.dell.com/manuals/common/customcooling_poweredge_idrac9.pdf (“PowerEdge Custom Cooling Fan Options” or CLOUDBYTE0004115), 9. Each of the options that are described earlier can be toggled independently and set at the same time. For example, low Fan Speed Offset, and Exhaust of 50°C and Minimum Fan Speed of 20% can be set concurrently. The algorithm calculates the appropriate fan speed that meets all the customization requests. See the screenshots that follow for an example of such settings.  Figure 16 Setting multiple custom control options PowerEdge Custom Cooling Fan Options, 18-19.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	This is a software limitation that may require access to the underlying source code. Accordingly, pursuant to Paragraph 3(a)(i) of the Discovery Order, Cloud Byte may supplement these contentions with additional information after Dell’s source code has been produced.
1[d] 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.	The Accused Dell ’632 Products include 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 of a PowerEdge server is beyond the upper limit estimated by the estimating unit. *See supra*, claim 1[c]. *See, e.g.,*

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Thermal Manage – Feature Overview Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits: • Optimize server-related power and cooling efficiencies across their datacenters. • Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience. • Provides a state-of-the-art PCIe cooling management dashboard. Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities. 1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. 2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. 3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. 4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. 5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.  *Figure 1 displays the features and its utilities.* iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Viewing sensor information The following sensors help to monitor the health of the managed system: • **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB). ⓘ **NOTE:** The Storage ROMB battery settings are available only if the system has a ROMB with a battery. • **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values. • **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure. • **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system. • **Intrusion** — Provides information about the chassis. • **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status. ⓘ **NOTE:** If there is only one power supply in the system, the power supply redundancy is set to **Disabled**. • **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM). ○ When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed. ○ If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted. ○ If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online. ○ During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off. ⓘ **NOTE:** If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC. ○ System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively. ⓘ **NOTE:** When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter. • **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value. • **Voltage** — Indicates the status and reading of the voltage sensors on various system components.

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User's Guide, 116; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x). **Configuring warning threshold for inlet temperature** You can modify the minimum and maximum warning threshold values for the system board inlet temperature sensor. If reset to default action is performed, the temperature thresholds are set to the default values. You must have Configure user privilege to set the warning threshold values for the inlet temperature sensor. https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Optimizing system performance and power consumption** The power required to cool a server can contribute a significant amount to the overall system power. Thermal control is the active management of system cooling through fan speed and system power management to make sure that the system is reliable while minimizing system power consumption, airflow, and system acoustic output. You can adjust the thermal control settings and optimize against the system performance and performance-per-Watt requirements. Using the iDRAC Web interface, RACADM, or the iDRAC Settings Utility, you can change the following thermal settings: • Optimize for performance • Optimize for minimum power • Set the maximum air exhaust temperature • Increase airflow through a fan offset, if required • Increase airflow through increasing minimum fan speed Following are the list of features in thermal management: • **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. • **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. • **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. • **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. • **PCIe Airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.

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	iDRAC User's Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Modifying thermal settings using iDRAC web interface** To modify the thermal settings: 1. In the iDRAC Web interface, go to **Configuration** > **System Settings** > **Hardware Settings** > **Cooling Configuration**. 2. Specify the following: • **Thermal Profile Optimization** — Select the thermal profile: ○ **Default Thermal Profile Settings (Minimum Power)** — Implies that the thermal algorithm uses the same system profile settings that is defined under **System BIOS** > **System BIOS Settings** > **System Profile Settings** page. By default, this option is set to **Default Thermal Profile Settings**. You can also select a custom algorithm, which is independent of the BIOS profile. The options available are: ○ **Maximum Performance (Performance Optimized)** : ▪ Reduced probability of memory or CPU throttling. ▪ Increased probability of turbo mode activation. ▪ Generally, higher fan speeds at idle and stress loads. ○ **Minimum Power (Performance per Watt Optimized)**: ▪ Optimized for lowest system power consumption based on optimum fan power state. ▪ Generally, lower fan speeds at idle and stress loads. ○ **Sound Cap** — Sound Cap provides reduced acoustical output from a server at the expense of some performance. Enabling Sound Cap may include temporary deployment or evaluation of a server in an occupied space, but it should not be used during benchmarking or performance sensitive applications. **NOTE:** Selecting **Maximum Performance** or **Minimum Power**, overrides thermal settings associated to System Profile setting under **System BIOS** > **System BIOS Settings.System Profile Settings** page. • **Maximum Exhaust Temperature Limit** — From the drop-down menu, select the maximum exhaust air temperature. The values are displayed based on the system. The default value is **Default, 70°C (158 °F)**. This option allows the system fans speeds to change such that the exhaust temperature does not exceed the selected exhaust temperature limit. This cannot always be guaranteed under all system operating conditions due to dependency on system load and system cooling capability. iDRAC User's Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x);

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

	https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).
	
	• **Thresholds**
	  ○ **Maximum PCIe Inlet Temperature Limit** — Default value is 55°C. Select the lower temperature of 45°C for third party PCIe cards which require lower inlet temperature.
	  ○ **Exhaust Temperature Limits** — By modifying the values for the following you can set the exhaust temperature limits:
	  ▪ **Set Maximum Exhaust Temperature Limit**
	  ▪ **Set Air Temperature Rise Limit**
	  ○ **Minimum Fan Speed in PWM (% of Max)** — Select this option to fine tune the fan speed. Using this option, you can set a higher baseline system fan speed or increase the system fan speed if other custom fan speed options are not resulting in the required higher fan speeds.
	  ▪ **Default** — Sets minimum fan speed to default value as determined by the system cooling algorithm.
	  ▪ **Custom** — Enter the percentage by which you want to change the fan speed. Range is between 9-100.
	
	The allowable range for minimum fan speed PWM is dynamic based on the system configuration. The first value is the idle speed and the second value is the configuration max (Depending on the system configuration, the maximum speed may be up to 100%.).
	
	System fans can run higher than this speed as per thermal requirements of the system but not lower than the defined minimum speed. For example, setting Minimum Fan Speed at 35% limits the fan speed to never go lower than 35% PWM.
	
	NOTE: 0% PWM does not indicate fan is off. It is the lowest fan speed that the fan can achieve.
	
	The settings are persistent, which means that once they are set and applied, they do not automatically change to the default setting during system reboot, power cycling, iDRAC, or BIOS updates. The custom cooling options may not be supported on all servers. If the options are not supported, they are not displayed or you cannot provide a custom value.
	
	iDRAC User's Guide, 65; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

Multi-Vector Cooling

Multi-Vector Cooling implements multi-prong approach to Thermal Controls in Dell EMC Server Platforms. You can configure multi-vector cooling options through iDRAC web interface by navigating to **Configuration** > **System Settings** > **Hardware Settings** > **Fan Configuration**. It includes (but not limited to):

- Large set of sensors (thermal, power, inventory etc.) that allows accurate interpretation of real-time system thermal state at various locations within the server. It displays only a small subset of sensors that are relevant to users need based on the configuration.
- Intelligent and adaptive closed loop control algorithm optimizes fan response to maintain component temperatures. It also conserves fan power, airflow consumption, and acoustics.

- Using fan zone mapping, cooling can be initiated for the components when it requires. Thus, it results maximum performance without compromising the efficiency of power utilization.
- Accurate representation of slot by slot PCIe airflow in terms of LFM metric (Linear Feet per Minute - an accepted industry standard on how PCIe card airflow requirement is specified). Display of this metric in various iDRAC interfaces allows user to:
  1. know the maximum LFM capability of each slot within the server.
  2. know what approach is being taken for PCIe cooling for each slot (airflow controlled, temperature controlled).
  3. know the minimum LFM being delivered to a slot, if the card is a 3rd Party Card (user defined custom card).
  4. dial in custom minimum LFM value for the 3rd Party Card allowing more accurate definition of the card cooling needs for which the user is better aware of through their custom card specification.
- Displays real-time system airflow metric (CFM, cubic feet per minute) in various iDRAC interfaces to the user to enable datacenter airflow balancing based on aggregation of per server CFM consumption.
- Allows custom thermal settings like Thermal Profiles (Maximum Performance vs. Maximum Performance per Watt, Sound Cap), custom fan speed options (minimum fan speed, fan speed offsets) and custom Exhaust Temperature settings.
  1. Most of these settings allow additional cooling over the baseline cooling generated by thermal algorithms and do not allow fan speeds to go below system cooling requirements.

     NOTE: One exception to above statement is for fan speeds that are added for 3rd Party PCIe cards. The thermal algorithm provision airflow for 3rd party cards may be more or less than the actual card cooling needs and customer may fine tune the response for the card by entering the LFM corresponding to the 3rd Party Card.
  2. Custom Exhaust Temperature option limits exhaust temperature to customer desired settings.

     NOTE: It is important to note that with certain configurations and workloads, it may not be physically possible to reduce exhaust below a desired set point (e.g. Custom exhaust setting of 45C with a high inlet temp {e.g. 30C} and a loaded config {high system power consumption, low airflow}).
  3. Sound Cap option is new in the 14th generation of PowerEdge server. It limits CPU power consumption and controls fan speed and acoustical ceiling. This is unique for acoustical deployments and may result in reduced system performance.

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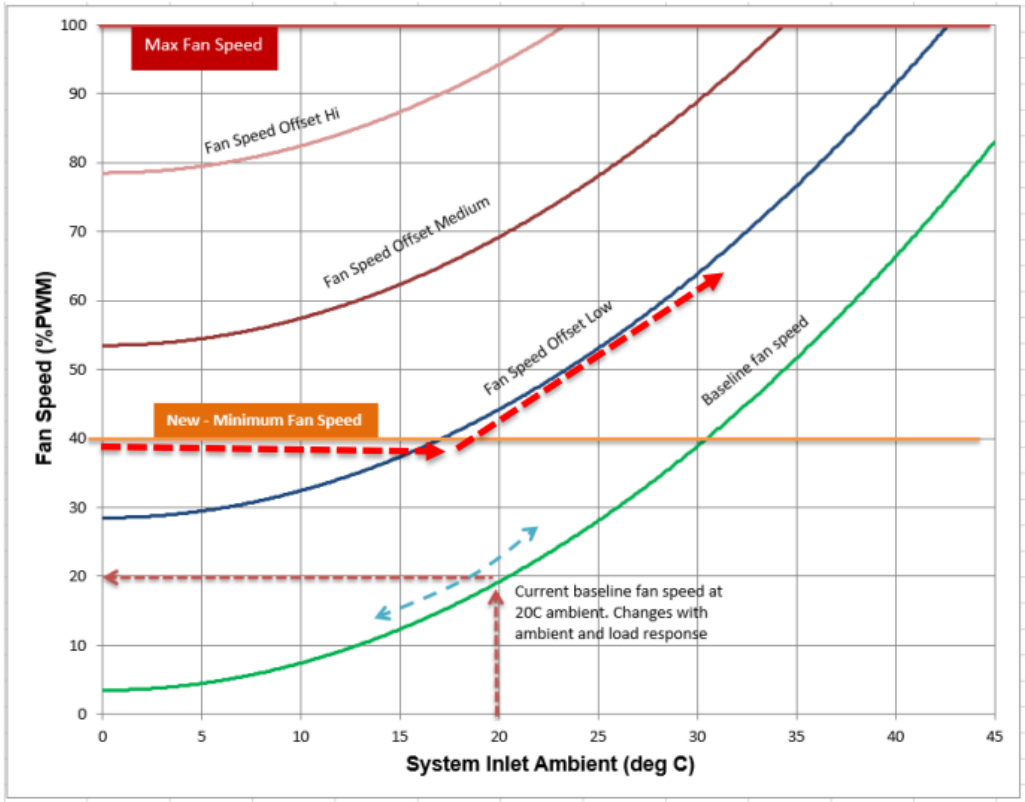
	iDRAC User’s Guide, 201-202; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).  Figure 3 How options can be combined with MFS and Offset set simultaneously If Low Offset and 40% MFS are applied, Fan Speed follows the red dotted line based on Inlet Ambient. PowerEdge Custom Cooling Fan Options, 9.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	This is a software limitation that may require access to the underlying source code. Accordingly, pursuant to Paragraph 3(a)(i) of the Discovery Order, Cloud Byte may supplement these contentions with additional information after Dell’s source code has been produced.
3[a] 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,	The Accused Dell ’632 Products include an abnormality detection device 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. *See supra*, claim 1. *See, e.g.*,

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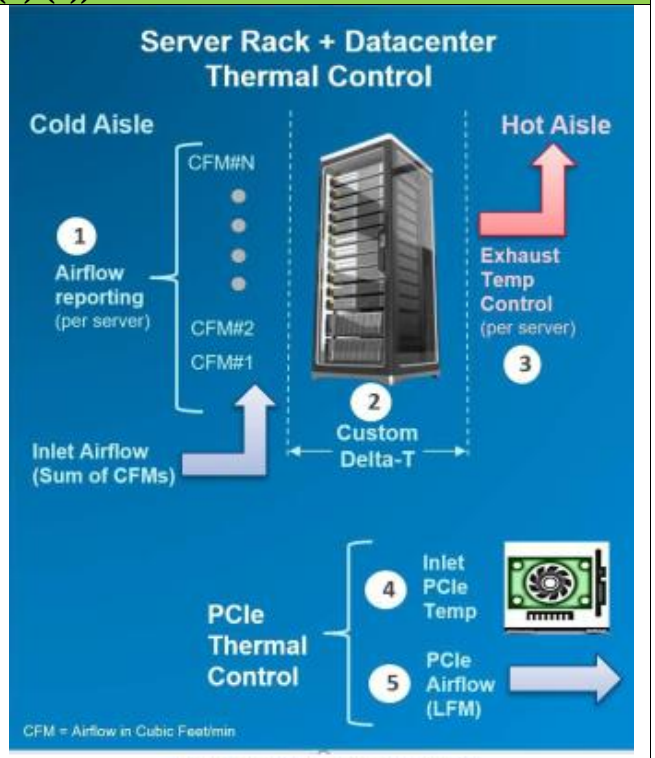
	Thermal Manage – Feature Overview Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits: • Optimize server-related power and cooling efficiencies across their datacenters. • Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience. • Provides a state-of-the-art PCIe cooling management dashboard. Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities. 1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. 2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. 3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. 4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. 5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.  *Figure 1 displays the features and its utilities.* iDRAC Thermal Manage Features.

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	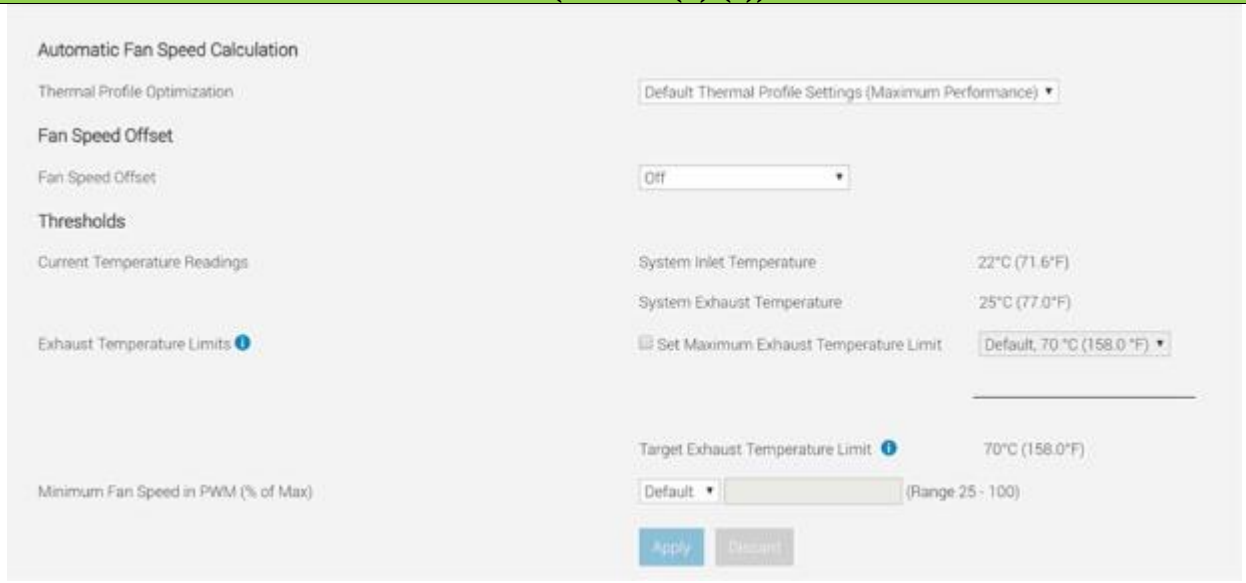 iDRAC Thermal Manage Features.

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	Viewing sensor information The following sensors help to monitor the health of the managed system: • **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB). ⓘ **NOTE:** The Storage ROMB battery settings are available only if the system has a ROMB with a battery. • **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values. • **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure. • **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system. • **Intrusion** — Provides information about the chassis. • **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status. ⓘ **NOTE:** If there is only one power supply in the system, the power supply redundancy is set to **Disabled**. • **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM). ○ When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed. ○ If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted. ○ If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online. ○ During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off. ⓘ **NOTE:** If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC. ○ System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively. ⓘ **NOTE:** When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter. • **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value. • **Voltage** — Indicates the status and reading of the voltage sensors on various system components.

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	iDRAC User's Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Modifying thermal settings using iDRAC web interface** To modify the thermal settings: 1. In the iDRAC Web interface, go to **Configuration** > **System Settings** > **Hardware Settings** > **Cooling Configuration**. 2. Specify the following: • **Thermal Profile Optimization** — Select the thermal profile: ○ **Default Thermal Profile Settings (Minimum Power)** — Implies that the thermal algorithm uses the same system profile settings that is defined under **System BIOS** > **System BIOS Settings** > **System Profile Settings** page. By default, this option is set to **Default Thermal Profile Settings**. You can also select a custom algorithm, which is independent of the BIOS profile. The options available are: ○ **Maximum Performance (Performance Optimized)** : ▪ Reduced probability of memory or CPU throttling. ▪ Increased probability of turbo mode activation. ▪ Generally, higher fan speeds at idle and stress loads. ○ **Minimum Power (Performance per Watt Optimized)**: ▪ Optimized for lowest system power consumption based on optimum fan power state. ▪ Generally, lower fan speeds at idle and stress loads. ○ **Sound Cap** — Sound Cap provides reduced acoustical output from a server at the expense of some performance. Enabling Sound Cap may include temporary deployment or evaluation of a server in an occupied space, but it should not be used during benchmarking or performance sensitive applications. **NOTE:** Selecting **Maximum Performance** or **Minimum Power**, overrides thermal settings associated to System Profile setting under **System BIOS** > **System BIOS Settings.System Profile Settings** page. • **Maximum Exhaust Temperature Limit** — From the drop-down menu, select the maximum exhaust air temperature. The values are displayed based on the system. The default value is **Default, 70°C (158 °F)**. This option allows the system fans speeds to change such that the exhaust temperature does not exceed the selected exhaust temperature limit. This cannot always be guaranteed under all system operating conditions due to dependency on system load and system cooling capability. iDRAC User's Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x);

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	• **Thresholds**
	  ○ **Maximum PCIe Inlet Temperature Limit** — Default value is 55°C. Select the lower temperature of 45°C for third party PCIe cards which require lower inlet temperature.
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	  ▪ **Default** — Sets minimum fan speed to default value as determined by the system cooling algorithm.
	  ▪ **Custom** — Enter the percentage by which you want to change the fan speed. Range is between 9-100.
	
	The allowable range for minimum fan speed PWM is dynamic based on the system configuration. The first value is the idle speed and the second value is the configuration max (Depending on the system configuration, the maximum speed may be up to 100%.).
	
	System fans can run higher than this speed as per thermal requirements of the system but not lower than the defined minimum speed. For example, setting Minimum Fan Speed at 35% limits the fan speed to never go lower than 35% PWM.
	
	ⓘ **NOTE:** 0% PWM does not indicate fan is off. It is the lowest fan speed that the fan can achieve.
	
	The settings are persistent, which means that once they are set and applied, they do not automatically change to the default setting during system reboot, power cycling, iDRAC, or BIOS updates. The custom cooling options may not be supported on all servers. If the options are not supported, they are not displayed or you cannot provide a custom value.
	
	iDRAC User's Guide, 65; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

Multi-Vector Cooling

Multi-Vector Cooling implements multi-prong approach to Thermal Controls in Dell EMC Server Platforms. You can configure multi-vector cooling options through iDRAC web interface by navigating to **Configuration** > **System Settings** > **Hardware Settings** > **Fan Configuration**. It includes (but not limited to):

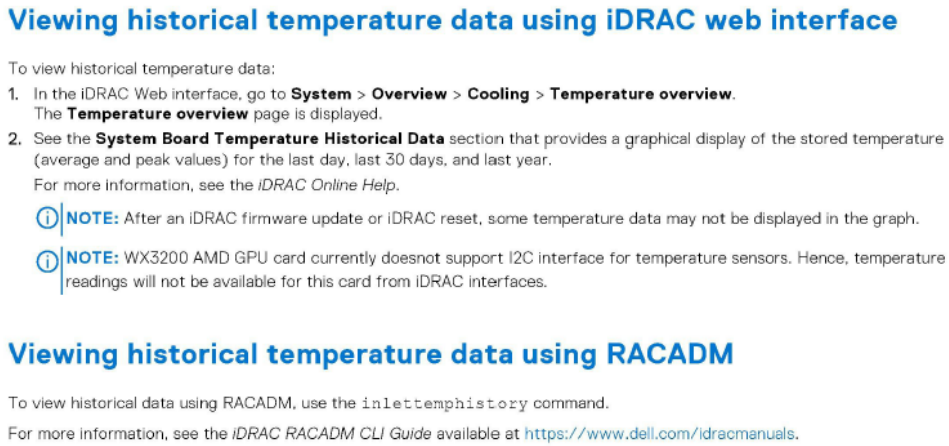
- Large set of sensors (thermal, power, inventory etc.) that allows accurate interpretation of real-time system thermal state at various locations within the server. It displays only a small subset of sensors that are relevant to users need based on the configuration.
- Intelligent and adaptive closed loop control algorithm optimizes fan response to maintain component temperatures. It also conserves fan power, airflow consumption, and acoustics.

- Using fan zone mapping, cooling can be initiated for the components when it requires. Thus, it results maximum performance without compromising the efficiency of power utilization.
- Accurate representation of slot by slot PCIe airflow in terms of LFM metric (Linear Feet per Minute - an accepted industry standard on how PCIe card airflow requirement is specified). Display of this metric in various iDRAC interfaces allows user to:
  1. know the maximum LFM capability of each slot within the server.
  2. know what approach is being taken for PCIe cooling for each slot (airflow controlled, temperature controlled).
  3. know the minimum LFM being delivered to a slot, if the card is a 3rd Party Card (user defined custom card).
  4. dial in custom minimum LFM value for the 3rd Party Card allowing more accurate definition of the card cooling needs for which the user is better aware of through their custom card specification.
- Displays real-time system airflow metric (CFM, cubic feet per minute) in various iDRAC interfaces to the user to enable datacenter airflow balancing based on aggregation of per server CFM consumption.
- Allows custom thermal settings like Thermal Profiles (Maximum Performance vs. Maximum Performance per Watt, Sound Cap), custom fan speed options (minimum fan speed, fan speed offsets) and custom Exhaust Temperature settings.
  1. Most of these settings allow additional cooling over the baseline cooling generated by thermal algorithms and do not allow fan speeds to go below system cooling requirements.

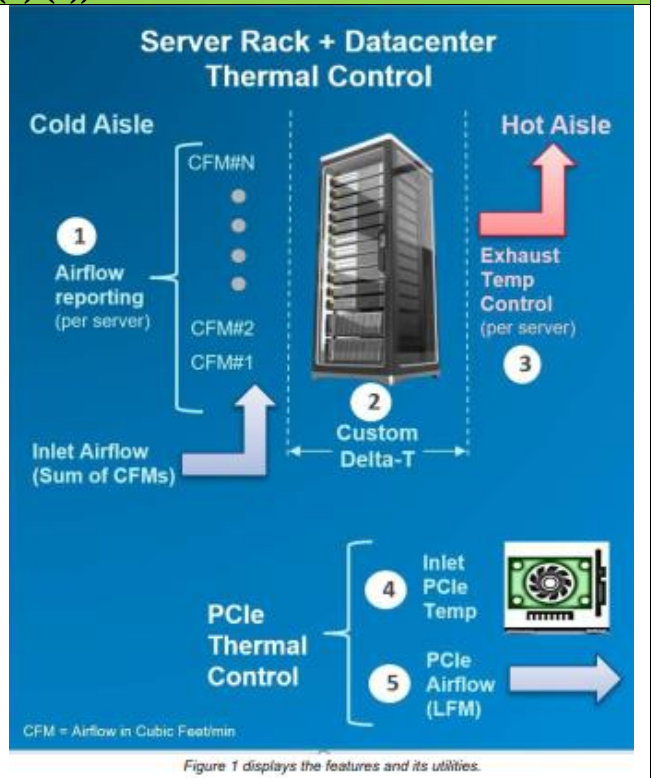
     NOTE: One exception to above statement is for fan speeds that are added for 3rd Party PCIe cards. The thermal algorithm provision airflow for 3rd party cards may be more or less than the actual card cooling needs and customer may fine tune the response for the card by entering the LFM corresponding to the 3rd Party Card.
  2. Custom Exhaust Temperature option limits exhaust temperature to customer desired settings.

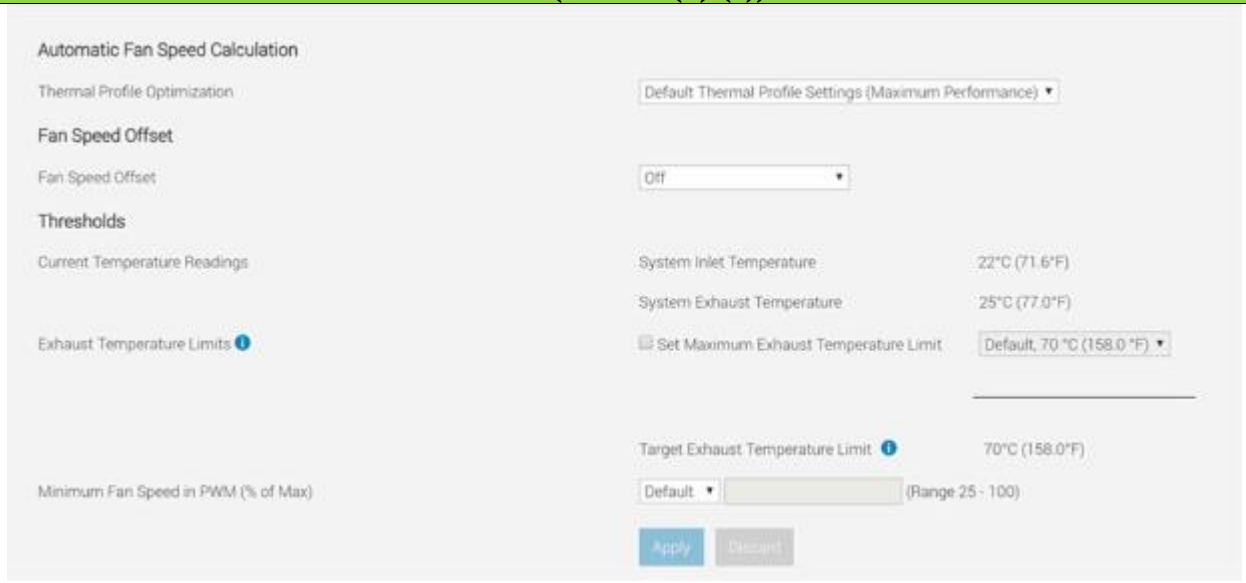
     NOTE: It is important to note that with certain configurations and workloads, it may not be physically possible to reduce exhaust below a desired set point (e.g. Custom exhaust setting of 45C with a high inlet temp (e.g. 30C) and a loaded config (high system power consumption, low airflow)).
  3. Sound Cap option is new in the 14th generation of PowerEdge server. It limits CPU power consumption and controls fan speed and acoustical ceiling. This is unique for acoustical deployments and may result in reduced system performance.

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User's Guide, 201-202; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Viewing historical temperature data** You can monitor the percentage of time the system has operated at ambient temperature that is greater than the normally supported fresh air temperature threshold. The system board temperature sensor reading is collected over a period of time to monitor the temperature. The data collection starts when the system is first powered on after it is shipped from the factory. The data is collected and displayed for the duration when the system is powered on. You can track and store the monitored temperature for the last seven years. **NOTE:** You can track the temperature history even for systems that are not Fresh-Air compliant. However, the threshold limits and fresh air related warnings generated are based on fresh air supported limits. The limits are 42ºC for warning and 47ºC for critical. These values correspond to 40ºC and 45ºC fresh air limits with 2ºC margin for accuracy. Two fixed temperature bands are tracked that are associated to fresh air limits: • Warning band — Consists of the duration a system has operated above the temperature sensor warning threshold (42ºC). The system can operate in the warning band for 10% of the time for 12 months. • Critical band — Consists of the duration a system has operated above the temperature sensor critical threshold (47ºC). The system can operate in the critical band for 1% of the time for 12 months which also increments time in the warning band. The collected data is represented in a graphical format to track the 10% and 1% levels. The logged temperature data can be cleared only before shipping from the factory. An event is generated if the system continues to operate above the normally supported temperature threshold for a specified operational time. If the average temperature over the specified operational time is greater than or equal to the warning level (> = 8%) or the critical level (> = 0.8%), an event is logged in the Lifecycle Log and the corresponding SNMP trap is generated. The events are: • Warning event when the temperature was greater than the warning threshold for duration of 8% or more in the last 12 months. • Critical event when the temperature was greater than the warning threshold for duration of 10% or more in the last 12 months. • Warning event when the temperature was greater than the critical threshold for duration of 0.8% or more in the last 12 months. • Critical event when the temperature was greater than the critical threshold for duration of 1% or more in the last 12 months. You can also configure iDRAC to generate additional events. For more information, see the Setting alert recurrence event section. iDRAC User's Guide, 121; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 **Viewing historical temperature data using iDRAC web interface** To view historical temperature data: 1. In the iDRAC Web interface, go to **System** > **Overview** > **Cooling** > **Temperature overview**. The **Temperature overview** page is displayed. 2. See the **System Board Temperature Historical Data** section that provides a graphical display of the stored temperature (average and peak values) for the last day, last 30 days, and last year. For more information, see the *iDRAC Online Help*. **NOTE:** After an iDRAC firmware update or iDRAC reset, some temperature data may not be displayed in the graph. **NOTE:** WX3200 AMD GPU card currently doesnot support I2C interface for temperature sensors. Hence, temperature readings will not be available for this card from iDRAC interfaces. **Viewing historical temperature data using RACADM** To view historical data using RACADM, use the `inlettemphistory` command. For more information, see the *iDRAC RACADM CLI Guide* available at https://www.dell.com/idracmanuals. iDRAC User's Guide, 121; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). This is a software limitation that may require access to the underlying source code. Accordingly, pursuant to Paragraph 3(a)(i) of the Discovery Order, Cloud Byte may supplement these contentions with additional information after Dell's source code has been produced. In addition and/or in the alternative to literally infringing this claim element, the Accused Dell '632 Products also infringe under the doctrine of equivalents. The Accused Dell '632 Products are at least equivalent to and insubstantially different from the claimed limitation where an abnormality detection device comprises 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 to perform substantially the same function (e.g., storing the prior upper limits of temperature for the ICT equipment based on

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	utilization rate and intake air temperatures) in substantially the same way (e.g., recording the upper limit of temperature of the ICT equipment for each given utilization rate and intake air temperature), to achieve substantially the same result (e.g., having a database of prior upper limit of temperature for the ICT equipment based on a given utilization rate and intake air temperature that can be referenced in the future).
3[b] 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.	The Accused Dell ’632 Products include an estimating unit that 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. *See supra*, claim 3[a]. *See, e.g.*,

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Thermal Manage – Feature Overview Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits: • Optimize server-related power and cooling efficiencies across their datacenters. • Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience. • Provides a state-of-the-art PCIe cooling management dashboard. Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities. 1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. 2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. 3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. 4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. 5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.  *Figure 1 displays the features and its utilities.* iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Viewing sensor information The following sensors help to monitor the health of the managed system: • **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB). ⓘ **NOTE:** The Storage ROMB battery settings are available only if the system has a ROMB with a battery. • **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values. • **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure. • **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system. • **Intrusion** — Provides information about the chassis. • **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status. ⓘ **NOTE:** If there is only one power supply in the system, the power supply redundancy is set to **Disabled**. • **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM). ○ When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed. ○ If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted. ○ If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online. ○ During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off. ⓘ **NOTE:** If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC. ○ System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively. ⓘ **NOTE:** When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter. • **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value. • **Voltage** — Indicates the status and reading of the voltage sensors on various system components.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User’s Guide, 116; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x). **Configuring warning threshold for inlet temperature** You can modify the minimum and maximum warning threshold values for the system board inlet temperature sensor. If reset to default action is performed, the temperature thresholds are set to the default values. You must have Configure user privilege to set the warning threshold values for the inlet temperature sensor. https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Optimizing system performance and power consumption** The power required to cool a server can contribute a significant amount to the overall system power. Thermal control is the active management of system cooling through fan speed and system power management to make sure that the system is reliable while minimizing system power consumption, airflow, and system acoustic output. You can adjust the thermal control settings and optimize against the system performance and performance-per-Watt requirements. Using the iDRAC Web interface, RACADM, or the iDRAC Settings Utility, you can change the following thermal settings: • Optimize for performance • Optimize for minimum power • Set the maximum air exhaust temperature • Increase airflow through a fan offset, if required • Increase airflow through increasing minimum fan speed Following are the list of features in thermal management: • **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. • **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. • **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. • **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. • **PCIe Airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User's Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Modifying thermal settings using iDRAC web interface** To modify the thermal settings: 1. In the iDRAC Web interface, go to **Configuration** > **System Settings** > **Hardware Settings** > **Cooling Configuration**. 2. Specify the following: • **Thermal Profile Optimization** — Select the thermal profile: ○ **Default Thermal Profile Settings (Minimum Power)** — Implies that the thermal algorithm uses the same system profile settings that is defined under **System BIOS** > **System BIOS Settings** > **System Profile Settings** page. By default, this option is set to **Default Thermal Profile Settings**. You can also select a custom algorithm, which is independent of the BIOS profile. The options available are: ○ **Maximum Performance (Performance Optimized)** : ▪ Reduced probability of memory or CPU throttling. ▪ Increased probability of turbo mode activation. ▪ Generally, higher fan speeds at idle and stress loads. ○ **Minimum Power (Performance per Watt Optimized)**: ▪ Optimized for lowest system power consumption based on optimum fan power state. ▪ Generally, lower fan speeds at idle and stress loads. ○ **Sound Cap** — Sound Cap provides reduced acoustical output from a server at the expense of some performance. Enabling Sound Cap may include temporary deployment or evaluation of a server in an occupied space, but it should not be used during benchmarking or performance sensitive applications. **NOTE:** Selecting **Maximum Performance** or **Minimum Power**, overrides thermal settings associated to System Profile setting under **System BIOS** > **System BIOS Settings.System Profile Settings** page. • **Maximum Exhaust Temperature Limit** — From the drop-down menu, select the maximum exhaust air temperature. The values are displayed based on the system. The default value is **Default, 70°C (158 °F)**. This option allows the system fans speeds to change such that the exhaust temperature does not exceed the selected exhaust temperature limit. This cannot always be guaranteed under all system operating conditions due to dependency on system load and system cooling capability. iDRAC User's Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x);

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

	https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).
	
	• **Thresholds**
	  ○ **Maximum PCIe Inlet Temperature Limit** — Default value is 55°C. Select the lower temperature of 45°C for third party PCIe cards which require lower inlet temperature.
	  ○ **Exhaust Temperature Limits** — By modifying the values for the following you can set the exhaust temperature limits:
	  ▪ **Set Maximum Exhaust Temperature Limit**
	  ▪ **Set Air Temperature Rise Limit**
	  ○ **Minimum Fan Speed in PWM (% of Max)** — Select this option to fine tune the fan speed. Using this option, you can set a higher baseline system fan speed or increase the system fan speed if other custom fan speed options are not resulting in the required higher fan speeds.
	  ▪ **Default** — Sets minimum fan speed to default value as determined by the system cooling algorithm.
	  ▪ **Custom** — Enter the percentage by which you want to change the fan speed. Range is between 9-100.
	
	The allowable range for minimum fan speed PWM is dynamic based on the system configuration. The first value is the idle speed and the second value is the configuration max (Depending on the system configuration, the maximum speed may be up to 100%.).
	
	System fans can run higher than this speed as per thermal requirements of the system but not lower than the defined minimum speed. For example, setting Minimum Fan Speed at 35% limits the fan speed to never go lower than 35% PWM.
	
	NOTE: 0% PWM does not indicate fan is off. It is the lowest fan speed that the fan can achieve.
	
	The settings are persistent, which means that once they are set and applied, they do not automatically change to the default setting during system reboot, power cycling, iDRAC, or BIOS updates. The custom cooling options may not be supported on all servers. If the options are not supported, they are not displayed or you cannot provide a custom value.
	
	iDRAC User's Guide, 65; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

Multi-Vector Cooling

Multi-Vector Cooling implements multi-prong approach to Thermal Controls in Dell EMC Server Platforms. You can configure multi-vector cooling options through iDRAC web interface by navigating to **Configuration** > **System Settings** > **Hardware Settings** > **Fan Configuration**. It includes (but not limited to):

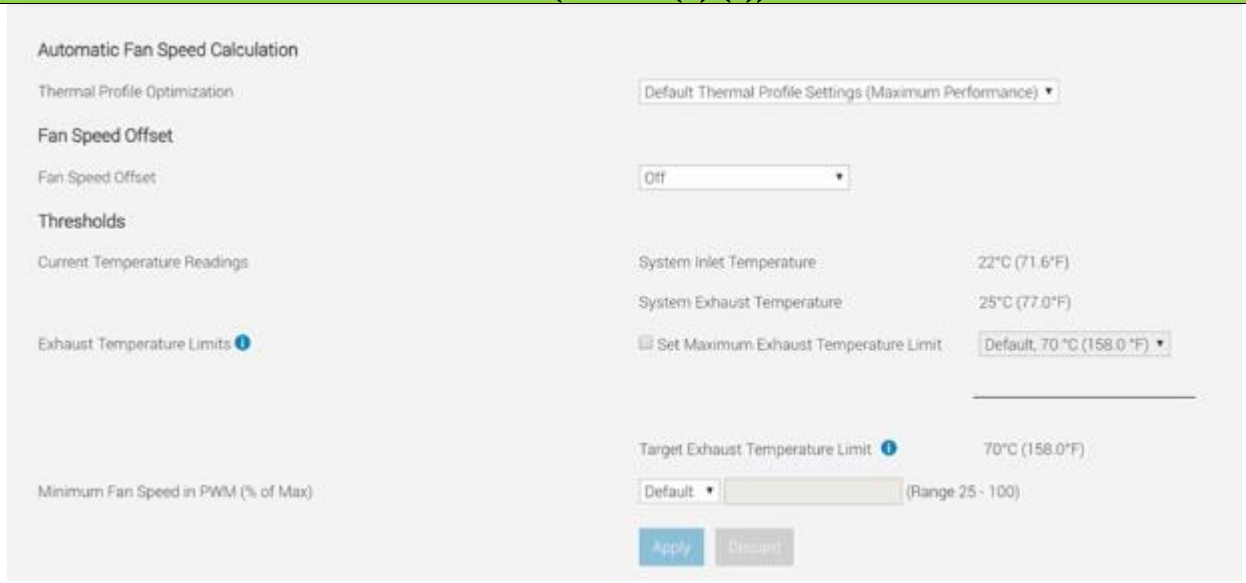
- Large set of sensors (thermal, power, inventory etc.) that allows accurate interpretation of real-time system thermal state at various locations within the server. It displays only a small subset of sensors that are relevant to users need based on the configuration.
- Intelligent and adaptive closed loop control algorithm optimizes fan response to maintain component temperatures. It also conserves fan power, airflow consumption, and acoustics.

- Using fan zone mapping, cooling can be initiated for the components when it requires. Thus, it results maximum performance without compromising the efficiency of power utilization.
- Accurate representation of slot by slot PCIe airflow in terms of LFM metric (Linear Feet per Minute - an accepted industry standard on how PCIe card airflow requirement is specified). Display of this metric in various iDRAC interfaces allows user to:
  1. know the maximum LFM capability of each slot within the server.
  2. know what approach is being taken for PCIe cooling for each slot (airflow controlled, temperature controlled).
  3. know the minimum LFM being delivered to a slot, if the card is a 3rd Party Card (user defined custom card).
  4. dial in custom minimum LFM value for the 3rd Party Card allowing more accurate definition of the card cooling needs for which the user is better aware of through their custom card specification.
- Displays real-time system airflow metric (CFM, cubic feet per minute) in various iDRAC interfaces to the user to enable datacenter airflow balancing based on aggregation of per server CFM consumption.
- Allows custom thermal settings like Thermal Profiles (Maximum Performance vs. Maximum Performance per Watt, Sound Cap), custom fan speed options (minimum fan speed, fan speed offsets) and custom Exhaust Temperature settings.
  1. Most of these settings allow additional cooling over the baseline cooling generated by thermal algorithms and do not allow fan speeds to go below system cooling requirements.

     NOTE: One exception to above statement is for fan speeds that are added for 3rd Party PCIe cards. The thermal algorithm provision airflow for 3rd party cards may be more or less than the actual card cooling needs and customer may fine tune the response for the card by entering the LFM corresponding to the 3rd Party Card.
  2. Custom Exhaust Temperature option limits exhaust temperature to customer desired settings.

     NOTE: It is important to note that with certain configurations and workloads, it may not be physically possible to reduce exhaust below a desired set point (e.g. Custom exhaust setting of 45C with a high inlet temp {e.g. 30C} and a loaded config {high system power consumption, low airflow}).
  3. Sound Cap option is new in the 14th generation of PowerEdge server. It limits CPU power consumption and controls fan speed and acoustical ceiling. This is unique for acoustical deployments and may result in reduced system performance.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User’s Guide, 201-202; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). This is a software limitation that may require access to the underlying source code. Accordingly, pursuant to Paragraph 3(a)(i) of the Discovery Order, Cloud Byte may supplement these contentions with additional information after Dell’s source code has been produced. In addition and/or in the alternative to literally infringing this claim element, the Accused Dell ’632 Products also infringe under the doctrine of equivalents. The Accused Dell ’632 Products are at least equivalent to and insubstantially different from the claimed limitation where 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 to perform substantially the same function (e.g., ascertaining the upper limit of temperature for the ICT equipment based on a given utilization rate and intake air temperature) in substantially the same way (e.g., searching in the database of previously recorded upper limit of temperature for the ICT equipment based on a given utilization rate and intake air temperature), to achieve substantially the same result (e.g., identifying a threshold temperature in which the ICT equipment should not exceed).
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 Accused Dell ’632 Products include an operational status detecting unit configured to detect a load on a CPU mounted in the ICT equipment as an operational status of the ICT equipment. *See supra*, claim 1. *See, e.g.*,

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Viewing sensor information The following sensors help to monitor the health of the managed system: • **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB). ⓘ **NOTE:** The Storage ROMB battery settings are available only if the system has a ROMB with a battery. • **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values. • **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure. • **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system. • **Intrusion** — Provides information about the chassis. • **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status. ⓘ **NOTE:** If there is only one power supply in the system, the power supply redundancy is set to **Disabled**. • **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM). ○ When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed. ○ If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted. ○ If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online. ○ During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off. ⓘ **NOTE:** If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC. ○ System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively. ⓘ **NOTE:** When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter. • **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value. • **Voltage** — Indicates the status and reading of the voltage sensors on various system components.

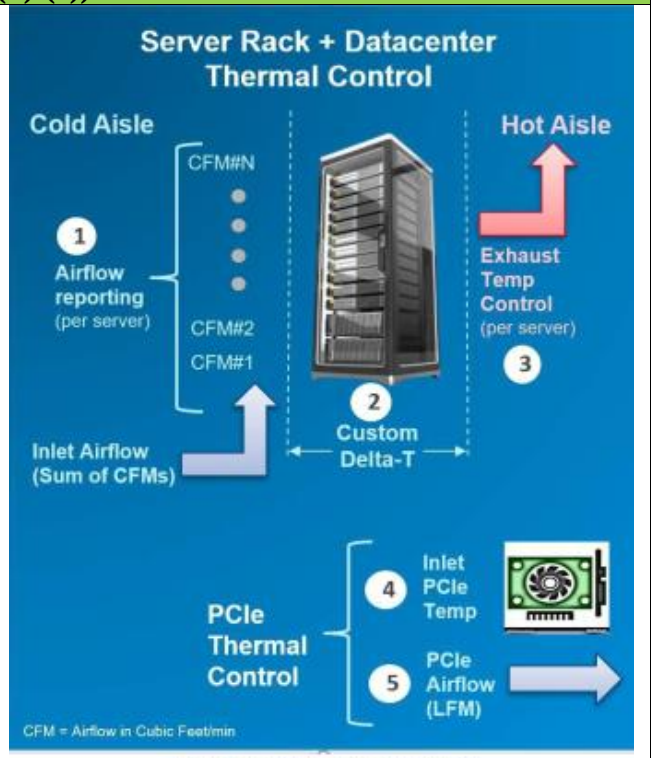
’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User’s Guide, 116; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x). **Optimizing system performance and power consumption** The power required to cool a server can contribute a significant amount to the overall system power. Thermal control is the active management of system cooling through fan speed and system power management to make sure that the system is reliable while minimizing system power consumption, airflow, and system acoustic output. You can adjust the thermal control settings and optimize against the system performance and performance-per-Watt requirements. Using the iDRAC Web interface, RACADM, or the iDRAC Settings Utility, you can change the following thermal settings: • Optimize for performance • Optimize for minimum power • Set the maximum air exhaust temperature • Increase airflow through a fan offset, if required • Increase airflow through increasing minimum fan speed Following are the list of features in thermal management: • **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. • **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. • **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. • **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. • **PCIe Airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards. iDRAC User’s Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

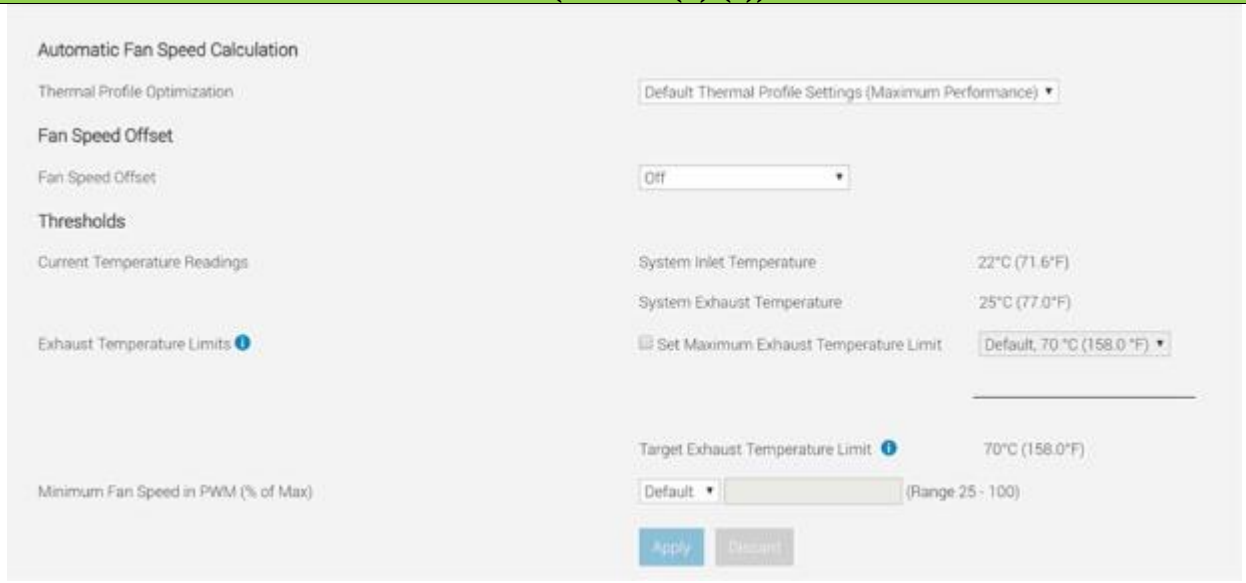
'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Monitoring performance index of CPU, memory, and input output modules In Dell's 14th generation Dell PowerEdge servers, Intel ME supports Compute Usage Per Second (CUPS) functionality. The CUPS functionality provides real-time monitoring of CPU, memory, and I/O utilization and system-level utilization index for the system. Intel ME allows out-of-band (OOB) performance monitoring and does not consume CPU resources. The Intel ME has a system CUPS sensor that provides computation, memory, and I/O resource utilization values as a CUPS Index. iDRAC monitors this CUPS index for the overall system utilization and also monitors the instantaneous utilization index of the CPU, Memory, and I/O. The CPU and chipset have dedicated Resource monitoring Counters (RMC). The data from these RMCs is queried to obtain utilization information of system resources. The data from RMCs is aggregated by the node manager to measure the cumulative utilization of each of these system resources that is read from iDRAC using existing intercommunication mechanisms to provide data through out-of-band management interfaces. The Intel sensor representation of performance parameters and index values is for complete physical system. Therefore, the performance data representation on the interfaces is for the complete physical system, even if the system is virtualized and has multiple virtual hosts. To display the performance parameters, the supported sensors must be present in the server. The four system utilization parameters are: • **CPU Utilization** — Data from RMCs for each CPU core is aggregated to provide cumulative utilization of all the cores in the system. This utilization is based on time spent in active and inactive states. A sample of RMC is taken every six seconds. • **Memory Utilization** — RMCs measure memory traffic occurring at each memory channel or memory controller instance. Data from these RMCs is aggregated to measure the cumulative memory traffic across all the memory channels on the system. This is a measure of memory bandwidth consumption and not amount of memory utilization. iDRAC aggregates it for one minute, so it may or may not match the memory utilization that other OS tools, such as **top** in Linux, show. Memory bandwidth utilization that the iDRAC shows is an indication of whether workload is memory intensive or not. • **I/O Utilization** — There is one RMC per root port in the PCI Express Root Complex to measure PCI Express traffic emanating from or directed to that root port and the lower segment. Data from these RMCs is aggregated for measuring PCI express traffic for all PCI Express segments emanating from the package. This is measure of I/O bandwidth utilization for the system. • **System Level CUPS Index** — The CUPS index is calculated by aggregating CPU, Memory, and I/O index considering a predefined load factor of each system resource. The load factor depends on the nature of the workload on the system. CUPS Index represents the measurement of the compute headroom available on the server. If the system has a large CUPS Index, then there is limited headroom to place more workload on that system. As the resource consumption decreases, the system's CUPS index decreases. A low CUPS index indicates that there is a large compute headroom and the server can receive new workloads and the server is in a lower power state to reduce power consumption. Workload monitoring can then be applied throughout the data center to provide a high-level and holistic view of the data center's workload, providing a dynamic data center solution.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User’s Guide, 117-118; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). This is a software limitation that may require access to the underlying source code. Accordingly, pursuant to Paragraph 3(a)(i) of the Discovery Order, Cloud Byte may supplement these contentions with additional information after Dell’s source code has been produced.
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 Accused Dell ’632 Products include an operational status detecting unit configured to detect power consumption of the ICT equipment as an operational status of the ICT equipment. *See supra*, claim 1. *See, e.g.*,

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Optimizing system performance and power consumption The power required to cool a server can contribute a significant amount to the overall system power. Thermal control is the active management of system cooling through fan speed and system power management to make sure that the system is reliable while minimizing system power consumption, airflow, and system acoustic output. You can adjust the thermal control settings and optimize against the system performance and performance-per-Watt requirements. Using the iDRAC Web interface, RACADM, or the iDRAC Settings Utility, you can change the following thermal settings: • Optimize for performance • Optimize for minimum power • Set the maximum air exhaust temperature • Increase airflow through a fan offset, if required • Increase airflow through increasing minimum fan speed Following are the list of features in thermal management: • **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. • **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. • **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. • **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. • **PCIe Airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards. iDRAC User’s Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Monitoring power iDRAC monitors the power consumption in the system continuously and displays the following power values: • Power consumption warning and critical thresholds. • Cumulative power, peak power, and peak amperage values. • Power consumption over the last hour, last day or last week. • Average, minimum, and maximum power consumption. • Historical peak values and peak timestamps. • Peak headroom and instantaneous headroom values (for rack and tower servers). iDRAC User’s Guide, 197; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). This is a software limitation that may require access to the underlying source code. Accordingly, pursuant to Paragraph 3(a)(i) of the Discovery Order, Cloud Byte may supplement these contentions with additional information after Dell’s source code has been produced.
7. The abnormality detection device according to claim 1, wherein the temperature sensor is configured to detect a temperature of exhaust air.	The Accused ’632 Products include a temperature sensor configured to detect a temperature of exhaust air. *See supra*, claim 1. *See, e.g.*,

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Thermal Manage – Feature Overview Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits: • Optimize server-related power and cooling efficiencies across their datacenters. • Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience. • Provides a state-of-the-art PCIe cooling management dashboard. Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities. 1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. 2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. 3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. 4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. 5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.  *Figure 1 displays the features and its utilities.* iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 iDRAC Thermal Manage Features.

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Viewing sensor information The following sensors help to monitor the health of the managed system: • **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB). ⓘ **NOTE:** The Storage ROMB battery settings are available only if the system has a ROMB with a battery. • **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values. • **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure. • **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system. • **Intrusion** — Provides information about the chassis. • **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status. ⓘ **NOTE:** If there is only one power supply in the system, the power supply redundancy is set to **Disabled**. • **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM). ○ When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed. ○ If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted. ○ If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online. ○ During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off. ⓘ **NOTE:** If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC. ○ System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively. ⓘ **NOTE:** When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter. • **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value. • **Voltage** — Indicates the status and reading of the voltage sensors on various system components. iDRAC User's Guide, 116; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x);

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x). **Modifying thermal settings using iDRAC web interface** To modify the thermal settings: 1. In the iDRAC Web interface, go to **Configuration** > **System Settings** > **Hardware Settings** > **Cooling Configuration**. 2. Specify the following: • **Thermal Profile Optimization** — Select the thermal profile: ○ **Default Thermal Profile Settings (Minimum Power)** — Implies that the thermal algorithm uses the same system profile settings that is defined under **System BIOS** > **System BIOS Settings** > **System Profile Settings** page. By default, this option is set to **Default Thermal Profile Settings**. You can also select a custom algorithm, which is independent of the BIOS profile. The options available are: ○ **Maximum Performance (Performance Optimized)** : ▪ Reduced probability of memory or CPU throttling. ▪ Increased probability of turbo mode activation. ▪ Generally, higher fan speeds at idle and stress loads. ○ **Minimum Power (Performance per Watt Optimized)**: ▪ Optimized for lowest system power consumption based on optimum fan power state. ▪ Generally, lower fan speeds at idle and stress loads. ○ **Sound Cap** — Sound Cap provides reduced acoustical output from a server at the expense of some performance. Enabling Sound Cap may include temporary deployment or evaluation of a server in an occupied space, but it should not be used during benchmarking or performance sensitive applications. **NOTE:** Selecting **Maximum Performance** or **Minimum Power**, overrides thermal settings associated to System Profile setting under **System BIOS** > **System BIOS Settings.System Profile Settings** page. • **Maximum Exhaust Temperature Limit** — From the drop-down menu, select the maximum exhaust air temperature. The values are displayed based on the system. The default value is **Default, 70°C (158 °F)**. This option allows the system fans speeds to change such that the exhaust temperature does not exceed the selected exhaust temperature limit. This cannot always be guaranteed under all system operating conditions due to dependency on system load and system cooling capability. iDRAC User’s Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

	• **Thresholds**
	  ○ **Maximum PCIe Inlet Temperature Limit** — Default value is 55°C. Select the lower temperature of 45°C for third party PCIe cards which require lower inlet temperature.
	  ○ **Exhaust Temperature Limits** — By modifying the values for the following you can set the exhaust temperature limits:
	  ▪ **Set Maximum Exhaust Temperature Limit**
	  ▪ **Set Air Temperature Rise Limit**
	  ○ **Minimum Fan Speed in PWM (% of Max)** — Select this option to fine tune the fan speed. Using this option, you can set a higher baseline system fan speed or increase the system fan speed if other custom fan speed options are not resulting in the required higher fan speeds.
	  ▪ **Default** — Sets minimum fan speed to default value as determined by the system cooling algorithm.
	  ▪ **Custom** — Enter the percentage by which you want to change the fan speed. Range is between 9-100.
	The allowable range for minimum fan speed PWM is dynamic based on the system configuration. The first value is the idle speed and the second value is the configuration max (Depending on the system configuration, the maximum speed may be up to 100%.).
	System fans can run higher than this speed as per thermal requirements of the system but not lower than the defined minimum speed. For example, setting Minimum Fan Speed at 35% limits the fan speed to never go lower than 35% PWM.
	ⓘ **NOTE:** 0% PWM does not indicate fan is off. It is the lowest fan speed that the fan can achieve.
	The settings are persistent, which means that once they are set and applied, they do not automatically change to the default setting during system reboot, power cycling, iDRAC, or BIOS updates. The custom cooling options may not be supported on all servers. If the options are not supported, they are not displayed or you cannot provide a custom value.
	iDRAC User’s Guide, 65; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).
	
	This is a software limitation that may require access to the underlying source code. Accordingly, pursuant to Paragraph 3(a)(i) of the Discovery Order, Cloud Byte may supplement these contentions with additional information after Dell’s source code has been produced.

8[pre] An Information and Communication Technology (ICT)	The Accused Dell ’632 Products include an information and communication technology (“ICT”) equipment including a cooling fan.

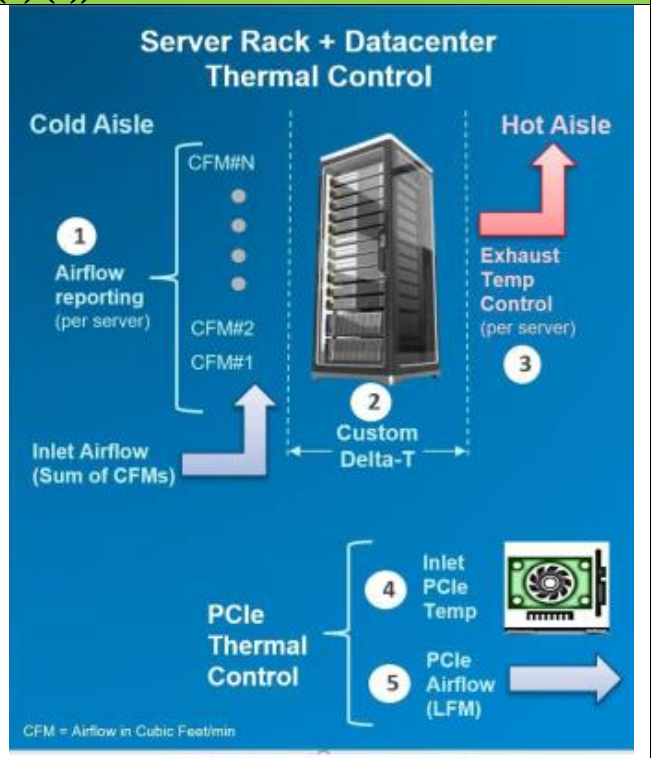
’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
equipment including a cooling fan, comprising:	For example, a Dell PowerEdge server is an information and communication technology equipment including a cooling fan. *See, e.g.*,  PowerEdge R6615 Powerful performance per investment dollar The new Dell PowerEdge R6615 is a 1U, single-socket rack server. Designed to be the best investment per dollar for your data center, this server provides performance and flexible, low-latency storage options in an air or Direct Liquid Cooling (DLC) configuration. Fans • Standard (STD) fans/High performance GOLD (VHP) fans • Up to 4 sets (dual fan module) hot plug fans R6615 Spec Sheet, 1-2.
8[a] an operational status detecting unit configured to detect an operational status of the ICT equipment;	The Accused Dell ’632 Products include an operational status detecting unit configured to detect an operational status of the ICT equipment. *See supra*, claim 8[pre]. *See, e.g.*,

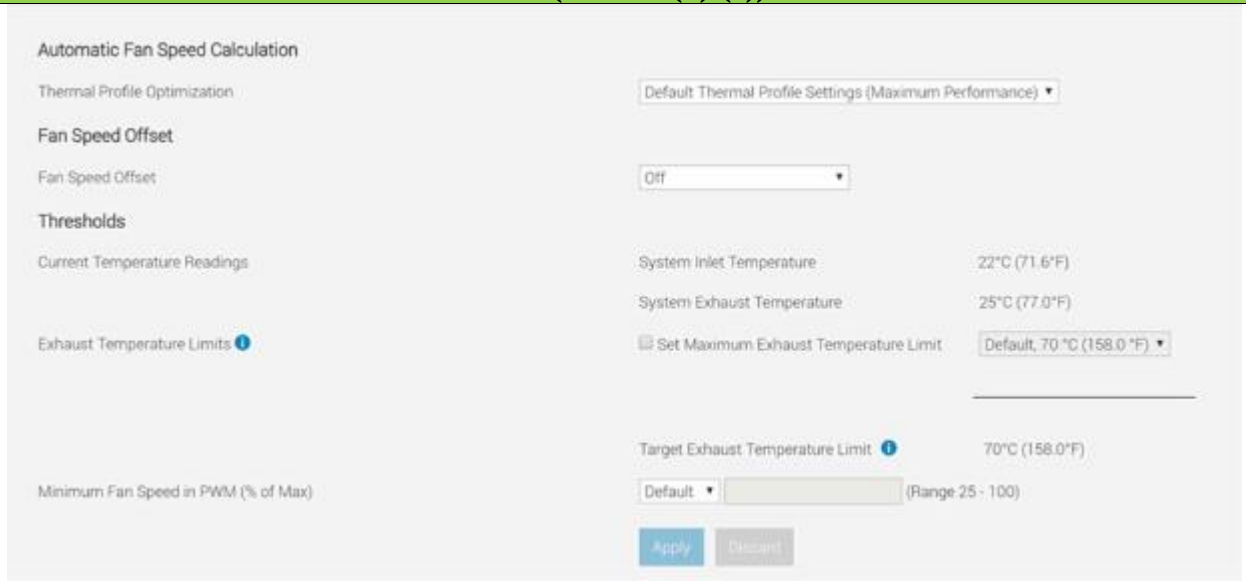
'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

iDRAC9 Features and Benefits

Features	Benefits
Telemetry Streaming	Perform deep analysis of server telemetry including CPU, GPU, SFP IO, power, thermals storage, networking, memory and more. Requires iDRAC9 Datacenter license.
Thermal Manage	Customize thermal and airflow management at the rack and server level. Requires iDRAC9 Datacenter license.
Automatic Certificate Enrollment	Automatic SSL certificate enrollment and renewal of the iDRAC self-signed certificated with a trusted CA certificate. Requires iDRAC9 Datacenter license.
Zero touch deployment and provisioning	Automatically configure PowerEdge servers when they are initially connected to your network. This process uses a Server Configuration Profile to set hardware, update firmware, and install OS. Requires iDRAC9 Enterprise or Datacenter license.
Virtual Clipboard	Provides an easy to enter complex passwords and more in the HTML5 vConsole. Users can copy text/passwords to local clipboard and paste into remote console view. Requires iDRAC9 Datacenter license.
Connection View	iDRAC sends standard LLDP packets to external switches, which provides the option to discover iDRACs on the network. iDRAC sends two types of LLDP packets to the outbound network; Topology and Discovery. Also, iDRAC can also display switch and port information.
System Lockdown	Helps to prevent configuration or firmware changes to a server when using Dell tools and even vendor tools for selected network cards. Requires iDRAC Enterprise or Datacenter License.
RSA SecurID 2FA	Add the RSA SecurID client software into iDRAC to provide native support for RSA 2FA solutions. Requires Datacenter license.
DRAC RESTful API	With this API, iDRAC enables support for the Redfish standard and enhances it with Dell extensions.
Cipher Select	Cipher Select is an advanced user setting where the user can choose to block undesired ciphers negotiated by iDRAC, providing increased security.
Secured Component Verification	Secured Component Verification (SCV) is a Supply chain assurance offering that enables Dell customers to verify that a PowerEdge server received by the customer matches what was manufactured in the factory.
System Erase	With proper authentication, administrators can securely erase data from local storage (HDDs, SSDs, NVMes).
iDRAC Direct	Secure front-panel USB connection to iDRAC web interface, which eliminates the need for crash carts or a trip to the hot aisle of your data center. You can use the same port to insert a USB key to upload new system profile for secure, rapid system configuration.

iDRAC Solution Brief, 2.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Thermal Manage – Feature Overview Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits: • Optimize server-related power and cooling efficiencies across their datacenters. • Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience. • Provides a state-of-the-art PCIe cooling management dashboard. Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities. 1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. 2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. 3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. 4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. 5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.  *Figure 1 displays the features and its utilities.* iDRAC Thermal Manage Features.

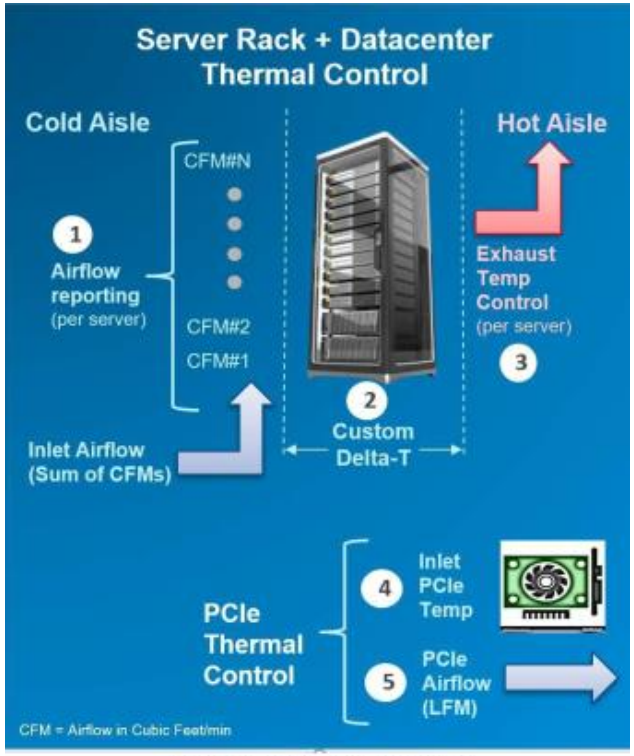
’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 iDRAC Thermal Manage Features.

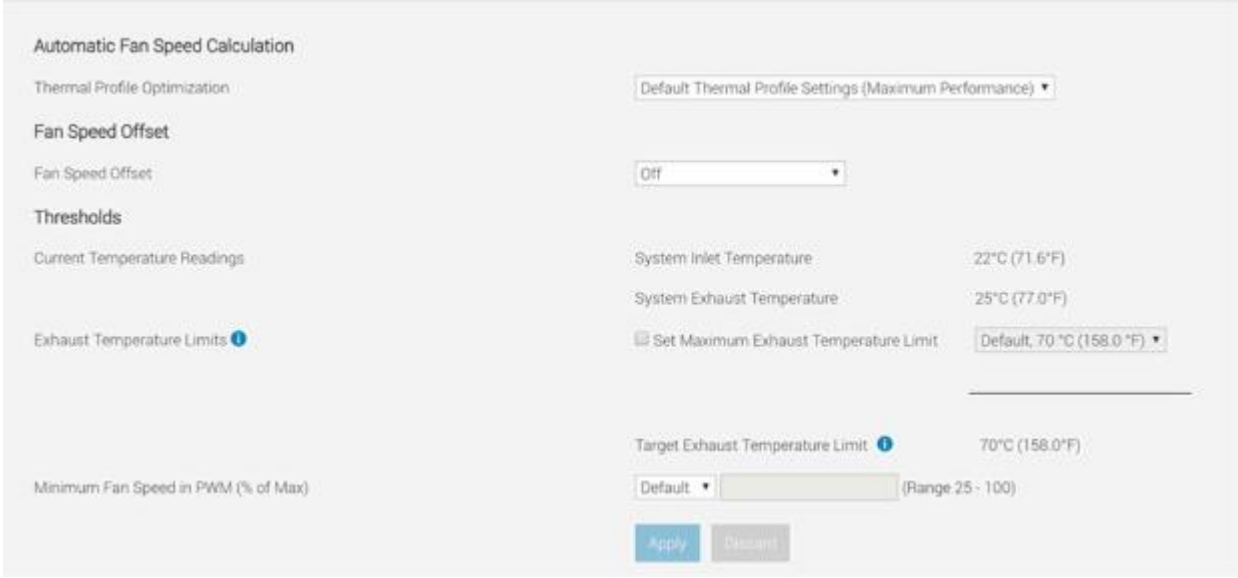
’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Viewing sensor information The following sensors help to monitor the health of the managed system: • **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB). ⓘ **NOTE:** The Storage ROMB battery settings are available only if the system has a ROMB with a battery. • **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values. • **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure. • **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system. • **Intrusion** — Provides information about the chassis. • **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status. ⓘ **NOTE:** If there is only one power supply in the system, the power supply redundancy is set to **Disabled**. • **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM). ○ When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed. ○ If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted. ○ If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online. ○ During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off. ⓘ **NOTE:** If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC. ○ System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively. ⓘ **NOTE:** When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter. • **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value. • **Voltage** — Indicates the status and reading of the voltage sensors on various system components.

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User's Guide, 116; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x). **Configuring warning threshold for inlet temperature** You can modify the minimum and maximum warning threshold values for the system board inlet temperature sensor. If reset to default action is performed, the temperature thresholds are set to the default values. You must have Configure user privilege to set the warning threshold values for the inlet temperature sensor. https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Optimizing system performance and power consumption** The power required to cool a server can contribute a significant amount to the overall system power. Thermal control is the active management of system cooling through fan speed and system power management to make sure that the system is reliable while minimizing system power consumption, airflow, and system acoustic output. You can adjust the thermal control settings and optimize against the system performance and performance-per-Watt requirements. Using the iDRAC Web interface, RACADM, or the iDRAC Settings Utility, you can change the following thermal settings: • Optimize for performance • Optimize for minimum power • Set the maximum air exhaust temperature • Increase airflow through a fan offset, if required • Increase airflow through increasing minimum fan speed Following are the list of features in thermal management: • **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. • **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. • **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. • **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. • **PCIe Airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User's Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Monitoring performance index of CPU, memory, and input output modules** In Dell's 14th generation Dell PowerEdge servers, Intel ME supports Compute Usage Per Second (CUPS) functionality. The CUPS functionality provides real-time monitoring of CPU, memory, and I/O utilization and system-level utilization index for the system. Intel ME allows out-of-band (OOB) performance monitoring and does not consume CPU resources. The Intel ME has a system CUPS sensor that provides computation, memory, and I/O resource utilization values as a CUPS Index. iDRAC monitors this CUPS index for the overall system utilization and also monitors the instantaneous utilization index of the CPU, Memory, and I/O. The CPU and chipset have dedicated Resource monitoring Counters (RMC). The data from these RMCs is queried to obtain utilization information of system resources. The data from RMCs is aggregated by the node manager to measure the cumulative utilization of each of these system resources that is read from iDRAC using existing intercommunication mechanisms to provide data through out-of-band management interfaces. The Intel sensor representation of performance parameters and index values is for complete physical system. Therefore, the performance data representation on the interfaces is for the complete physical system, even if the system is virtualized and has multiple virtual hosts. To display the performance parameters, the supported sensors must be present in the server. The four system utilization parameters are: • **CPU Utilization** — Data from RMCs for each CPU core is aggregated to provide cumulative utilization of all the cores in the system. This utilization is based on time spent in active and inactive states. A sample of RMC is taken every six seconds. • **Memory Utilization** — RMCs measure memory traffic occurring at each memory channel or memory controller instance. Data from these RMCs is aggregated to measure the cumulative memory traffic across all the memory channels on the system. This is a measure of memory bandwidth consumption and not amount of memory utilization. iDRAC aggregates it for one minute, so it may or may not match the memory utilization that other OS tools, such as **top** in Linux, show. Memory bandwidth utilization that the iDRAC shows is an indication of whether workload is memory intensive or not. • **I/O Utilization** — There is one RMC per root port in the PCI Express Root Complex to measure PCI Express traffic emanating from or directed to that root port and the lower segment. Data from these RMCs is aggregated for measuring PCI express traffic for all PCI Express segments emanating from the package. This is measure of I/O bandwidth utilization for the system.

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	• **System Level CUPS Index** — The CUPS index is calculated by aggregating CPU, Memory, and I/O index considering a predefined load factor of each system resource. The load factor depends on the nature of the workload on the system. CUPS Index represents the measurement of the compute headroom available on the server. If the system has a large CUPS Index, then there is limited headroom to place more workload on that system. As the resource consumption decreases, the system's CUPS index decreases. A low CUPS index indicates that there is a large compute headroom and the server can receive new workloads and the server is in a lower power state to reduce power consumption. Workload monitoring can then be applied throughout the data center to provide a high-level and holistic view of the data center's workload, providing a dynamic data center solution. iDRAC User's Guide, 117-118; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Monitoring power** iDRAC monitors the power consumption in the system continuously and displays the following power values: • Power consumption warning and critical thresholds. • Cumulative power, peak power, and peak amperage values. • Power consumption over the last hour, last day or last week. • Average, minimum, and maximum power consumption. • Historical peak values and peak timestamps. • Peak headroom and instantaneous headroom values (for rack and tower servers). iDRAC User's Guide, 197; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). This is a software limitation that may require access to the underlying source code. Accordingly, pursuant to Paragraph 3(a)(i) of the Discovery Order, Cloud Byte may supplement these contentions with additional information after Dell's source code has been produced.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
8[b] an intake-air temperature sensor configured to detect an intake air temperature of intake air of the ICT equipment;	The Accused Dell ’632 Products include an intake-air temperature sensor configured to detect an intake air temperature of intake air of the ICT equipment. *See supra*, claim 8[a]. *See, e.g.*, Thermal Manage – Feature Overview Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits: • Optimize server-related power and cooling efficiencies across their datacenters. • Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience. • Provides a state-of-the-art PCIe cooling management dashboard. Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities. 1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. 2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. 3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. 4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. 5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.  *Figure 1 displays the features and its utilities.* iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Viewing sensor information The following sensors help to monitor the health of the managed system: • **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB). ⓘ **NOTE:** The Storage ROMB battery settings are available only if the system has a ROMB with a battery. • **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values. • **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure. • **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system. • **Intrusion** — Provides information about the chassis. • **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status. ⓘ **NOTE:** If there is only one power supply in the system, the power supply redundancy is set to **Disabled**. • **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM). ○ When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed. ○ If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted. ○ If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online. ○ During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off. ⓘ **NOTE:** If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC. ○ System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively. ⓘ **NOTE:** When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter. • **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value. • **Voltage** — Indicates the status and reading of the voltage sensors on various system components.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User’s Guide, 116; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x). **Configuring warning threshold for inlet temperature** You can modify the minimum and maximum warning threshold values for the system board inlet temperature sensor. If reset to default action is performed, the temperature thresholds are set to the default values. You must have Configure user privilege to set the warning threshold values for the inlet temperature sensor. https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).
8[c] an equipment temperature sensor configured to detect an equipment temperature in a predetermined position of the ICT equipment;	The Accused Dell ’632 Products include an equipment temperature sensor configured to detect an equipment temperature in a predetermined position of the ICT equipment. *See supra*, claim 8[b]. *See, e.g.*,

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

Thermal Manage – Feature Overview

Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits:

- Optimize server-related power and cooling efficiencies across their datacenters.
- Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience.
- Provides a state-of-the-art PCIe cooling management dashboard.

Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities.

1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level.
2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling.
3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs.
4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements.
5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.

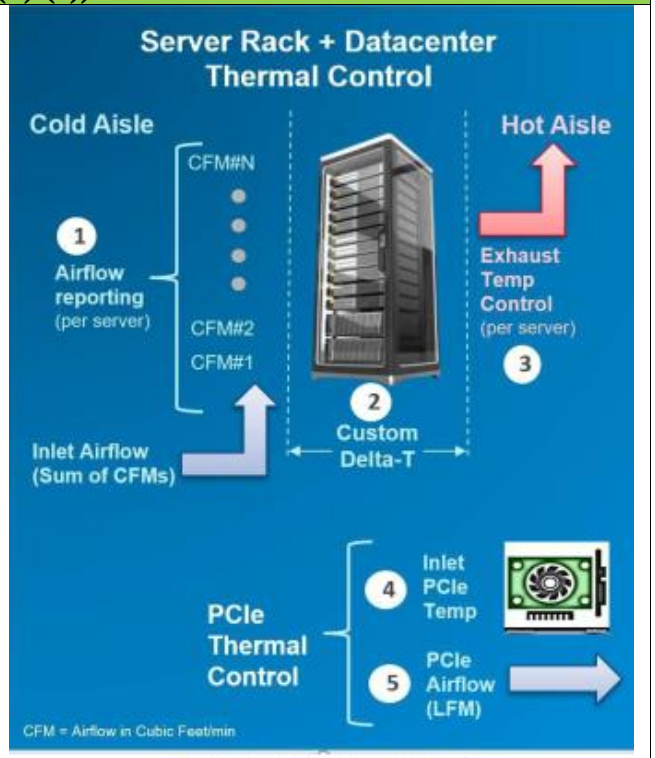
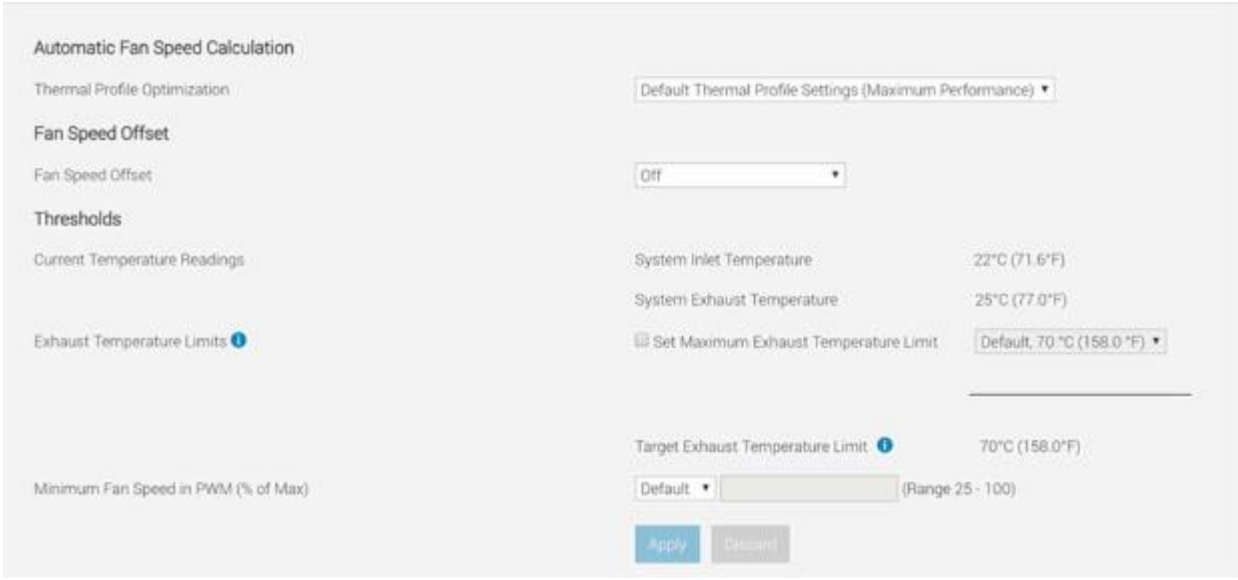


Figure 1 displays the features and its utilities.

iDRAC Thermal Manage Features.

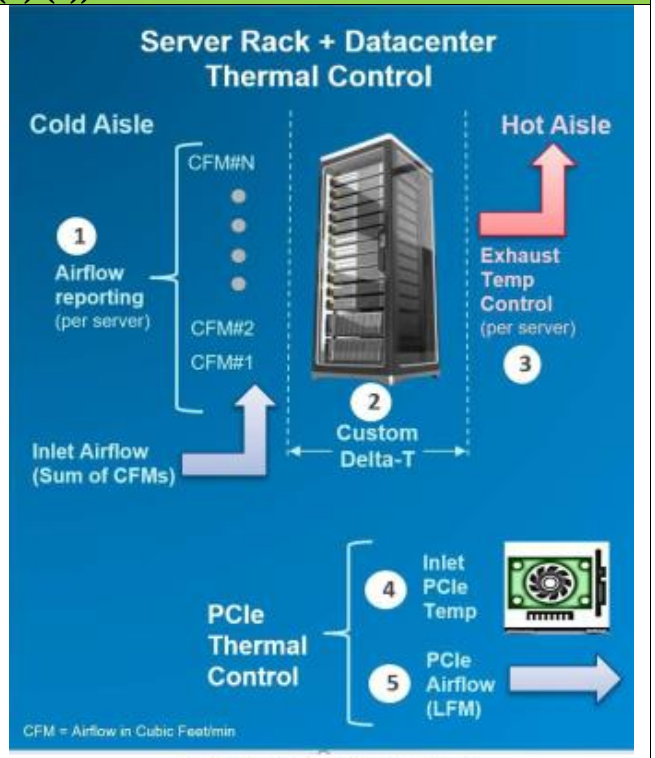
’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 iDRAC Thermal Manage Features.

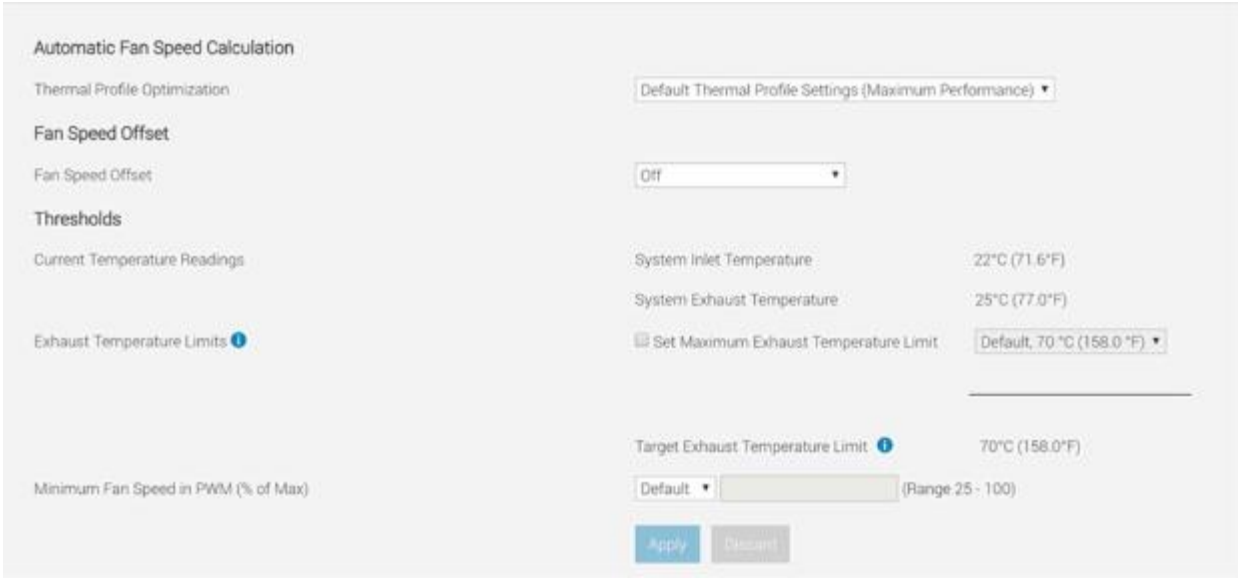
’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Viewing sensor information The following sensors help to monitor the health of the managed system: • **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB). ⓘ **NOTE:** The Storage ROMB battery settings are available only if the system has a ROMB with a battery. • **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values. • **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure. • **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system. • **Intrusion** — Provides information about the chassis. • **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status. ⓘ **NOTE:** If there is only one power supply in the system, the power supply redundancy is set to **Disabled**. • **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM). ○ When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed. ○ If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted. ○ If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online. ○ During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off. ⓘ **NOTE:** If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC. ○ System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively. ⓘ **NOTE:** When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter. • **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value. • **Voltage** — Indicates the status and reading of the voltage sensors on various system components.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User’s Guide, 116; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x). **Configuring warning threshold for inlet temperature** You can modify the minimum and maximum warning threshold values for the system board inlet temperature sensor. If reset to default action is performed, the temperature thresholds are set to the default values. You must have Configure user privilege to set the warning threshold values for the inlet temperature sensor. https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).
8[d] a hardware processor including:	The Accused Dell ’632 Products include a hardware processor. *See supra*, claims 1[a] and 8[c]. For example, iDRAC is a hardware controller embedded on a PowerEdge server motherboard. *See, e.g.*,

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 Full Access Management of PowerEdge Servers Modernize with Dell PowerEdge portfolio The integrated Dell Remote Access Controller (iDRAC) delivers advanced, agent-free local and remote server administration. The iDRAC provides a secure means to automate a multitude of management tasks. Given that iDRAC is embedded in every PowerEdge server, there's no additional software to install. Once iDRAC has been enabled, you will have a complete set of server management features at your fingertips. iDRAC Solution Brief, 1. The iDRAC controller is a piece of hardware integrated on the motherboard of the server, and as well as other BMC solutions, has its own processor, memory, network connection, and access to the system bus. The iDRAC provides remote access to the system console (keyboard and screen), allowing the system BIOS to be accessed over the Internet when the server is rebooted. Key features of iDRAC include power management, virtual media access, and remote console capabilities. These features give administrators the ability to configure a machine as if they were sitting in front of the local console. https://www.storagereview.com/review/dell-emc-idrac-9-and-lifecycle-controller-review (“iDRAC Review”); *see also* https://www.dell.com/support/kbdoc/en-us/000179517/dell-poweredge-how-to-configure-the-idrac-system-management-options-on-servers.
8[e] an operational status detecting unit configured to	The Accused Dell ’632 Products include an operational status detecting unit configured to detect an operational status of the ICT equipment.

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
detect an operational status of the ICT equipment;	*See supra*, claims 1[b] and 8[d]. *See, e.g.*, **iDRAC9 Features and Benefits** Features / Benefits Telemetry Streaming — Perform deep analysis of server telemetry including CPU, GPU, SFP IO, power, thermals storage, networking, memory and more. Requires iDRAC9 Datacenter license. Thermal Manage — Customize thermal and airflow management at the rack and server level. Requires iDRAC9 Datacenter license. Automatic Certificate Enrollment — Automatic SSL certificate enrollment and renewal of the iDRAC self-signed certificated with a trusted CA certificate. Requires iDRAC9 Datacenter license. Zero touch deployment and provisioning — Automatically configure PowerEdge servers when they are initially connected to your network. This process uses a Server Configuration Profile to set hardware, update firmware, and install OS. Requires iDRAC9 Enterprise or Datacenter license. Virtual Clipboard — Provides an easy to enter complex passwords and more in the HTML5 vConsole. Users can copy text/passwords to local clipboard and paste into remote console view. Requires iDRAC9 Datacenter license. Connection View — iDRAC sends standard LLDP packets to external switches, which provides the option to discover iDRACs on the network. iDRAC sends two types of LLDP packets to the outbound network; Topology and Discovery. Also, iDRAC can also display switch and port information. System Lockdown — Helps to prevent configuration or firmware changes to a server when using Dell tools and even vendor tools for selected network cards. Requires iDRAC Enterprise or Datacenter License. RSA SecurID 2FA — Add the RSA SecurID client software into iDRAC to provide native support for RSA 2FA solutions. Requires Datacenter license. DRAC RESTful API — With this API, iDRAC enables support for the Redfish standard and enhances it with Dell extensions. Cipher Select — Cipher Select is an advanced user setting where the user can choose to block undesired ciphers negotiated by iDRAC, providing increased security. Secured Component Verification — Secured Component Verification (SCV) is a Supply chain assurance offering that enables Dell customers to verify that a PowerEdge server received by the customer matches what was manufactured in the factory. System Erase — With proper authentication, administrators can securely erase data from local storage (HDDs, SSDs, NVMes). iDRAC Direct — Secure front-panel USB connection to iDRAC web interface, which eliminates the need for crash carts or a trip to the hot aisle of your data center. You can use the same port to insert a USB key to upload new system profile for secure, rapid system configuration. iDRAC Solution Brief, 2.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Thermal Manage – Feature Overview Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits: • Optimize server-related power and cooling efficiencies across their datacenters. • Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience. • Provides a state-of-the-art PCIe cooling management dashboard. Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities. 1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. 2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. 3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. 4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. 5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.  *Figure 1 displays the features and its utilities.* iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Viewing sensor information The following sensors help to monitor the health of the managed system: • **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB). ⓘ **NOTE:** The Storage ROMB battery settings are available only if the system has a ROMB with a battery. • **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values. • **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure. • **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system. • **Intrusion** — Provides information about the chassis. • **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status. ⓘ **NOTE:** If there is only one power supply in the system, the power supply redundancy is set to **Disabled**. • **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM). ○ When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed. ○ If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted. ○ If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online. ○ During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off. ⓘ **NOTE:** If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC. ○ System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively. ⓘ **NOTE:** When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter. • **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value. • **Voltage** — Indicates the status and reading of the voltage sensors on various system components. iDRAC User’s Guide, 116; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x);

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x). **Configuring warning threshold for inlet temperature** You can modify the minimum and maximum warning threshold values for the system board inlet temperature sensor. If reset to default action is performed, the temperature thresholds are set to the default values. You must have Configure user privilege to set the warning threshold values for the inlet temperature sensor. https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Optimizing system performance and power consumption** The power required to cool a server can contribute a significant amount to the overall system power. Thermal control is the active management of system cooling through fan speed and system power management to make sure that the system is reliable while minimizing system power consumption, airflow, and system acoustic output. You can adjust the thermal control settings and optimize against the system performance and performance-per-Watt requirements. Using the iDRAC Web interface, RACADM, or the iDRAC Settings Utility, you can change the following thermal settings: • Optimize for performance • Optimize for minimum power • Set the maximum air exhaust temperature • Increase airflow through a fan offset, if required • Increase airflow through increasing minimum fan speed Following are the list of features in thermal management: • **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. • **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. • **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. • **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. • **PCIe Airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards. iDRAC User’s Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Monitoring performance index of CPU, memory, and input output modules** In Dell's 14th generation Dell PowerEdge servers, Intel ME supports Compute Usage Per Second (CUPS) functionality. The CUPS functionality provides real-time monitoring of CPU, memory, and I/O utilization and system-level utilization index for the system. Intel ME allows out-of-band (OOB) performance monitoring and does not consume CPU resources. The Intel ME has a system CUPS sensor that provides computation, memory, and I/O resource utilization values as a CUPS Index. iDRAC monitors this CUPS index for the overall system utilization and also monitors the instantaneous utilization index of the CPU, Memory, and I/O. The CPU and chipset have dedicated Resource monitoring Counters (RMC). The data from these RMCs is queried to obtain utilization information of system resources. The data from RMCs is aggregated by the node manager to measure the cumulative utilization of each of these system resources that is read from iDRAC using existing intercommunication mechanisms to provide data through out-of-band management interfaces. The Intel sensor representation of performance parameters and index values is for complete physical system. Therefore, the performance data representation on the interfaces is for the complete physical system, even if the system is virtualized and has multiple virtual hosts. To display the performance parameters, the supported sensors must be present in the server. The four system utilization parameters are: • **CPU Utilization** — Data from RMCs for each CPU core is aggregated to provide cumulative utilization of all the cores in the system. This utilization is based on time spent in active and inactive states. A sample of RMC is taken every six seconds. • **Memory Utilization** — RMCs measure memory traffic occurring at each memory channel or memory controller instance. Data from these RMCs is aggregated to measure the cumulative memory traffic across all the memory channels on the system. This is a measure of memory bandwidth consumption and not amount of memory utilization. iDRAC aggregates it for one minute, so it may or may not match the memory utilization that other OS tools, such as **top** in Linux, show. Memory bandwidth utilization that the iDRAC shows is an indication of whether workload is memory intensive or not. • **I/O Utilization** — There is one RMC per root port in the PCI Express Root Complex to measure PCI Express traffic emanating from or directed to that root port and the lower segment. Data from these RMCs is aggregated for measuring PCI express traffic for all PCI Express segments emanating from the package. This is measure of I/O bandwidth utilization for the system.

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	• **System Level CUPS Index** — The CUPS index is calculated by aggregating CPU, Memory, and I/O index considering a predefined load factor of each system resource. The load factor depends on the nature of the workload on the system. CUPS Index represents the measurement of the compute headroom available on the server. If the system has a large CUPS Index, then there is limited headroom to place more workload on that system. As the resource consumption decreases, the system's CUPS index decreases. A low CUPS index indicates that there is a large compute headroom and the server can receive new workloads and the server is in a lower power state to reduce power consumption. Workload monitoring can then be applied throughout the data center to provide a high-level and holistic view of the data center's workload, providing a dynamic data center solution. iDRAC User's Guide, 117-118; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Monitoring power** iDRAC monitors the power consumption in the system continuously and displays the following power values: • Power consumption warning and critical thresholds. • Cumulative power, peak power, and peak amperage values. • Power consumption over the last hour, last day or last week. • Average, minimum, and maximum power consumption. • Historical peak values and peak timestamps. • Peak headroom and instantaneous headroom values (for rack and tower servers). iDRAC User's Guide, 197; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). This is a software limitation that may require access to the underlying source code. Accordingly, pursuant to Paragraph 3(a)(i) of the Discovery Order, Cloud Byte may supplement these contentions with additional information after Dell's source code has been produced.

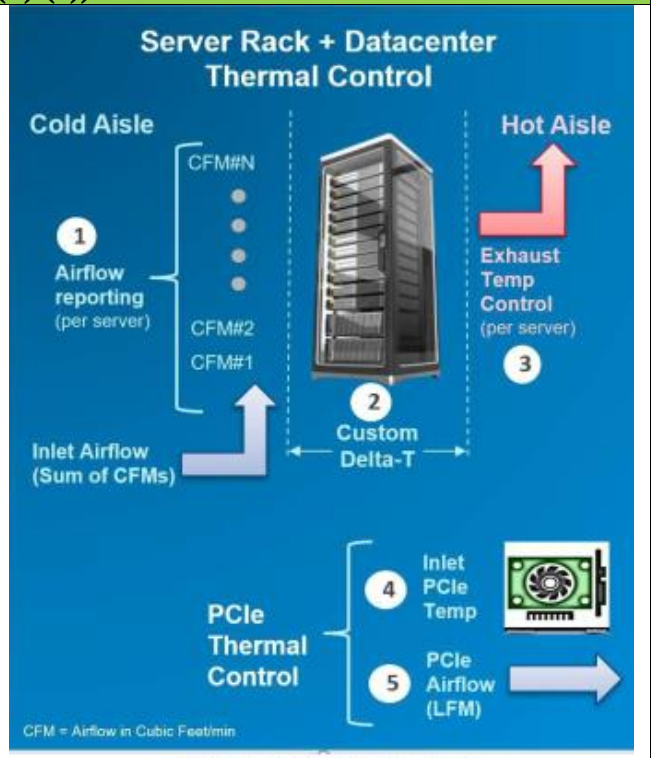
’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
8[f] an estimating unit configured to estimate an upper value limit of possible temperatures in a predetermined position of the ICT equipment when a quantity of intake air into the 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,	The Accused Dell ’632 Products include 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. *See supra*, claims 1[b] and 8[e]. *See, e.g.*,

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

iDRAC9 Features and Benefits

Features	Benefits
Telemetry Streaming	Perform deep analysis of server telemetry including CPU, GPU, SFP IO, power, thermals storage, networking, memory and more. Requires iDRAC9 Datacenter license.
Thermal Manage	Customize thermal and airflow management at the rack and server level. Requires iDRAC9 Datacenter license.
Automatic Certificate Enrollment	Automatic SSL certificate enrollment and renewal of the iDRAC self-signed certificated with a trusted CA certificate. Requires iDRAC9 Datacenter license.
Zero touch deployment and provisioning	Automatically configure PowerEdge servers when they are initially connected to your network. This process uses a Server Configuration Profile to set hardware, update firmware, and install OS. Requires iDRAC9 Enterprise or Datacenter license.
Virtual Clipboard	Provides an easy to enter complex passwords and more in the HTML5 vConsole. Users can copy text/passwords to local clipboard and paste into remote console view. Requires iDRAC9 Datacenter license.
Connection View	iDRAC sends standard LLDP packets to external switches, which provides the option to discover iDRACs on the network. iDRAC sends two types of LLDP packets to the outbound network; Topology and Discovery. Also, iDRAC can also display switch and port information.
System Lockdown	Helps to prevent configuration or firmware changes to a server when using Dell tools and even vendor tools for selected network cards. Requires iDRAC Enterprise or Datacenter License.
RSA SecurID 2FA	Add the RSA SecurID client software into iDRAC to provide native support for RSA 2FA solutions. Requires Datacenter license.
DRAC RESTful API	With this API, iDRAC enables support for the Redfish standard and enhances it with Dell extensions.
Cipher Select	Cipher Select is an advanced user setting where the user can choose to block undesired ciphers negotiated by iDRAC, providing increased security.
Secured Component Verification	Secured Component Verification (SCV) is a Supply chain assurance offering that enables Dell customers to verify that a PowerEdge server received by the customer matches what was manufactured in the factory.
System Erase	With proper authentication, administrators can securely erase data from local storage (HDDs, SSDs, NVMes).
iDRAC Direct	Secure front-panel USB connection to iDRAC web interface, which eliminates the need for crash carts or a trip to the hot aisle of your data center. You can use the same port to insert a USB key to upload new system profile for secure, rapid system configuration.

iDRAC Solution Brief, 2.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Thermal Manage – Feature Overview Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits: • Optimize server-related power and cooling efficiencies across their datacenters. • Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience. • Provides a state-of-the-art PCIe cooling management dashboard. Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities. 1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. 2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. 3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. 4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. 5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.  *Figure 1 displays the features and its utilities.* iDRAC Thermal Manage Features.

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	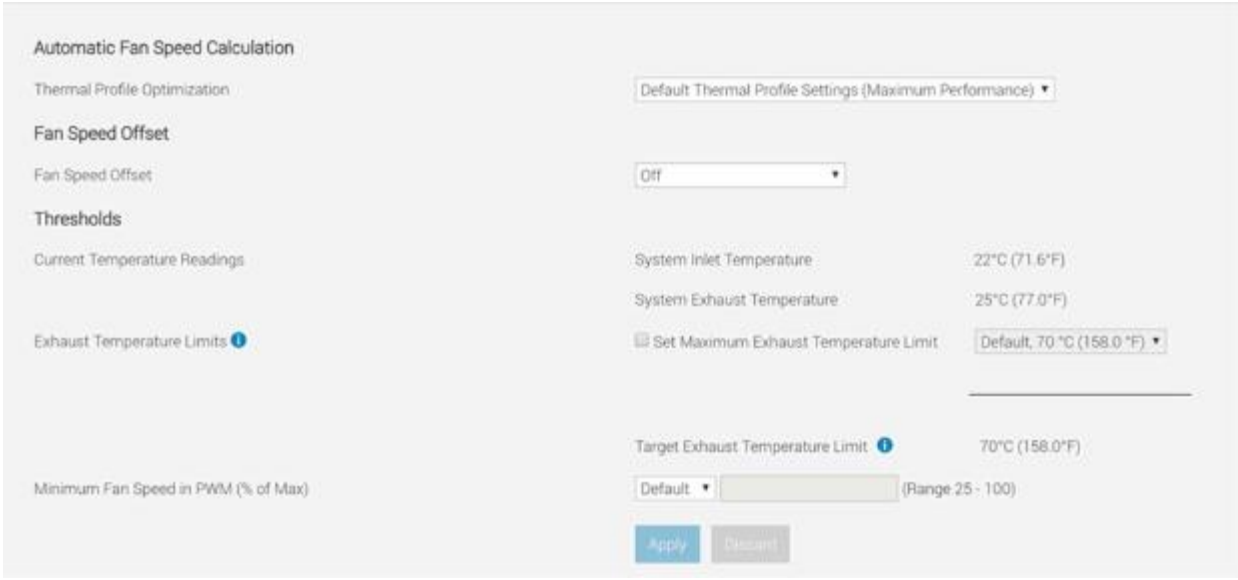 iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Viewing sensor information The following sensors help to monitor the health of the managed system: • **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB). ⓘ **NOTE:** The Storage ROMB battery settings are available only if the system has a ROMB with a battery. • **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values. • **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure. • **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system. • **Intrusion** — Provides information about the chassis. • **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status. ⓘ **NOTE:** If there is only one power supply in the system, the power supply redundancy is set to **Disabled**. • **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM). ○ When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed. ○ If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted. ○ If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online. ○ During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off. ⓘ **NOTE:** If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC. ○ System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively. ⓘ **NOTE:** When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter. • **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value. • **Voltage** — Indicates the status and reading of the voltage sensors on various system components.

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	iDRAC User's Guide, 116; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x). **Configuring warning threshold for inlet temperature** You can modify the minimum and maximum warning threshold values for the system board inlet temperature sensor. If reset to default action is performed, the temperature thresholds are set to the default values. You must have Configure user privilege to set the warning threshold values for the inlet temperature sensor. https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Optimizing system performance and power consumption** The power required to cool a server can contribute a significant amount to the overall system power. Thermal control is the active management of system cooling through fan speed and system power management to make sure that the system is reliable while minimizing system power consumption, airflow, and system acoustic output. You can adjust the thermal control settings and optimize against the system performance and performance-per-Watt requirements. Using the iDRAC Web interface, RACADM, or the iDRAC Settings Utility, you can change the following thermal settings: • Optimize for performance • Optimize for minimum power • Set the maximum air exhaust temperature • Increase airflow through a fan offset, if required • Increase airflow through increasing minimum fan speed Following are the list of features in thermal management: • **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. • **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. • **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. • **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. • **PCIe Airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.

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	• **System Level CUPS Index** — The CUPS index is calculated by aggregating CPU, Memory, and I/O index considering a predefined load factor of each system resource. The load factor depends on the nature of the workload on the system. CUPS Index represents the measurement of the compute headroom available on the server. If the system has a large CUPS Index, then there is limited headroom to place more workload on that system. As the resource consumption decreases, the system's CUPS index decreases. A low CUPS index indicates that there is a large compute headroom and the server can receive new workloads and the server is in a lower power state to reduce power consumption. Workload monitoring can then be applied throughout the data center to provide a high-level and holistic view of the data center's workload, providing a dynamic data center solution. iDRAC User's Guide, 117-118; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Monitoring power** iDRAC monitors the power consumption in the system continuously and displays the following power values: • Power consumption warning and critical thresholds. • Cumulative power, peak power, and peak amperage values. • Power consumption over the last hour, last day or last week. • Average, minimum, and maximum power consumption. • Historical peak values and peak timestamps. • Peak headroom and instantaneous headroom values (for rack and tower servers). iDRAC User's Guide, 197; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

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Modifying thermal settings using iDRAC web interface

To modify the thermal settings:

1. In the iDRAC Web interface, go to **Configuration** > **System Settings** > **Hardware Settings** > **Cooling Configuration**.
2. Specify the following:
   - **Thermal Profile Optimization** — Select the thermal profile:
     - **Default Thermal Profile Settings (Minimum Power)** — Implies that the thermal algorithm uses the same system profile settings that is defined under **System BIOS** > **System BIOS Settings** > **System Profile Settings** page.

     By default, this option is set to **Default Thermal Profile Settings**. You can also select a custom algorithm, which is independent of the BIOS profile. The options available are:
     - **Maximum Performance (Performance Optimized)** :
       - Reduced probability of memory or CPU throttling.
       - Increased probability of turbo mode activation.
       - Generally, higher fan speeds at idle and stress loads.
     - **Minimum Power (Performance per Watt Optimized)**:
       - Optimized for lowest system power consumption based on optimum fan power state.
       - Generally, lower fan speeds at idle and stress loads.
     - **Sound Cap** — Sound Cap provides reduced acoustical output from a server at the expense of some performance. Enabling Sound Cap may include temporary deployment or evaluation of a server in an occupied space, but it should not be used during benchmarking or performance sensitive applications.

     NOTE: Selecting **Maximum Performance** or **Minimum Power**, overrides thermal settings associated to System Profile setting under **System BIOS** > **System BIOS Settings.System Profile Settings** page.
   - **Maximum Exhaust Temperature Limit** — From the drop-down menu, select the maximum exhaust air temperature. The values are displayed based on the system.

     The default value is **Default, 70°C (158 °F)**.

     This option allows the system fans speeds to change such that the exhaust temperature does not exceed the selected exhaust temperature limit. This cannot always be guaranteed under all system operating conditions due to dependency on system load and system cooling capability.

iDRAC User’s Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

	• **Thresholds**
	  ○ **Maximum PCIe Inlet Temperature Limit** — Default value is 55°C. Select the lower temperature of 45°C for third party PCIe cards which require lower inlet temperature.
	  ○ **Exhaust Temperature Limits** — By modifying the values for the following you can set the exhaust temperature limits:
	  ▪ **Set Maximum Exhaust Temperature Limit**
	  ▪ **Set Air Temperature Rise Limit**
	  ○ **Minimum Fan Speed in PWM (% of Max)** — Select this option to fine tune the fan speed. Using this option, you can set a higher baseline system fan speed or increase the system fan speed if other custom fan speed options are not resulting in the required higher fan speeds.
	  ▪ **Default** — Sets minimum fan speed to default value as determined by the system cooling algorithm.
	  ▪ **Custom** — Enter the percentage by which you want to change the fan speed. Range is between 9-100.
	The allowable range for minimum fan speed PWM is dynamic based on the system configuration. The first value is the idle speed and the second value is the configuration max (Depending on the system configuration, the maximum speed may be up to 100%.).
	System fans can run higher than this speed as per thermal requirements of the system but not lower than the defined minimum speed. For example, setting Minimum Fan Speed at 35% limits the fan speed to never go lower than 35% PWM.
	NOTE: 0% PWM does not indicate fan is off. It is the lowest fan speed that the fan can achieve.
	The settings are persistent, which means that once they are set and applied, they do not automatically change to the default setting during system reboot, power cycling, iDRAC, or BIOS updates. The custom cooling options may not be supported on all servers. If the options are not supported, they are not displayed or you cannot provide a custom value.
	iDRAC User’s Guide, 65; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

Multi-Vector Cooling

Multi-Vector Cooling implements multi-prong approach to Thermal Controls in Dell EMC Server Platforms. You can configure multi-vector cooling options through iDRAC web interface by navigating to **Configuration** > **System Settings** > **Hardware Settings** > **Fan Configuration**. It includes (but not limited to):

- Large set of sensors (thermal, power, inventory etc.) that allows accurate interpretation of real-time system thermal state at various locations within the server. It displays only a small subset of sensors that are relevant to users need based on the configuration.
- Intelligent and adaptive closed loop control algorithm optimizes fan response to maintain component temperatures. It also conserves fan power, airflow consumption, and acoustics.

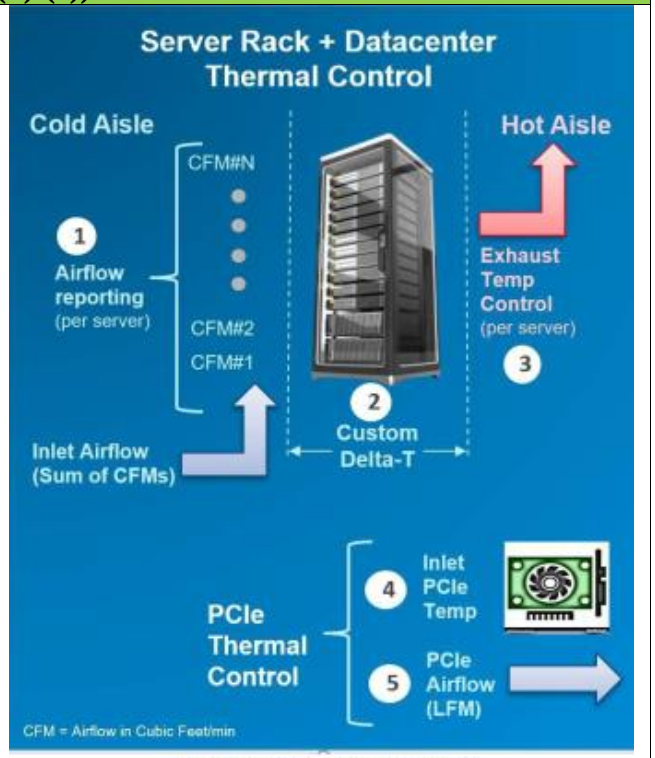
- Using fan zone mapping, cooling can be initiated for the components when it requires. Thus, it results maximum performance without compromising the efficiency of power utilization.
- Accurate representation of slot by slot PCIe airflow in terms of LFM metric (Linear Feet per Minute - an accepted industry standard on how PCIe card airflow requirement is specified). Display of this metric in various iDRAC interfaces allows user to:
  1. know the maximum LFM capability of each slot within the server.
  2. know what approach is being taken for PCIe cooling for each slot (airflow controlled, temperature controlled).
  3. know the minimum LFM being delivered to a slot, if the card is a 3rd Party Card (user defined custom card).
  4. dial in custom minimum LFM value for the 3rd Party Card allowing more accurate definition of the card cooling needs for which the user is better aware of through their custom card specification.
- Displays real-time system airflow metric (CFM, cubic feet per minute) in various iDRAC interfaces to the user to enable datacenter airflow balancing based on aggregation of per server CFM consumption.
- Allows custom thermal settings like Thermal Profiles (Maximum Performance vs. Maximum Performance per Watt, Sound Cap), custom fan speed options (minimum fan speed, fan speed offsets) and custom Exhaust Temperature settings.
  1. Most of these settings allow additional cooling over the baseline cooling generated by thermal algorithms and do not allow fan speeds to go below system cooling requirements.

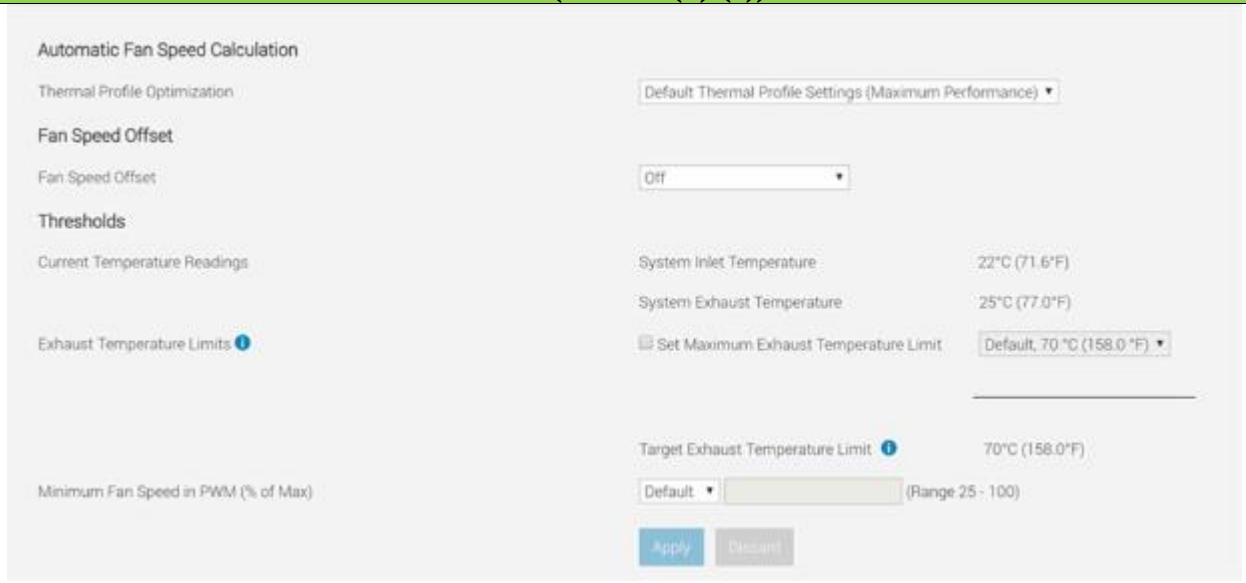
     NOTE: One exception to above statement is for fan speeds that are added for 3rd Party PCIe cards. The thermal algorithm provision airflow for 3rd party cards may be more or less than the actual card cooling needs and customer may fine tune the response for the card by entering the LFM corresponding to the 3rd Party Card.
  2. Custom Exhaust Temperature option limits exhaust temperature to customer desired settings.

     NOTE: It is important to note that with certain configurations and workloads, it may not be physically possible to reduce exhaust below a desired set point (e.g. Custom exhaust setting of 45C with a high inlet temp {e.g. 30C} and a loaded config {high system power consumption, low airflow}).
  3. Sound Cap option is new in the 14th generation of PowerEdge server. It limits CPU power consumption and controls fan speed and acoustical ceiling. This is unique for acoustical deployments and may result in reduced system performance.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User’s Guide, 201-202; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). This is a software limitation that may require access to the underlying source code. Accordingly, pursuant to Paragraph 3(a)(i) of the Discovery Order, Cloud Byte may supplement these contentions with additional information after Dell’s source code has been produced. In addition and/or in the alternative to literally infringing this claim element, the Accused Dell ’632 Products also infringe under the doctrine of equivalents. The Accused Dell ’632 Products are at least equivalent to and insubstantially different from the claimed limitation where an estimating unit is 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 to perform substantially the same function (e.g., estimating an upper value limit of temperature for the ICT equipment) in substantially the same way (e.g., based at least on the operational status and intake air temperature of the ICT equipment), to achieve substantially the same result (e.g., identifying a threshold temperature in which the ICT equipment should not exceed).
8[g] 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	In the Accused Dell ’632 Products, the operational status of the ICT equipment and the intake air temperature of the ICT equipment determines a rotation speed of the cooling fan. *See supra*, claims 1[c] and 8[f]. *See, e.g.*,

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 PowerEdge R6615 Powerful performance per investment dollar The new Dell PowerEdge R6615 is a 1U, single-socket rack server. Designed to be the best investment per dollar for your data center, this server provides performance and flexible, low-latency storage options in an air or Direct Liquid Cooling (DLC) configuration. Fans • Standard (STD) fans/High performance GOLD (VHP) fans • Up to 4 sets (dual fan module) hot plug fans R6615 Spec Sheet, 1-2.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Thermal Manage – Feature Overview Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits: • Optimize server-related power and cooling efficiencies across their datacenters. • Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience. • Provides a state-of-the-art PCIe cooling management dashboard. Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities. 1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. 2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. 3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. 4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. 5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.  *Figure 1 displays the features and its utilities.* iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Viewing sensor information The following sensors help to monitor the health of the managed system: • **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB). ⓘ **NOTE:** The Storage ROMB battery settings are available only if the system has a ROMB with a battery. • **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values. • **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure. • **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system. • **Intrusion** — Provides information about the chassis. • **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status. ⓘ **NOTE:** If there is only one power supply in the system, the power supply redundancy is set to **Disabled**. • **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM). ○ When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed. ○ If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted. ○ If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online. ○ During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off. ⓘ **NOTE:** If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC. ○ System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively. ⓘ **NOTE:** When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter. • **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value. • **Voltage** — Indicates the status and reading of the voltage sensors on various system components. iDRAC User’s Guide, 116; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x);

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x). **Configuring warning threshold for inlet temperature** You can modify the minimum and maximum warning threshold values for the system board inlet temperature sensor. If reset to default action is performed, the temperature thresholds are set to the default values. You must have Configure user privilege to set the warning threshold values for the inlet temperature sensor. https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Optimizing system performance and power consumption** The power required to cool a server can contribute a significant amount to the overall system power. Thermal control is the active management of system cooling through fan speed and system power management to make sure that the system is reliable while minimizing system power consumption, airflow, and system acoustic output. You can adjust the thermal control settings and optimize against the system performance and performance-per-Watt requirements. Using the iDRAC Web interface, RACADM, or the iDRAC Settings Utility, you can change the following thermal settings: • Optimize for performance • Optimize for minimum power • Set the maximum air exhaust temperature • Increase airflow through a fan offset, if required • Increase airflow through increasing minimum fan speed Following are the list of features in thermal management: • **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. • **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. • **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. • **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. • **PCIe Airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards. iDRAC User’s Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Monitoring performance index of CPU, memory, and input output modules** In Dell's 14th generation Dell PowerEdge servers, Intel ME supports Compute Usage Per Second (CUPS) functionality. The CUPS functionality provides real-time monitoring of CPU, memory, and I/O utilization and system-level utilization index for the system. Intel ME allows out-of-band (OOB) performance monitoring and does not consume CPU resources. The Intel ME has a system CUPS sensor that provides computation, memory, and I/O resource utilization values as a CUPS Index. iDRAC monitors this CUPS index for the overall system utilization and also monitors the instantaneous utilization index of the CPU, Memory, and I/O. The CPU and chipset have dedicated Resource monitoring Counters (RMC). The data from these RMCs is queried to obtain utilization information of system resources. The data from RMCs is aggregated by the node manager to measure the cumulative utilization of each of these system resources that is read from iDRAC using existing intercommunication mechanisms to provide data through out-of-band management interfaces. The Intel sensor representation of performance parameters and index values is for complete physical system. Therefore, the performance data representation on the interfaces is for the complete physical system, even if the system is virtualized and has multiple virtual hosts. To display the performance parameters, the supported sensors must be present in the server. The four system utilization parameters are: • **CPU Utilization** — Data from RMCs for each CPU core is aggregated to provide cumulative utilization of all the cores in the system. This utilization is based on time spent in active and inactive states. A sample of RMC is taken every six seconds. • **Memory Utilization** — RMCs measure memory traffic occurring at each memory channel or memory controller instance. Data from these RMCs is aggregated to measure the cumulative memory traffic across all the memory channels on the system. This is a measure of memory bandwidth consumption and not amount of memory utilization. iDRAC aggregates it for one minute, so it may or may not match the memory utilization that other OS tools, such as **top** in Linux, show. Memory bandwidth utilization that the iDRAC shows is an indication of whether workload is memory intensive or not. • **I/O Utilization** — There is one RMC per root port in the PCI Express Root Complex to measure PCI Express traffic emanating from or directed to that root port and the lower segment. Data from these RMCs is aggregated for measuring PCI express traffic for all PCI Express segments emanating from the package. This is measure of I/O bandwidth utilization for the system.

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	• **System Level CUPS Index** — The CUPS index is calculated by aggregating CPU, Memory, and I/O index considering a predefined load factor of each system resource. The load factor depends on the nature of the workload on the system. CUPS Index represents the measurement of the compute headroom available on the server. If the system has a large CUPS Index, then there is limited headroom to place more workload on that system. As the resource consumption decreases, the system's CUPS index decreases. A low CUPS index indicates that there is a large compute headroom and the server can receive new workloads and the server is in a lower power state to reduce power consumption. Workload monitoring can then be applied throughout the data center to provide a high-level and holistic view of the data center's workload, providing a dynamic data center solution. iDRAC User's Guide, 117-118; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Monitoring power** iDRAC monitors the power consumption in the system continuously and displays the following power values: • Power consumption warning and critical thresholds. • Cumulative power, peak power, and peak amperage values. • Power consumption over the last hour, last day or last week. • Average, minimum, and maximum power consumption. • Historical peak values and peak timestamps. • Peak headroom and instantaneous headroom values (for rack and tower servers). iDRAC User's Guide, 197; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Modifying thermal settings using iDRAC web interface To modify the thermal settings: 1. In the iDRAC Web interface, go to **Configuration** > **System Settings** > **Hardware Settings** > **Cooling Configuration**. 2. Specify the following: • **Thermal Profile Optimization** — Select the thermal profile: ○ **Default Thermal Profile Settings (Minimum Power)** — Implies that the thermal algorithm uses the same system profile settings that is defined under **System BIOS** > **System BIOS Settings** > **System Profile Settings** page. By default, this option is set to **Default Thermal Profile Settings**. You can also select a custom algorithm, which is independent of the BIOS profile. The options available are: ○ **Maximum Performance (Performance Optimized)** : ▪ Reduced probability of memory or CPU throttling. ▪ Increased probability of turbo mode activation. ▪ Generally, higher fan speeds at idle and stress loads. ○ **Minimum Power (Performance per Watt Optimized)**: ▪ Optimized for lowest system power consumption based on optimum fan power state. ▪ Generally, lower fan speeds at idle and stress loads. ○ **Sound Cap** — Sound Cap provides reduced acoustical output from a server at the expense of some performance. Enabling Sound Cap may include temporary deployment or evaluation of a server in an occupied space, but it should not be used during benchmarking or performance sensitive applications. **NOTE:** Selecting **Maximum Performance** or **Minimum Power**, overrides thermal settings associated to System Profile setting under **System BIOS** > **System BIOS Settings.System Profile Settings** page. • **Maximum Exhaust Temperature Limit** — From the drop-down menu, select the maximum exhaust air temperature. The values are displayed based on the system. The default value is **Default, 70°C (158 °F)**. This option allows the system fans speeds to change such that the exhaust temperature does not exceed the selected exhaust temperature limit. This cannot always be guaranteed under all system operating conditions due to dependency on system load and system cooling capability. iDRAC User’s Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

	• **Thresholds**
	  ○ **Maximum PCIe Inlet Temperature Limit** — Default value is 55°C. Select the lower temperature of 45°C for third party PCIe cards which require lower inlet temperature.
	  ○ **Exhaust Temperature Limits** — By modifying the values for the following you can set the exhaust temperature limits:
	  ▪ **Set Maximum Exhaust Temperature Limit**
	  ▪ **Set Air Temperature Rise Limit**
	  ○ **Minimum Fan Speed in PWM (% of Max)** — Select this option to fine tune the fan speed. Using this option, you can set a higher baseline system fan speed or increase the system fan speed if other custom fan speed options are not resulting in the required higher fan speeds.
	  ▪ **Default** — Sets minimum fan speed to default value as determined by the system cooling algorithm.
	  ▪ **Custom** — Enter the percentage by which you want to change the fan speed. Range is between 9-100.
	The allowable range for minimum fan speed PWM is dynamic based on the system configuration. The first value is the idle speed and the second value is the configuration max (Depending on the system configuration, the maximum speed may be up to 100%.).
	System fans can run higher than this speed as per thermal requirements of the system but not lower than the defined minimum speed. For example, setting Minimum Fan Speed at 35% limits the fan speed to never go lower than 35% PWM.
	NOTE: 0% PWM does not indicate fan is off. It is the lowest fan speed that the fan can achieve.
	The settings are persistent, which means that once they are set and applied, they do not automatically change to the default setting during system reboot, power cycling, iDRAC, or BIOS updates. The custom cooling options may not be supported on all servers. If the options are not supported, they are not displayed or you cannot provide a custom value.
	iDRAC User’s Guide, 65; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

Multi-Vector Cooling

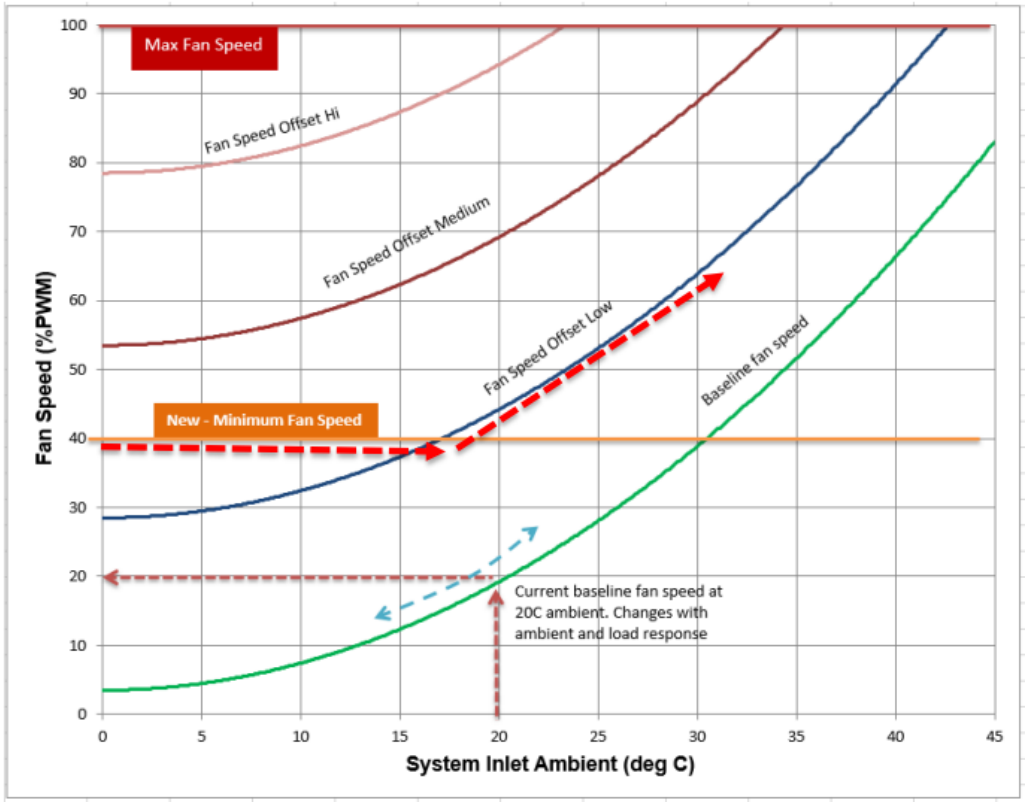
Multi-Vector Cooling implements multi-prong approach to Thermal Controls in Dell EMC Server Platforms. You can configure multi-vector cooling options through iDRAC web interface by navigating to **Configuration** > **System Settings** > **Hardware Settings** > **Fan Configuration**. It includes (but not limited to):

- Large set of sensors (thermal, power, inventory etc.) that allows accurate interpretation of real-time system thermal state at various locations within the server. It displays only a small subset of sensors that are relevant to users need based on the configuration.
- Intelligent and adaptive closed loop control algorithm optimizes fan response to maintain component temperatures. It also conserves fan power, airflow consumption, and acoustics.

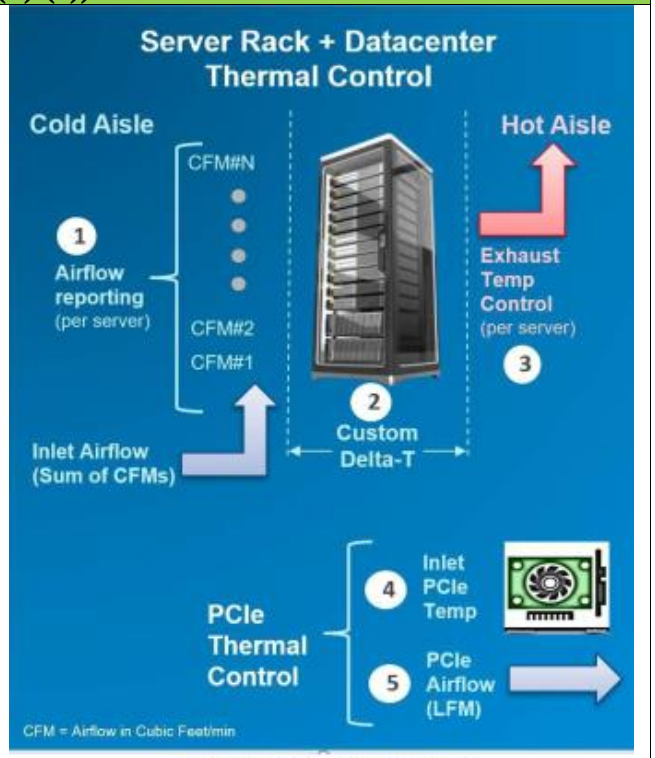
- Using fan zone mapping, cooling can be initiated for the components when it requires. Thus, it results maximum performance without compromising the efficiency of power utilization.
- Accurate representation of slot by slot PCIe airflow in terms of LFM metric (Linear Feet per Minute - an accepted industry standard on how PCIe card airflow requirement is specified). Display of this metric in various iDRAC interfaces allows user to:
  1. know the maximum LFM capability of each slot within the server.
  2. know what approach is being taken for PCIe cooling for each slot (airflow controlled, temperature controlled).
  3. know the minimum LFM being delivered to a slot, if the card is a 3rd Party Card (user defined custom card).
  4. dial in custom minimum LFM value for the 3rd Party Card allowing more accurate definition of the card cooling needs for which the user is better aware of through their custom card specification.
- Displays real-time system airflow metric (CFM, cubic feet per minute) in various iDRAC interfaces to the user to enable datacenter airflow balancing based on aggregation of per server CFM consumption.
- Allows custom thermal settings like Thermal Profiles (Maximum Performance vs. Maximum Performance per Watt, Sound Cap), custom fan speed options (minimum fan speed, fan speed offsets) and custom Exhaust Temperature settings.
  1. Most of these settings allow additional cooling over the baseline cooling generated by thermal algorithms and do not allow fan speeds to go below system cooling requirements.

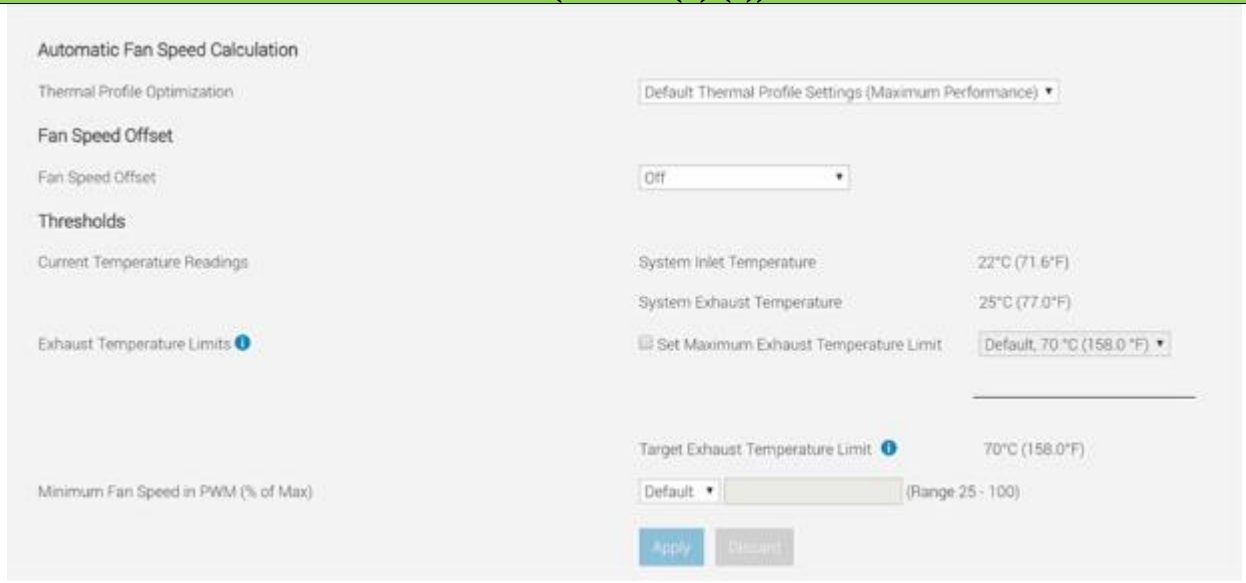
     NOTE: One exception to above statement is for fan speeds that are added for 3rd Party PCIe cards. The thermal algorithm provision airflow for 3rd party cards may be more or less than the actual card cooling needs and customer may fine tune the response for the card by entering the LFM corresponding to the 3rd Party Card.
  2. Custom Exhaust Temperature option limits exhaust temperature to customer desired settings.

     NOTE: It is important to note that with certain configurations and workloads, it may not be physically possible to reduce exhaust below a desired set point (e.g. Custom exhaust setting of 45C with a high inlet temp {e.g. 30C} and a loaded config {high system power consumption, low airflow}).
  3. Sound Cap option is new in the 14th generation of PowerEdge server. It limits CPU power consumption and controls fan speed and acoustical ceiling. This is unique for acoustical deployments and may result in reduced system performance.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User’s Guide, 201-202; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).  Figure 3 How options can be combined with MFS and Offset set simultaneously If Low Offset and 40% MFS are applied, Fan Speed follows the red dotted line based on Inlet Ambient. PowerEdge Custom Cooling Fan Options, 9.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	This is a software limitation that may require access to the underlying source code. Accordingly, pursuant to Paragraph 3(a)(i) of the Discovery Order, Cloud Byte may supplement these contentions with additional information after Dell’s source code has been produced.
8[h] 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.	The Accused Dell ’632 Products include 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. *See supra*, claims 1[d] and 8[g]. *See, e.g.*,

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Thermal Manage – Feature Overview Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits: • Optimize server-related power and cooling efficiencies across their datacenters. • Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience. • Provides a state-of-the-art PCIe cooling management dashboard. Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities. 1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. 2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. 3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. 4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. 5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.  *Figure 1 displays the features and its utilities.* iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Viewing sensor information The following sensors help to monitor the health of the managed system: • **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB). ⓘ **NOTE:** The Storage ROMB battery settings are available only if the system has a ROMB with a battery. • **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values. • **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure. • **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system. • **Intrusion** — Provides information about the chassis. • **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status. ⓘ **NOTE:** If there is only one power supply in the system, the power supply redundancy is set to **Disabled**. • **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM). ○ When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed. ○ If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted. ○ If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online. ○ During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off. ⓘ **NOTE:** If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC. ○ System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively. ⓘ **NOTE:** When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter. • **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value. • **Voltage** — Indicates the status and reading of the voltage sensors on various system components. iDRAC User’s Guide, 116; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x);

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x). **Configuring warning threshold for inlet temperature** You can modify the minimum and maximum warning threshold values for the system board inlet temperature sensor. If reset to default action is performed, the temperature thresholds are set to the default values. You must have Configure user privilege to set the warning threshold values for the inlet temperature sensor. https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Optimizing system performance and power consumption** The power required to cool a server can contribute a significant amount to the overall system power. Thermal control is the active management of system cooling through fan speed and system power management to make sure that the system is reliable while minimizing system power consumption, airflow, and system acoustic output. You can adjust the thermal control settings and optimize against the system performance and performance-per-Watt requirements. Using the iDRAC Web interface, RACADM, or the iDRAC Settings Utility, you can change the following thermal settings: • Optimize for performance • Optimize for minimum power • Set the maximum air exhaust temperature • Increase airflow through a fan offset, if required • Increase airflow through increasing minimum fan speed Following are the list of features in thermal management: • **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. • **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. • **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. • **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. • **PCIe Airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards. iDRAC User’s Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Modifying thermal settings using iDRAC web interface** To modify the thermal settings: 1. In the iDRAC Web interface, go to **Configuration** > **System Settings** > **Hardware Settings** > **Cooling Configuration**. 2. Specify the following: • **Thermal Profile Optimization** — Select the thermal profile: ○ **Default Thermal Profile Settings (Minimum Power)** — Implies that the thermal algorithm uses the same system profile settings that is defined under **System BIOS** > **System BIOS Settings** > **System Profile Settings** page. By default, this option is set to **Default Thermal Profile Settings**. You can also select a custom algorithm, which is independent of the BIOS profile. The options available are: ○ **Maximum Performance (Performance Optimized)** : ▪ Reduced probability of memory or CPU throttling. ▪ Increased probability of turbo mode activation. ▪ Generally, higher fan speeds at idle and stress loads. ○ **Minimum Power (Performance per Watt Optimized)**: ▪ Optimized for lowest system power consumption based on optimum fan power state. ▪ Generally, lower fan speeds at idle and stress loads. ○ **Sound Cap** — Sound Cap provides reduced acoustical output from a server at the expense of some performance. Enabling Sound Cap may include temporary deployment or evaluation of a server in an occupied space, but it should not be used during benchmarking or performance sensitive applications. **NOTE:** Selecting **Maximum Performance** or **Minimum Power**, overrides thermal settings associated to System Profile setting under **System BIOS** > **System BIOS Settings.System Profile Settings** page. • **Maximum Exhaust Temperature Limit** — From the drop-down menu, select the maximum exhaust air temperature. The values are displayed based on the system. The default value is **Default, 70°C (158 °F)**. This option allows the system fans speeds to change such that the exhaust temperature does not exceed the selected exhaust temperature limit. This cannot always be guaranteed under all system operating conditions due to dependency on system load and system cooling capability. iDRAC User's Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

	• **Thresholds**
	  ○ **Maximum PCIe Inlet Temperature Limit** — Default value is 55°C. Select the lower temperature of 45°C for third party PCIe cards which require lower inlet temperature.
	  ○ **Exhaust Temperature Limits** — By modifying the values for the following you can set the exhaust temperature limits:
	  ▪ **Set Maximum Exhaust Temperature Limit**
	  ▪ **Set Air Temperature Rise Limit**
	  ○ **Minimum Fan Speed in PWM (% of Max)** — Select this option to fine tune the fan speed. Using this option, you can set a higher baseline system fan speed or increase the system fan speed if other custom fan speed options are not resulting in the required higher fan speeds.
	  ▪ **Default** — Sets minimum fan speed to default value as determined by the system cooling algorithm.
	  ▪ **Custom** — Enter the percentage by which you want to change the fan speed. Range is between 9-100.
	  The allowable range for minimum fan speed PWM is dynamic based on the system configuration. The first value is the idle speed and the second value is the configuration max (Depending on the system configuration, the maximum speed may be up to 100%.).
	  System fans can run higher than this speed as per thermal requirements of the system but not lower than the defined minimum speed. For example, setting Minimum Fan Speed at 35% limits the fan speed to never go lower than 35% PWM.
	  NOTE: 0% PWM does not indicate fan is off. It is the lowest fan speed that the fan can achieve.
	The settings are persistent, which means that once they are set and applied, they do not automatically change to the default setting during system reboot, power cycling, iDRAC, or BIOS updates. The custom cooling options may not be supported on all servers. If the options are not supported, they are not displayed or you cannot provide a custom value.
	iDRAC User's Guide, 65; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

Multi-Vector Cooling

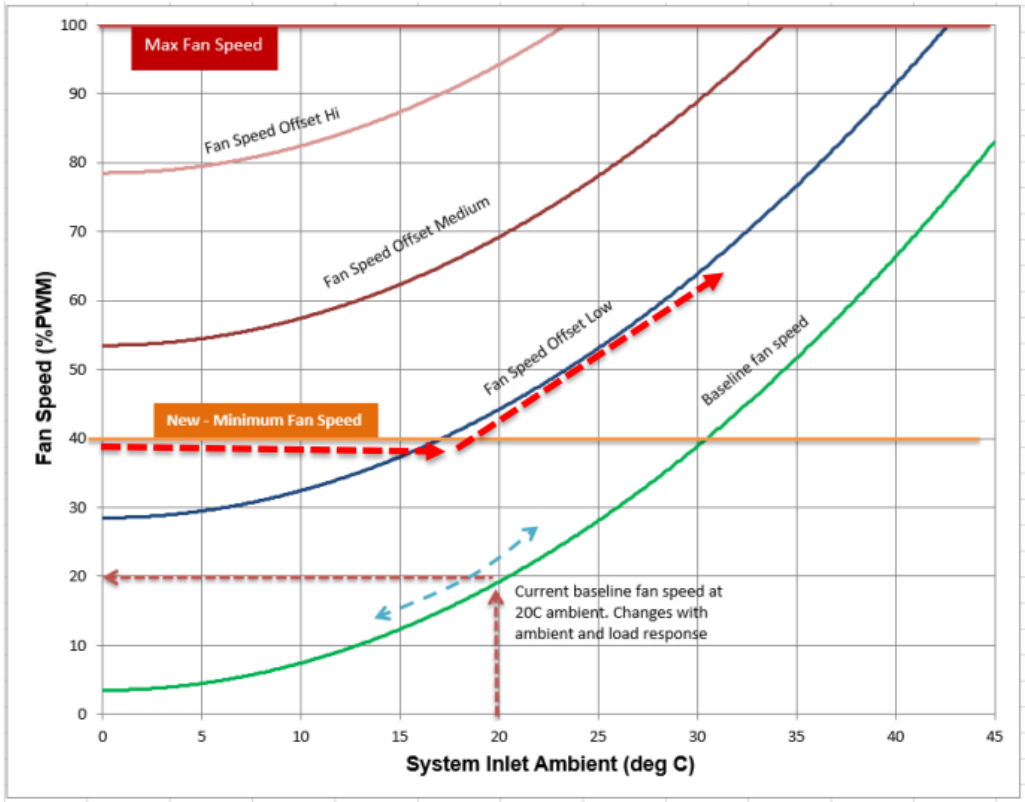
Multi-Vector Cooling implements multi-prong approach to Thermal Controls in Dell EMC Server Platforms. You can configure multi-vector cooling options through iDRAC web interface by navigating to **Configuration** > **System Settings** > **Hardware Settings** > **Fan Configuration**. It includes (but not limited to):

- Large set of sensors (thermal, power, inventory etc.) that allows accurate interpretation of real-time system thermal state at various locations within the server. It displays only a small subset of sensors that are relevant to users need based on the configuration.
- Intelligent and adaptive closed loop control algorithm optimizes fan response to maintain component temperatures. It also conserves fan power, airflow consumption, and acoustics.

- Using fan zone mapping, cooling can be initiated for the components when it requires. Thus, it results maximum performance without compromising the efficiency of power utilization.
- Accurate representation of slot by slot PCIe airflow in terms of LFM metric (Linear Feet per Minute - an accepted industry standard on how PCIe card airflow requirement is specified). Display of this metric in various iDRAC interfaces allows user to:
  1. know the maximum LFM capability of each slot within the server.
  2. know what approach is being taken for PCIe cooling for each slot (airflow controlled, temperature controlled).
  3. know the minimum LFM being delivered to a slot, if the card is a 3rd Party Card (user defined custom card).
  4. dial in custom minimum LFM value for the 3rd Party Card allowing more accurate definition of the card cooling needs for which the user is better aware of through their custom card specification.
- Displays real-time system airflow metric (CFM, cubic feet per minute) in various iDRAC interfaces to the user to enable datacenter airflow balancing based on aggregation of per server CFM consumption.
- Allows custom thermal settings like Thermal Profiles (Maximum Performance vs. Maximum Performance per Watt, Sound Cap), custom fan speed options (minimum fan speed, fan speed offsets) and custom Exhaust Temperature settings.
  1. Most of these settings allow additional cooling over the baseline cooling generated by thermal algorithms and do not allow fan speeds to go below system cooling requirements.

     NOTE: One exception to above statement is for fan speeds that are added for 3rd Party PCIe cards. The thermal algorithm provision airflow for 3rd party cards may be more or less than the actual card cooling needs and customer may fine tune the response for the card by entering the LFM corresponding to the 3rd Party Card.
  2. Custom Exhaust Temperature option limits exhaust temperature to customer desired settings.

     NOTE: It is important to note that with certain configurations and workloads, it may not be physically possible to reduce exhaust below a desired set point (e.g. Custom exhaust setting of 45C with a high inlet temp {e.g. 30C} and a loaded config {high system power consumption, low airflow}).
  3. Sound Cap option is new in the 14th generation of PowerEdge server. It limits CPU power consumption and controls fan speed and acoustical ceiling. This is unique for acoustical deployments and may result in reduced system performance.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User’s Guide, 201-202; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).  Figure 3 How options can be combined with MFS and Offset set simultaneously If Low Offset and 40% MFS are applied, Fan Speed follows the red dotted line based on Inlet Ambient. PowerEdge Custom Cooling Fan Options, 9.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	This is a software limitation that may require access to the underlying source code. Accordingly, pursuant to Paragraph 3(a)(i) of the Discovery Order, Cloud Byte may supplement these contentions with additional information after Dell’s source code has been produced.
9[pre] An abnormality detection method of Information and Communication Technology (ICT) equipment including a cooling fan, the method comprising:	The Accused Dell ’632 Products perform an abnormality detection method of information and communication technology (“ICT”) equipment including a cooling fan. For example, a Dell PowerEdge server is an information and communication technology equipment having a cooling fan. *See*, *e.g.*,  PowerEdge R6615 Powerful performance per investment dollar The new Dell PowerEdge R6615 is a 1U, single-socket rack server. Designed to be the best investment per dollar for your data center, this server provides performance and flexible, low-latency storage options in an air or Direct Liquid Cooling (DLC) configuration. Fans • Standard (STD) fans/High performance GOLD (VHP) fans • Up to 4 sets (dual fan module) hot plug fans R6615 Spec Sheet, 1-2. The Integrated Dell Remote Access Controller (iDRAC) is embedded in every PowerEdge server to deliver remote server administration with a set of server management features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 Full Access Management of PowerEdge Servers Modernize with Dell PowerEdge portfolio The integrated Dell Remote Access Controller (iDRAC) delivers advanced, agent-free local and remote server administration. The iDRAC provides a secure means to automate a multitude of management tasks. Given that iDRAC is embedded in every PowerEdge server, there's no additional software to install. Once iDRAC has been enabled, you will have a complete set of server management features at your fingertips. iDRAC Solution Brief, 1. iDRAC includes the ability to measure and analyze server telemetry, including CPU, power, and thermals. Its “Thermal Manage” feature includes the ability to customize thermal management at the rack and server level.

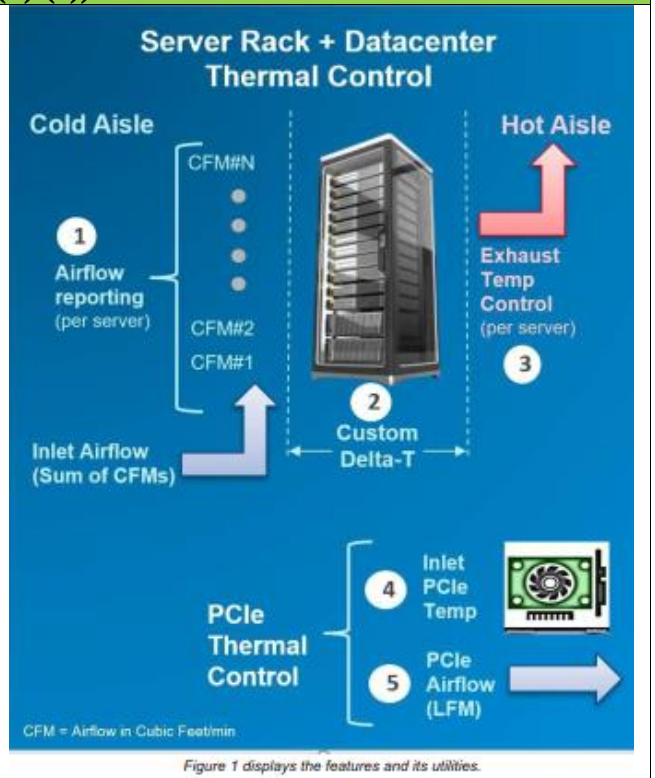
’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

iDRAC9 Features and Benefits

Features	Benefits
Telemetry Streaming	Perform deep analysis of server telemetry including CPU, GPU, SFP IO, power, thermals storage, networking, memory and more. Requires iDRAC9 Datacenter license.
Thermal Manage	Customize thermal and airflow management at the rack and server level. Requires iDRAC9 Datacenter license.
Automatic Certificate Enrollment	Automatic SSL certificate enrollment and renewal of the iDRAC self-signed certificated with a trusted CA certificate. Requires iDRAC9 Datacenter license.
Zero touch deployment and provisioning	Automatically configure PowerEdge servers when they are initially connected to your network. This process uses a Server Configuration Profile to set hardware, update firmware, and install OS. Requires iDRAC9 Enterprise or Datacenter license.
Virtual Clipboard	Provides an easy to enter complex passwords and more in the HTML5 vConsole. Users can copy text/passwords to local clipboard and paste into remote console view. Requires iDRAC9 Datacenter license.
Connection View	iDRAC sends standard LLDP packets to external switches, which provides the option to discover iDRACs on the network. iDRAC sends two types of LLDP packets to the outbound network; Topology and Discovery. Also, iDRAC can also display switch and port information.
System Lockdown	Helps to prevent configuration or firmware changes to a server when using Dell tools and even vendor tools for selected network cards. Requires iDRAC Enterprise or Datacenter License.
RSA SecurID 2FA	Add the RSA SecurID client software into iDRAC to provide native support for RSA 2FA solutions. Requires Datacenter license.
DRAC RESTful API	With this API, iDRAC enables support for the Redfish standard and enhances it with Dell extensions.
Cipher Select	Cipher Select is an advanced user setting where the user can choose to block undesired ciphers negotiated by iDRAC, providing increased security.
Secured Component Verification	Secured Component Verification (SCV) is a Supply chain assurance offering that enables Dell customers to verify that a PowerEdge server received by the customer matches what was manufactured in the factory.
System Erase	With proper authentication, administrators can securely erase data from local storage (HDDs, SSDs, NVMes).
iDRAC Direct	Secure front-panel USB connection to iDRAC web interface, which eliminates the need for crash carts or a trip to the hot aisle of your data center. You can use the same port to insert a USB key to upload new system profile for secure, rapid system configuration.

iDRAC Solution Brief, 2.

The iDRAC “Thermal Manage” feature includes the (i) ability to limit a rise in air temperature from the server inlet to exhaust (“Custom Delta-T”) and (ii) ability to specify the temperature limit of the server exhaust air (“Exhaust Temperature Control”).

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Thermal Manage – Feature Overview Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits: • Optimize server-related power and cooling efficiencies across their datacenters. • Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience. • Provides a state-of-the-art PCIe cooling management dashboard. Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities. 1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. 2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. 3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. 4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. 5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.  *Figure 1 displays the features and its utilities.* iDRAC Thermal Manage Features.
9[a] detecting an operational status and an intake air temperature of the ICT equipment;	The Accused Dell ’632 Products detect an operational status and an intake air temperature of the ICT equipment. *See supra*, claims 1[b], 8[a], 8[b], and 9[pre]. *See, e.g.*,

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

iDRAC9 Features and Benefits

Features	Benefits
Telemetry Streaming	Perform deep analysis of server telemetry including CPU, GPU, SFP IO, power, thermals storage, networking, memory and more. Requires iDRAC9 Datacenter license.
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RSA SecurID 2FA	Add the RSA SecurID client software into iDRAC to provide native support for RSA 2FA solutions. Requires Datacenter license.
DRAC RESTful API	With this API, iDRAC enables support for the Redfish standard and enhances it with Dell extensions.
Cipher Select	Cipher Select is an advanced user setting where the user can choose to block undesired ciphers negotiated by iDRAC, providing increased security.
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iDRAC Solution Brief, 2.

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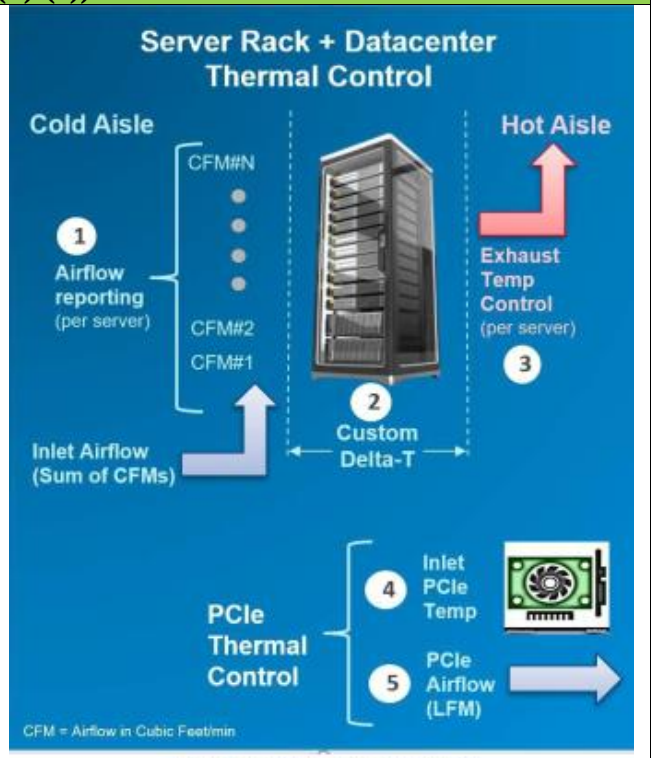
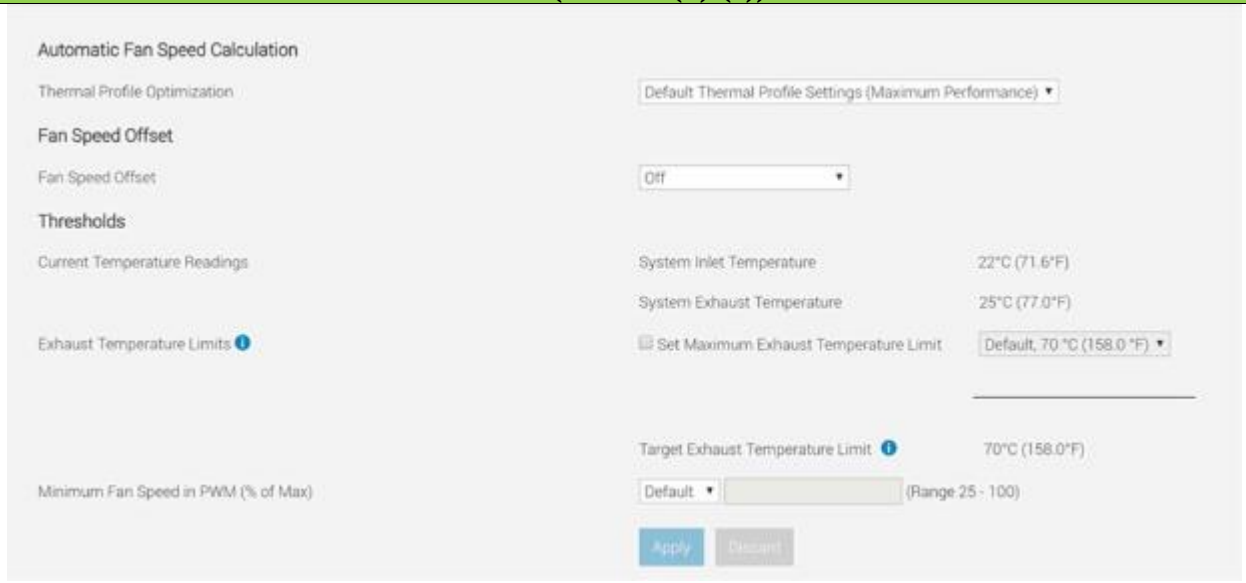
	Thermal Manage – Feature Overview Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits: • Optimize server-related power and cooling efficiencies across their datacenters. • Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience. • Provides a state-of-the-art PCIe cooling management dashboard. Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities. 1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. 2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. 3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. 4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. 5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.  *Figure 1 displays the features and its utilities.* iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Viewing sensor information The following sensors help to monitor the health of the managed system: • **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB). ⓘ **NOTE:** The Storage ROMB battery settings are available only if the system has a ROMB with a battery. • **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values. • **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure. • **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system. • **Intrusion** — Provides information about the chassis. • **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status. ⓘ **NOTE:** If there is only one power supply in the system, the power supply redundancy is set to **Disabled**. • **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM). ○ When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed. ○ If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted. ○ If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online. ○ During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off. ⓘ **NOTE:** If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC. ○ System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively. ⓘ **NOTE:** When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter. • **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value. • **Voltage** — Indicates the status and reading of the voltage sensors on various system components. iDRAC User’s Guide, 116; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x);

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x). **Configuring warning threshold for inlet temperature** You can modify the minimum and maximum warning threshold values for the system board inlet temperature sensor. If reset to default action is performed, the temperature thresholds are set to the default values. You must have Configure user privilege to set the warning threshold values for the inlet temperature sensor. https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Optimizing system performance and power consumption** The power required to cool a server can contribute a significant amount to the overall system power. Thermal control is the active management of system cooling through fan speed and system power management to make sure that the system is reliable while minimizing system power consumption, airflow, and system acoustic output. You can adjust the thermal control settings and optimize against the system performance and performance-per-Watt requirements. Using the iDRAC Web interface, RACADM, or the iDRAC Settings Utility, you can change the following thermal settings: • Optimize for performance • Optimize for minimum power • Set the maximum air exhaust temperature • Increase airflow through a fan offset, if required • Increase airflow through increasing minimum fan speed Following are the list of features in thermal management: • **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. • **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. • **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. • **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. • **PCIe Airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards. iDRAC User’s Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Monitoring performance index of CPU, memory, and input output modules** In Dell's 14th generation Dell PowerEdge servers, Intel ME supports Compute Usage Per Second (CUPS) functionality. The CUPS functionality provides real-time monitoring of CPU, memory, and I/O utilization and system-level utilization index for the system. Intel ME allows out-of-band (OOB) performance monitoring and does not consume CPU resources. The Intel ME has a system CUPS sensor that provides computation, memory, and I/O resource utilization values as a CUPS Index. iDRAC monitors this CUPS index for the overall system utilization and also monitors the instantaneous utilization index of the CPU, Memory, and I/O. The CPU and chipset have dedicated Resource monitoring Counters (RMC). The data from these RMCs is queried to obtain utilization information of system resources. The data from RMCs is aggregated by the node manager to measure the cumulative utilization of each of these system resources that is read from iDRAC using existing intercommunication mechanisms to provide data through out-of-band management interfaces. The Intel sensor representation of performance parameters and index values is for complete physical system. Therefore, the performance data representation on the interfaces is for the complete physical system, even if the system is virtualized and has multiple virtual hosts. To display the performance parameters, the supported sensors must be present in the server. The four system utilization parameters are: • **CPU Utilization** — Data from RMCs for each CPU core is aggregated to provide cumulative utilization of all the cores in the system. This utilization is based on time spent in active and inactive states. A sample of RMC is taken every six seconds. • **Memory Utilization** — RMCs measure memory traffic occurring at each memory channel or memory controller instance. Data from these RMCs is aggregated to measure the cumulative memory traffic across all the memory channels on the system. This is a measure of memory bandwidth consumption and not amount of memory utilization. iDRAC aggregates it for one minute, so it may or may not match the memory utilization that other OS tools, such as **top** in Linux, show. Memory bandwidth utilization that the iDRAC shows is an indication of whether workload is memory intensive or not. • **I/O Utilization** — There is one RMC per root port in the PCI Express Root Complex to measure PCI Express traffic emanating from or directed to that root port and the lower segment. Data from these RMCs is aggregated for measuring PCI express traffic for all PCI Express segments emanating from the package. This is measure of I/O bandwidth utilization for the system.

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	• **System Level CUPS Index** — The CUPS index is calculated by aggregating CPU, Memory, and I/O index considering a predefined load factor of each system resource. The load factor depends on the nature of the workload on the system. CUPS Index represents the measurement of the compute headroom available on the server. If the system has a large CUPS Index, then there is limited headroom to place more workload on that system. As the resource consumption decreases, the system's CUPS index decreases. A low CUPS index indicates that there is a large compute headroom and the server can receive new workloads and the server is in a lower power state to reduce power consumption. Workload monitoring can then be applied throughout the data center to provide a high-level and holistic view of the data center's workload, providing a dynamic data center solution. iDRAC User's Guide, 117-118; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Monitoring power** iDRAC monitors the power consumption in the system continuously and displays the following power values: • Power consumption warning and critical thresholds. • Cumulative power, peak power, and peak amperage values. • Power consumption over the last hour, last day or last week. • Average, minimum, and maximum power consumption. • Historical peak values and peak timestamps. • Peak headroom and instantaneous headroom values (for rack and tower servers). iDRAC User's Guide, 197; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Modifying thermal settings using iDRAC web interface To modify the thermal settings: 1. In the iDRAC Web interface, go to **Configuration** > **System Settings** > **Hardware Settings** > **Cooling Configuration**. 2. Specify the following: • **Thermal Profile Optimization** — Select the thermal profile: ○ **Default Thermal Profile Settings (Minimum Power)** — Implies that the thermal algorithm uses the same system profile settings that is defined under **System BIOS** > **System BIOS Settings** > **System Profile Settings** page. By default, this option is set to **Default Thermal Profile Settings**. You can also select a custom algorithm, which is independent of the BIOS profile. The options available are: ○ **Maximum Performance (Performance Optimized)** : ▪ Reduced probability of memory or CPU throttling. ▪ Increased probability of turbo mode activation. ▪ Generally, higher fan speeds at idle and stress loads. ○ **Minimum Power (Performance per Watt Optimized)**: ▪ Optimized for lowest system power consumption based on optimum fan power state. ▪ Generally, lower fan speeds at idle and stress loads. ○ **Sound Cap** — Sound Cap provides reduced acoustical output from a server at the expense of some performance. Enabling Sound Cap may include temporary deployment or evaluation of a server in an occupied space, but it should not be used during benchmarking or performance sensitive applications. **NOTE:** Selecting **Maximum Performance** or **Minimum Power**, overrides thermal settings associated to System Profile setting under **System BIOS** > **System BIOS Settings.System Profile Settings** page. • **Maximum Exhaust Temperature Limit** — From the drop-down menu, select the maximum exhaust air temperature. The values are displayed based on the system. The default value is **Default, 70°C (158 °F)**. This option allows the system fans speeds to change such that the exhaust temperature does not exceed the selected exhaust temperature limit. This cannot always be guaranteed under all system operating conditions due to dependency on system load and system cooling capability. iDRAC User's Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

	• **Thresholds**
	  ○ **Maximum PCIe Inlet Temperature Limit** — Default value is 55°C. Select the lower temperature of 45°C for third party PCIe cards which require lower inlet temperature.
	  ○ **Exhaust Temperature Limits** — By modifying the values for the following you can set the exhaust temperature limits:
	  ▪ **Set Maximum Exhaust Temperature Limit**
	  ▪ **Set Air Temperature Rise Limit**
	  ○ **Minimum Fan Speed in PWM (% of Max)** — Select this option to fine tune the fan speed. Using this option, you can set a higher baseline system fan speed or increase the system fan speed if other custom fan speed options are not resulting in the required higher fan speeds.
	  ▪ **Default** — Sets minimum fan speed to default value as determined by the system cooling algorithm.
	  ▪ **Custom** — Enter the percentage by which you want to change the fan speed. Range is between 9-100.
	  The allowable range for minimum fan speed PWM is dynamic based on the system configuration. The first value is the idle speed and the second value is the configuration max (Depending on the system configuration, the maximum speed may be up to 100%.).
	  System fans can run higher than this speed as per thermal requirements of the system but not lower than the defined minimum speed. For example, setting Minimum Fan Speed at 35% limits the fan speed to never go lower than 35% PWM.
	  NOTE: 0% PWM does not indicate fan is off. It is the lowest fan speed that the fan can achieve.
	The settings are persistent, which means that once they are set and applied, they do not automatically change to the default setting during system reboot, power cycling, iDRAC, or BIOS updates. The custom cooling options may not be supported on all servers. If the options are not supported, they are not displayed or you cannot provide a custom value.
	iDRAC User's Guide, 65; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

Multi-Vector Cooling

Multi-Vector Cooling implements multi-prong approach to Thermal Controls in Dell EMC Server Platforms. You can configure multi-vector cooling options through iDRAC web interface by navigating to **Configuration** > **System Settings** > **Hardware Settings** > **Fan Configuration**. It includes (but not limited to):

- Large set of sensors (thermal, power, inventory etc.) that allows accurate interpretation of real-time system thermal state at various locations within the server. It displays only a small subset of sensors that are relevant to users need based on the configuration.
- Intelligent and adaptive closed loop control algorithm optimizes fan response to maintain component temperatures. It also conserves fan power, airflow consumption, and acoustics.

- Using fan zone mapping, cooling can be initiated for the components when it requires. Thus, it results maximum performance without compromising the efficiency of power utilization.
- Accurate representation of slot by slot PCIe airflow in terms of LFM metric (Linear Feet per Minute - an accepted industry standard on how PCIe card airflow requirement is specified). Display of this metric in various iDRAC interfaces allows user to:
  1. know the maximum LFM capability of each slot within the server.
  2. know what approach is being taken for PCIe cooling for each slot (airflow controlled, temperature controlled).
  3. know the minimum LFM being delivered to a slot, if the card is a 3rd Party Card (user defined custom card).
  4. dial in custom minimum LFM value for the 3rd Party Card allowing more accurate definition of the card cooling needs for which the user is better aware of through their custom card specification.
- Displays real-time system airflow metric (CFM, cubic feet per minute) in various iDRAC interfaces to the user to enable datacenter airflow balancing based on aggregation of per server CFM consumption.
- Allows custom thermal settings like Thermal Profiles (Maximum Performance vs. Maximum Performance per Watt, Sound Cap), custom fan speed options (minimum fan speed, fan speed offsets) and custom Exhaust Temperature settings.
  1. Most of these settings allow additional cooling over the baseline cooling generated by thermal algorithms and do not allow fan speeds to go below system cooling requirements.

     NOTE: One exception to above statement is for fan speeds that are added for 3rd Party PCIe cards. The thermal algorithm provision airflow for 3rd party cards may be more or less than the actual card cooling needs and customer may fine tune the response for the card by entering the LFM corresponding to the 3rd Party Card.
  2. Custom Exhaust Temperature option limits exhaust temperature to customer desired settings.

     NOTE: It is important to note that with certain configurations and workloads, it may not be physically possible to reduce exhaust below a desired set point (e.g. Custom exhaust setting of 45C with a high inlet temp {e.g. 30C} and a loaded config {high system power consumption, low airflow}).
  3. Sound Cap option is new in the 14th generation of PowerEdge server. It limits CPU power consumption and controls fan speed and acoustical ceiling. This is unique for acoustical deployments and may result in reduced system performance.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User’s Guide, 201-202; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).
9[b] 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;	The Accused Dell ’632 Products, by an estimating unit, estimate 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. *See supra*, claims 1[b], 8[f], and 9[a]. *See, e.g.*,

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

iDRAC9 Features and Benefits

Features	Benefits
Telemetry Streaming	Perform deep analysis of server telemetry including CPU, GPU, SFP IO, power, thermals storage, networking, memory and more. Requires iDRAC9 Datacenter license.
Thermal Manage	Customize thermal and airflow management at the rack and server level. Requires iDRAC9 Datacenter license.
Automatic Certificate Enrollment	Automatic SSL certificate enrollment and renewal of the iDRAC self-signed certificated with a trusted CA certificate. Requires iDRAC9 Datacenter license.
Zero touch deployment and provisioning	Automatically configure PowerEdge servers when they are initially connected to your network. This process uses a Server Configuration Profile to set hardware, update firmware, and install OS. Requires iDRAC9 Enterprise or Datacenter license.
Virtual Clipboard	Provides an easy to enter complex passwords and more in the HTML5 vConsole. Users can copy text/passwords to local clipboard and paste into remote console view. Requires iDRAC9 Datacenter license.
Connection View	iDRAC sends standard LLDP packets to external switches, which provides the option to discover iDRACs on the network. iDRAC sends two types of LLDP packets to the outbound network; Topology and Discovery. Also, iDRAC can also display switch and port information.
System Lockdown	Helps to prevent configuration or firmware changes to a server when using Dell tools and even vendor tools for selected network cards. Requires iDRAC Enterprise or Datacenter License.
RSA SecurID 2FA	Add the RSA SecurID client software into iDRAC to provide native support for RSA 2FA solutions. Requires Datacenter license.
DRAC RESTful API	With this API, iDRAC enables support for the Redfish standard and enhances it with Dell extensions.
Cipher Select	Cipher Select is an advanced user setting where the user can choose to block undesired ciphers negotiated by iDRAC, providing increased security.
Secured Component Verification	Secured Component Verification (SCV) is a Supply chain assurance offering that enables Dell customers to verify that a PowerEdge server received by the customer matches what was manufactured in the factory.
System Erase	With proper authentication, administrators can securely erase data from local storage (HDDs, SSDs, NVMes).
iDRAC Direct	Secure front-panel USB connection to iDRAC web interface, which eliminates the need for crash carts or a trip to the hot aisle of your data center. You can use the same port to insert a USB key to upload new system profile for secure, rapid system configuration.

iDRAC Solution Brief, 2.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

Thermal Manage – Feature Overview

Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits:

- Optimize server-related power and cooling efficiencies across their datacenters.
- Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience.
- Provides a state-of-the-art PCIe cooling management dashboard.

Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities.

1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level.
2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling.
3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs.
4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements.
5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.

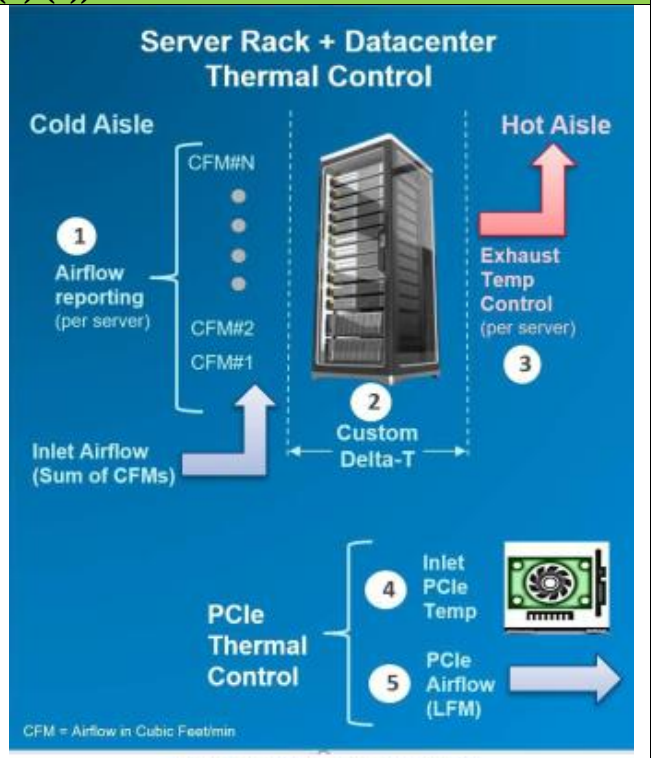
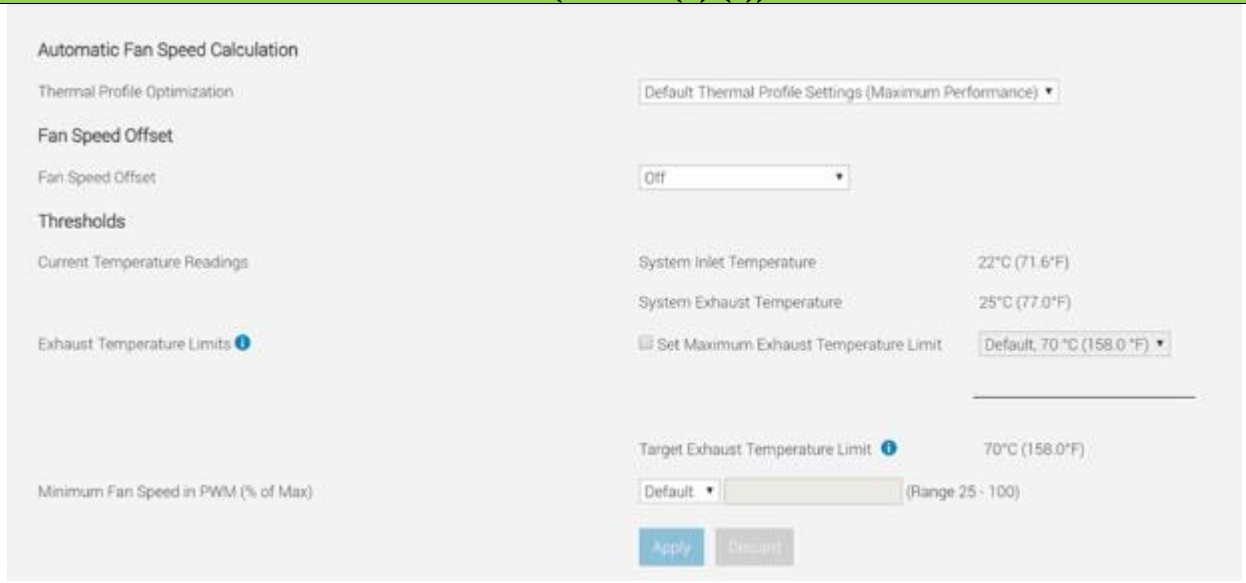


Figure 1 displays the features and its utilities.

iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

Viewing sensor information

The following sensors help to monitor the health of the managed system:

- **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB).

  NOTE: The Storage ROMB battery settings are available only if the system has a ROMB with a battery.
- **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values.
- **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure.
- **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system.
- **Intrusion** — Provides information about the chassis.
- **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status.

  NOTE: If there is only one power supply in the system, the power supply redundancy is set to **Disabled**.
- **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM).
  - When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed.
  - If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted.
  - If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online.
  - During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off.

    NOTE: If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC.
  - System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively.

  NOTE: When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter.
- **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value.
- **Voltage** — Indicates the status and reading of the voltage sensors on various system components.

iDRAC User’s Guide, 116; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x);

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x). **Configuring warning threshold for inlet temperature** You can modify the minimum and maximum warning threshold values for the system board inlet temperature sensor. If reset to default action is performed, the temperature thresholds are set to the default values. You must have Configure user privilege to set the warning threshold values for the inlet temperature sensor. https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Optimizing system performance and power consumption** The power required to cool a server can contribute a significant amount to the overall system power. Thermal control is the active management of system cooling through fan speed and system power management to make sure that the system is reliable while minimizing system power consumption, airflow, and system acoustic output. You can adjust the thermal control settings and optimize against the system performance and performance-per-Watt requirements. Using the iDRAC Web interface, RACADM, or the iDRAC Settings Utility, you can change the following thermal settings: • Optimize for performance • Optimize for minimum power • Set the maximum air exhaust temperature • Increase airflow through a fan offset, if required • Increase airflow through increasing minimum fan speed Following are the list of features in thermal management: • **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. • **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. • **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. • **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. • **PCIe Airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards. iDRAC User's Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Monitoring performance index of CPU, memory, and input output modules** In Dell's 14th generation Dell PowerEdge servers, Intel ME supports Compute Usage Per Second (CUPS) functionality. The CUPS functionality provides real-time monitoring of CPU, memory, and I/O utilization and system-level utilization index for the system. Intel ME allows out-of-band (OOB) performance monitoring and does not consume CPU resources. The Intel ME has a system CUPS sensor that provides computation, memory, and I/O resource utilization values as a CUPS Index. iDRAC monitors this CUPS index for the overall system utilization and also monitors the instantaneous utilization index of the CPU, Memory, and I/O. The CPU and chipset have dedicated Resource monitoring Counters (RMC). The data from these RMCs is queried to obtain utilization information of system resources. The data from RMCs is aggregated by the node manager to measure the cumulative utilization of each of these system resources that is read from iDRAC using existing intercommunication mechanisms to provide data through out-of-band management interfaces. The Intel sensor representation of performance parameters and index values is for complete physical system. Therefore, the performance data representation on the interfaces is for the complete physical system, even if the system is virtualized and has multiple virtual hosts. To display the performance parameters, the supported sensors must be present in the server. The four system utilization parameters are: • **CPU Utilization** — Data from RMCs for each CPU core is aggregated to provide cumulative utilization of all the cores in the system. This utilization is based on time spent in active and inactive states. A sample of RMC is taken every six seconds. • **Memory Utilization** — RMCs measure memory traffic occurring at each memory channel or memory controller instance. Data from these RMCs is aggregated to measure the cumulative memory traffic across all the memory channels on the system. This is a measure of memory bandwidth consumption and not amount of memory utilization. iDRAC aggregates it for one minute, so it may or may not match the memory utilization that other OS tools, such as **top** in Linux, show. Memory bandwidth utilization that the iDRAC shows is an indication of whether workload is memory intensive or not. • **I/O Utilization** — There is one RMC per root port in the PCI Express Root Complex to measure PCI Express traffic emanating from or directed to that root port and the lower segment. Data from these RMCs is aggregated for measuring PCI express traffic for all PCI Express segments emanating from the package. This is measure of I/O bandwidth utilization for the system.

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	• **System Level CUPS Index** — The CUPS index is calculated by aggregating CPU, Memory, and I/O index considering a predefined load factor of each system resource. The load factor depends on the nature of the workload on the system. CUPS Index represents the measurement of the compute headroom available on the server. If the system has a large CUPS Index, then there is limited headroom to place more workload on that system. As the resource consumption decreases, the system's CUPS index decreases. A low CUPS index indicates that there is a large compute headroom and the server can receive new workloads and the server is in a lower power state to reduce power consumption. Workload monitoring can then be applied throughout the data center to provide a high-level and holistic view of the data center's workload, providing a dynamic data center solution. iDRAC User's Guide, 117-118; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Monitoring power** iDRAC monitors the power consumption in the system continuously and displays the following power values: • Power consumption warning and critical thresholds. • Cumulative power, peak power, and peak amperage values. • Power consumption over the last hour, last day or last week. • Average, minimum, and maximum power consumption. • Historical peak values and peak timestamps. • Peak headroom and instantaneous headroom values (for rack and tower servers). iDRAC User's Guide, 197; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

Modifying thermal settings using iDRAC web interface

To modify the thermal settings:

1. In the iDRAC Web interface, go to **Configuration** > **System Settings** > **Hardware Settings** > **Cooling Configuration**.
2. Specify the following:
   - **Thermal Profile Optimization** — Select the thermal profile:
     - **Default Thermal Profile Settings (Minimum Power)** — Implies that the thermal algorithm uses the same system profile settings that is defined under **System BIOS** > **System BIOS Settings** > **System Profile Settings** page.

     By default, this option is set to **Default Thermal Profile Settings**. You can also select a custom algorithm, which is independent of the BIOS profile. The options available are:
     - **Maximum Performance (Performance Optimized)** :
       - Reduced probability of memory or CPU throttling.
       - Increased probability of turbo mode activation.
       - Generally, higher fan speeds at idle and stress loads.
     - **Minimum Power (Performance per Watt Optimized)**:
       - Optimized for lowest system power consumption based on optimum fan power state.
       - Generally, lower fan speeds at idle and stress loads.
     - **Sound Cap** — Sound Cap provides reduced acoustical output from a server at the expense of some performance. Enabling Sound Cap may include temporary deployment or evaluation of a server in an occupied space, but it should not be used during benchmarking or performance sensitive applications.

     NOTE: Selecting **Maximum Performance** or **Minimum Power**, overrides thermal settings associated to System Profile setting under **System BIOS** > **System BIOS Settings.System Profile Settings** page.
   - **Maximum Exhaust Temperature Limit** — From the drop-down menu, select the maximum exhaust air temperature. The values are displayed based on the system.

     The default value is **Default, 70°C (158 °F)**.

     This option allows the system fans speeds to change such that the exhaust temperature does not exceed the selected exhaust temperature limit. This cannot always be guaranteed under all system operating conditions due to dependency on system load and system cooling capability.

iDRAC User’s Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

	• **Thresholds**
	  ○ **Maximum PCIe Inlet Temperature Limit** — Default value is 55°C. Select the lower temperature of 45°C for third party PCIe cards which require lower inlet temperature.
	  ○ **Exhaust Temperature Limits** — By modifying the values for the following you can set the exhaust temperature limits:
	  ▪ **Set Maximum Exhaust Temperature Limit**
	  ▪ **Set Air Temperature Rise Limit**
	  ○ **Minimum Fan Speed in PWM (% of Max)** — Select this option to fine tune the fan speed. Using this option, you can set a higher baseline system fan speed or increase the system fan speed if other custom fan speed options are not resulting in the required higher fan speeds.
	  ▪ **Default** — Sets minimum fan speed to default value as determined by the system cooling algorithm.
	  ▪ **Custom** — Enter the percentage by which you want to change the fan speed. Range is between 9-100.
	The allowable range for minimum fan speed PWM is dynamic based on the system configuration. The first value is the idle speed and the second value is the configuration max (Depending on the system configuration, the maximum speed may be up to 100%.).
	System fans can run higher than this speed as per thermal requirements of the system but not lower than the defined minimum speed. For example, setting Minimum Fan Speed at 35% limits the fan speed to never go lower than 35% PWM.
	NOTE: 0% PWM does not indicate fan is off. It is the lowest fan speed that the fan can achieve.
	The settings are persistent, which means that once they are set and applied, they do not automatically change to the default setting during system reboot, power cycling, iDRAC, or BIOS updates. The custom cooling options may not be supported on all servers. If the options are not supported, they are not displayed or you cannot provide a custom value.
	iDRAC User's Guide, 65; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

Multi-Vector Cooling

Multi-Vector Cooling implements multi-prong approach to Thermal Controls in Dell EMC Server Platforms. You can configure multi-vector cooling options through iDRAC web interface by navigating to **Configuration** > **System Settings** > **Hardware Settings** > **Fan Configuration**. It includes (but not limited to):

- Large set of sensors (thermal, power, inventory etc.) that allows accurate interpretation of real-time system thermal state at various locations within the server. It displays only a small subset of sensors that are relevant to users need based on the configuration.
- Intelligent and adaptive closed loop control algorithm optimizes fan response to maintain component temperatures. It also conserves fan power, airflow consumption, and acoustics.

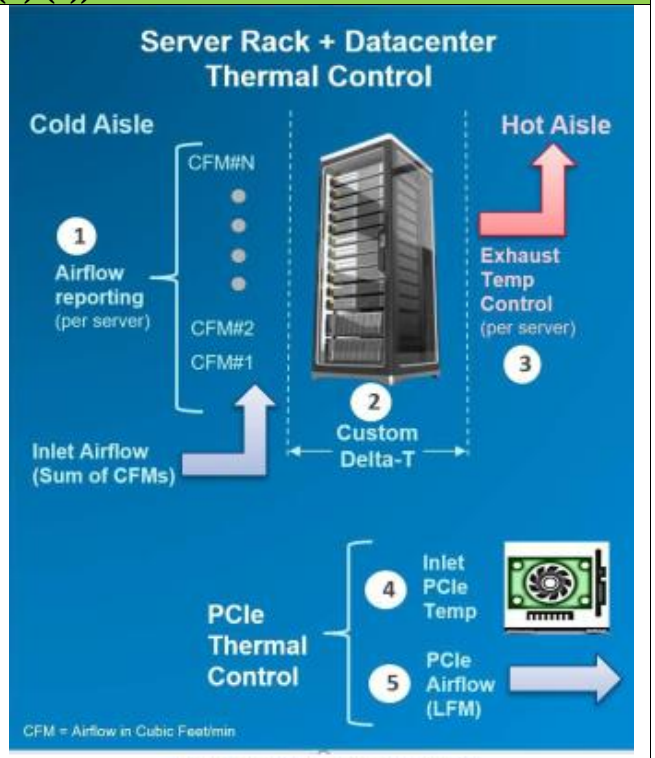
- Using fan zone mapping, cooling can be initiated for the components when it requires. Thus, it results maximum performance without compromising the efficiency of power utilization.
- Accurate representation of slot by slot PCIe airflow in terms of LFM metric (Linear Feet per Minute - an accepted industry standard on how PCIe card airflow requirement is specified). Display of this metric in various iDRAC interfaces allows user to:
  1. know the maximum LFM capability of each slot within the server.
  2. know what approach is being taken for PCIe cooling for each slot (airflow controlled, temperature controlled).
  3. know the minimum LFM being delivered to a slot, if the card is a 3rd Party Card (user defined custom card).
  4. dial in custom minimum LFM value for the 3rd Party Card allowing more accurate definition of the card cooling needs for which the user is better aware of through their custom card specification.
- Displays real-time system airflow metric (CFM, cubic feet per minute) in various iDRAC interfaces to the user to enable datacenter airflow balancing based on aggregation of per server CFM consumption.
- Allows custom thermal settings like Thermal Profiles (Maximum Performance vs. Maximum Performance per Watt, Sound Cap), custom fan speed options (minimum fan speed, fan speed offsets) and custom Exhaust Temperature settings.
  1. Most of these settings allow additional cooling over the baseline cooling generated by thermal algorithms and do not allow fan speeds to go below system cooling requirements.

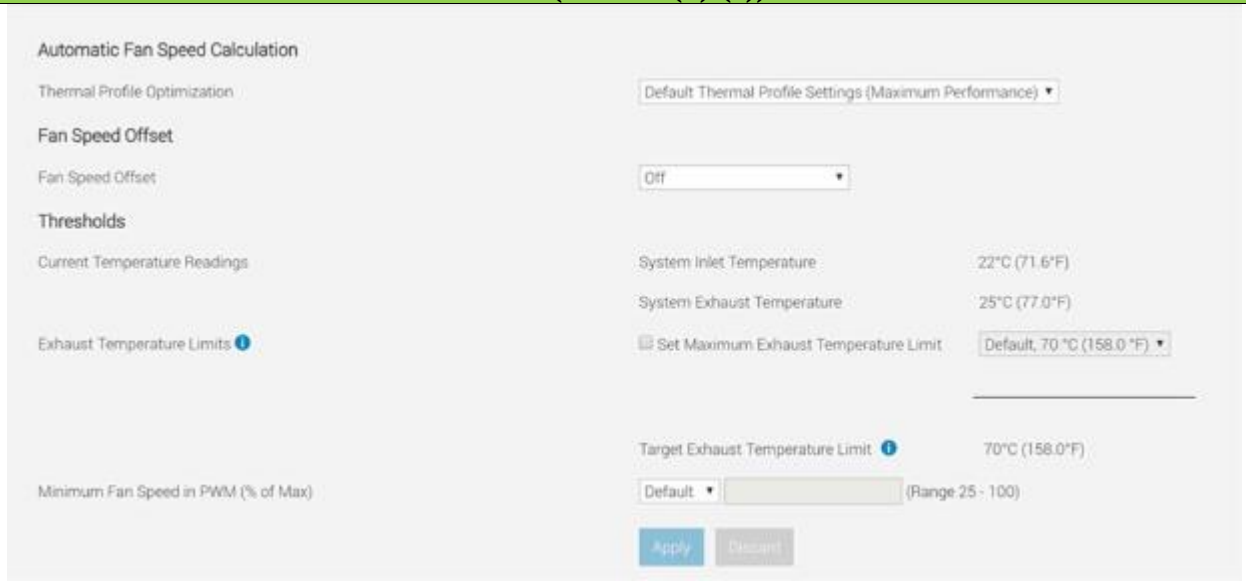
     NOTE: One exception to above statement is for fan speeds that are added for 3rd Party PCIe cards. The thermal algorithm provision airflow for 3rd party cards may be more or less than the actual card cooling needs and customer may fine tune the response for the card by entering the LFM corresponding to the 3rd Party Card.
  2. Custom Exhaust Temperature option limits exhaust temperature to customer desired settings.

     NOTE: It is important to note that with certain configurations and workloads, it may not be physically possible to reduce exhaust below a desired set point (e.g. Custom exhaust setting of 45C with a high inlet temp {e.g. 30C} and a loaded config {high system power consumption, low airflow}).
  3. Sound Cap option is new in the 14th generation of PowerEdge server. It limits CPU power consumption and controls fan speed and acoustical ceiling. This is unique for acoustical deployments and may result in reduced system performance.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User’s Guide, 201-202; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). This is a software limitation that may require access to the underlying source code. Accordingly, pursuant to Paragraph 3(a)(i) of the Discovery Order, Cloud Byte may supplement these contentions with additional information after Dell’s source code has been produced. In addition and/or in the alternative to literally infringing this claim element, the Accused Dell ’632 Products also infringe under the doctrine of equivalents. The Accused Dell ’632 Products are at least equivalent to and insubstantially different from the claimed limitation where an estimating unit estimates 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 to perform substantially the same function (e.g., estimating an upper limit of temperature for the ICT equipment) in substantially the same way (e.g., based at least on the operational status and intake air temperature of the ICT equipment), to achieve substantially the same result (e.g., identifying a threshold temperature in which the ICT equipment should not exceed).
9[c] determining a rotation speed of the cooling fan based on the detected operational status and the air intake temperature; and	The Accused Dell ’632 Products determine a rotation speed of the cooling fan based on the detected operational status and the air intake temperature. *See supra*, claims 1[c], 8[g], and 9[b]. *See, e.g.*,

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 PowerEdge R6615 Powerful performance per investment dollar The new Dell PowerEdge R6615 is a 1U, single-socket rack server. Designed to be the best investment per dollar for your data center, this server provides performance and flexible, low-latency storage options in an air or Direct Liquid Cooling (DLC) configuration. Fans • Standard (STD) fans/High performance GOLD (VHP) fans • Up to 4 sets (dual fan module) hot plug fans R6615 Spec Sheet, 1-2.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Thermal Manage – Feature Overview Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits: • Optimize server-related power and cooling efficiencies across their datacenters. • Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience. • Provides a state-of-the-art PCIe cooling management dashboard. Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities. 1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. 2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. 3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. 4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. 5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.  *Figure 1 displays the features and its utilities.* iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Viewing sensor information The following sensors help to monitor the health of the managed system: • **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB). ⓘ **NOTE:** The Storage ROMB battery settings are available only if the system has a ROMB with a battery. • **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values. • **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure. • **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system. • **Intrusion** — Provides information about the chassis. • **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status. ⓘ **NOTE:** If there is only one power supply in the system, the power supply redundancy is set to **Disabled**. • **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM). ○ When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed. ○ If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted. ○ If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online. ○ During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off. ⓘ **NOTE:** If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC. ○ System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively. ⓘ **NOTE:** When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter. • **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value. • **Voltage** — Indicates the status and reading of the voltage sensors on various system components. iDRAC User’s Guide, 116; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x);

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	guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Monitoring performance index of CPU, memory, and input output modules** In Dell's 14th generation Dell PowerEdge servers, Intel ME supports Compute Usage Per Second (CUPS) functionality. The CUPS functionality provides real-time monitoring of CPU, memory, and I/O utilization and system-level utilization index for the system. Intel ME allows out-of-band (OOB) performance monitoring and does not consume CPU resources. The Intel ME has a system CUPS sensor that provides computation, memory, and I/O resource utilization values as a CUPS Index. iDRAC monitors this CUPS index for the overall system utilization and also monitors the instantaneous utilization index of the CPU, Memory, and I/O. The CPU and chipset have dedicated Resource monitoring Counters (RMC). The data from these RMCs is queried to obtain utilization information of system resources. The data from RMCs is aggregated by the node manager to measure the cumulative utilization of each of these system resources that is read from iDRAC using existing intercommunication mechanisms to provide data through out-of-band management interfaces. The Intel sensor representation of performance parameters and index values is for complete physical system. Therefore, the performance data representation on the interfaces is for the complete physical system, even if the system is virtualized and has multiple virtual hosts. To display the performance parameters, the supported sensors must be present in the server. The four system utilization parameters are: • **CPU Utilization** — Data from RMCs for each CPU core is aggregated to provide cumulative utilization of all the cores in the system. This utilization is based on time spent in active and inactive states. A sample of RMC is taken every six seconds. • **Memory Utilization** — RMCs measure memory traffic occurring at each memory channel or memory controller instance. Data from these RMCs is aggregated to measure the cumulative memory traffic across all the memory channels on the system. This is a measure of memory bandwidth consumption and not amount of memory utilization. iDRAC aggregates it for one minute, so it may or may not match the memory utilization that other OS tools, such as **top** in Linux, show. Memory bandwidth utilization that the iDRAC shows is an indication of whether workload is memory intensive or not. • **I/O Utilization** — There is one RMC per root port in the PCI Express Root Complex to measure PCI Express traffic emanating from or directed to that root port and the lower segment. Data from these RMCs is aggregated for measuring PCI express traffic for all PCI Express segments emanating from the package. This is measure of I/O bandwidth utilization for the system.

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	• **System Level CUPS Index** — The CUPS index is calculated by aggregating CPU, Memory, and I/O index considering a predefined load factor of each system resource. The load factor depends on the nature of the workload on the system. CUPS Index represents the measurement of the compute headroom available on the server. If the system has a large CUPS Index, then there is limited headroom to place more workload on that system. As the resource consumption decreases, the system's CUPS index decreases. A low CUPS index indicates that there is a large compute headroom and the server can receive new workloads and the server is in a lower power state to reduce power consumption. Workload monitoring can then be applied throughout the data center to provide a high-level and holistic view of the data center's workload, providing a dynamic data center solution. iDRAC User's Guide, 117-118; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Monitoring power** iDRAC monitors the power consumption in the system continuously and displays the following power values: • Power consumption warning and critical thresholds. • Cumulative power, peak power, and peak amperage values. • Power consumption over the last hour, last day or last week. • Average, minimum, and maximum power consumption. • Historical peak values and peak timestamps. • Peak headroom and instantaneous headroom values (for rack and tower servers). iDRAC User's Guide, 197; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Modifying thermal settings using iDRAC web interface To modify the thermal settings: 1. In the iDRAC Web interface, go to **Configuration** > **System Settings** > **Hardware Settings** > **Cooling Configuration**. 2. Specify the following: • **Thermal Profile Optimization** — Select the thermal profile: ○ **Default Thermal Profile Settings (Minimum Power)** — Implies that the thermal algorithm uses the same system profile settings that is defined under **System BIOS** > **System BIOS Settings** > **System Profile Settings** page. By default, this option is set to **Default Thermal Profile Settings**. You can also select a custom algorithm, which is independent of the BIOS profile. The options available are: ○ **Maximum Performance (Performance Optimized)** : ▪ Reduced probability of memory or CPU throttling. ▪ Increased probability of turbo mode activation. ▪ Generally, higher fan speeds at idle and stress loads. ○ **Minimum Power (Performance per Watt Optimized)**: ▪ Optimized for lowest system power consumption based on optimum fan power state. ▪ Generally, lower fan speeds at idle and stress loads. ○ **Sound Cap** — Sound Cap provides reduced acoustical output from a server at the expense of some performance. Enabling Sound Cap may include temporary deployment or evaluation of a server in an occupied space, but it should not be used during benchmarking or performance sensitive applications. **NOTE:** Selecting **Maximum Performance** or **Minimum Power**, overrides thermal settings associated to System Profile setting under **System BIOS** > **System BIOS Settings.System Profile Settings** page. • **Maximum Exhaust Temperature Limit** — From the drop-down menu, select the maximum exhaust air temperature. The values are displayed based on the system. The default value is **Default, 70°C (158 °F)**. This option allows the system fans speeds to change such that the exhaust temperature does not exceed the selected exhaust temperature limit. This cannot always be guaranteed under all system operating conditions due to dependency on system load and system cooling capability. iDRAC User's Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

	• **Thresholds**
	  ○ **Maximum PCIe Inlet Temperature Limit** — Default value is 55°C. Select the lower temperature of 45°C for third party PCIe cards which require lower inlet temperature.
	  ○ **Exhaust Temperature Limits** — By modifying the values for the following you can set the exhaust temperature limits:
	  ▪ **Set Maximum Exhaust Temperature Limit**
	  ▪ **Set Air Temperature Rise Limit**
	  ○ **Minimum Fan Speed in PWM (% of Max)** — Select this option to fine tune the fan speed. Using this option, you can set a higher baseline system fan speed or increase the system fan speed if other custom fan speed options are not resulting in the required higher fan speeds.
	  ▪ **Default** — Sets minimum fan speed to default value as determined by the system cooling algorithm.
	  ▪ **Custom** — Enter the percentage by which you want to change the fan speed. Range is between 9-100.
	  The allowable range for minimum fan speed PWM is dynamic based on the system configuration. The first value is the idle speed and the second value is the configuration max (Depending on the system configuration, the maximum speed may be up to 100%.).
	  System fans can run higher than this speed as per thermal requirements of the system but not lower than the defined minimum speed. For example, setting Minimum Fan Speed at 35% limits the fan speed to never go lower than 35% PWM.
	  NOTE: 0% PWM does not indicate fan is off. It is the lowest fan speed that the fan can achieve.
	The settings are persistent, which means that once they are set and applied, they do not automatically change to the default setting during system reboot, power cycling, iDRAC, or BIOS updates. The custom cooling options may not be supported on all servers. If the options are not supported, they are not displayed or you cannot provide a custom value.
	iDRAC User's Guide, 65; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

Multi-Vector Cooling

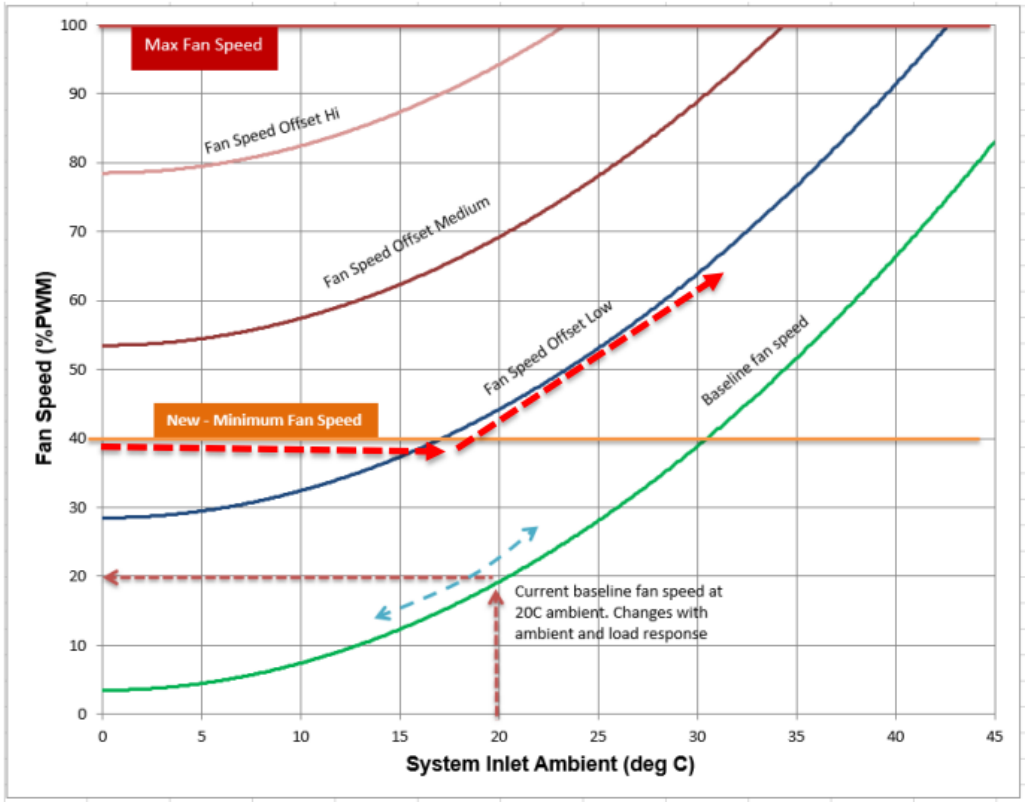
Multi-Vector Cooling implements multi-prong approach to Thermal Controls in Dell EMC Server Platforms. You can configure multi-vector cooling options through iDRAC web interface by navigating to **Configuration** > **System Settings** > **Hardware Settings** > **Fan Configuration**. It includes (but not limited to):

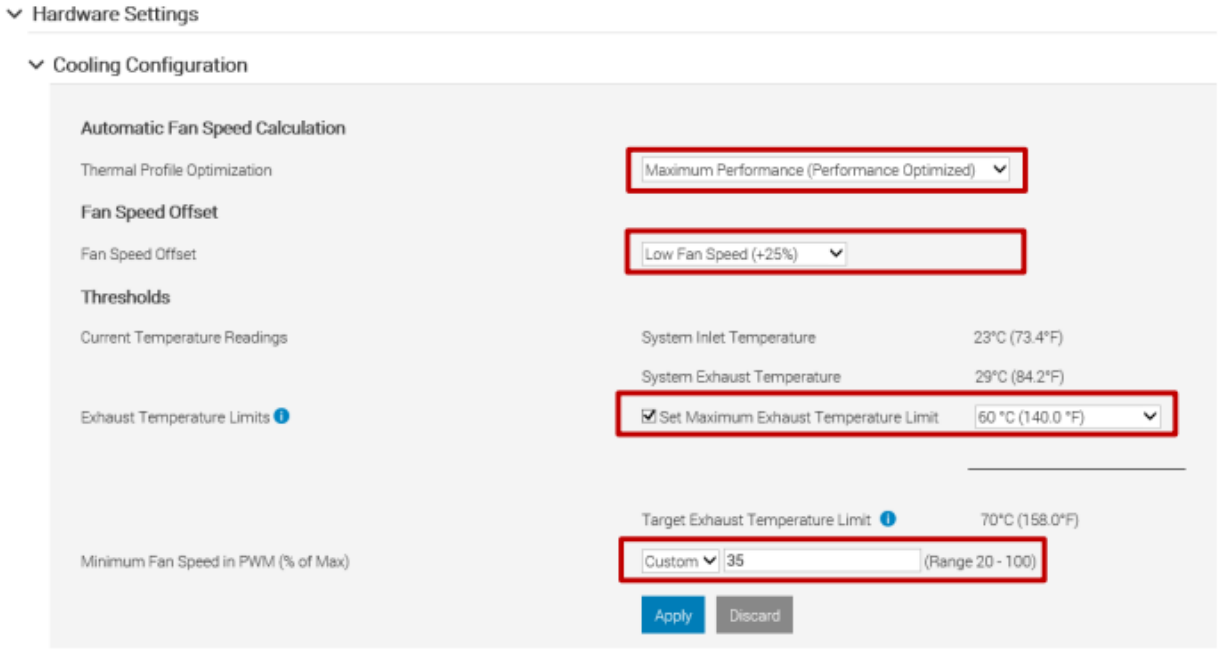
- Large set of sensors (thermal, power, inventory etc.) that allows accurate interpretation of real-time system thermal state at various locations within the server. It displays only a small subset of sensors that are relevant to users need based on the configuration.
- Intelligent and adaptive closed loop control algorithm optimizes fan response to maintain component temperatures. It also conserves fan power, airflow consumption, and acoustics.

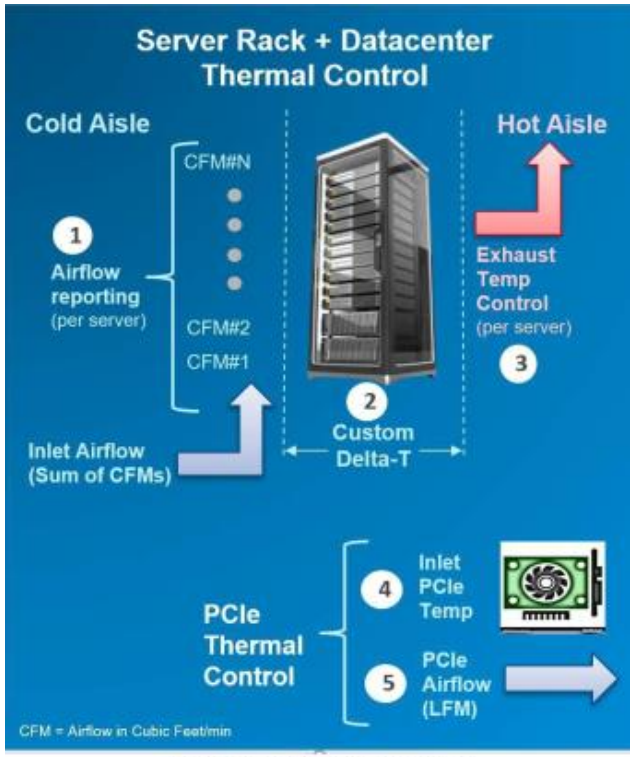
- Using fan zone mapping, cooling can be initiated for the components when it requires. Thus, it results maximum performance without compromising the efficiency of power utilization.
- Accurate representation of slot by slot PCIe airflow in terms of LFM metric (Linear Feet per Minute - an accepted industry standard on how PCIe card airflow requirement is specified). Display of this metric in various iDRAC interfaces allows user to:
  1. know the maximum LFM capability of each slot within the server.
  2. know what approach is being taken for PCIe cooling for each slot (airflow controlled, temperature controlled).
  3. know the minimum LFM being delivered to a slot, if the card is a 3rd Party Card (user defined custom card).
  4. dial in custom minimum LFM value for the 3rd Party Card allowing more accurate definition of the card cooling needs for which the user is better aware of through their custom card specification.
- Displays real-time system airflow metric (CFM, cubic feet per minute) in various iDRAC interfaces to the user to enable datacenter airflow balancing based on aggregation of per server CFM consumption.
- Allows custom thermal settings like Thermal Profiles (Maximum Performance vs. Maximum Performance per Watt, Sound Cap), custom fan speed options (minimum fan speed, fan speed offsets) and custom Exhaust Temperature settings.
  1. Most of these settings allow additional cooling over the baseline cooling generated by thermal algorithms and do not allow fan speeds to go below system cooling requirements.

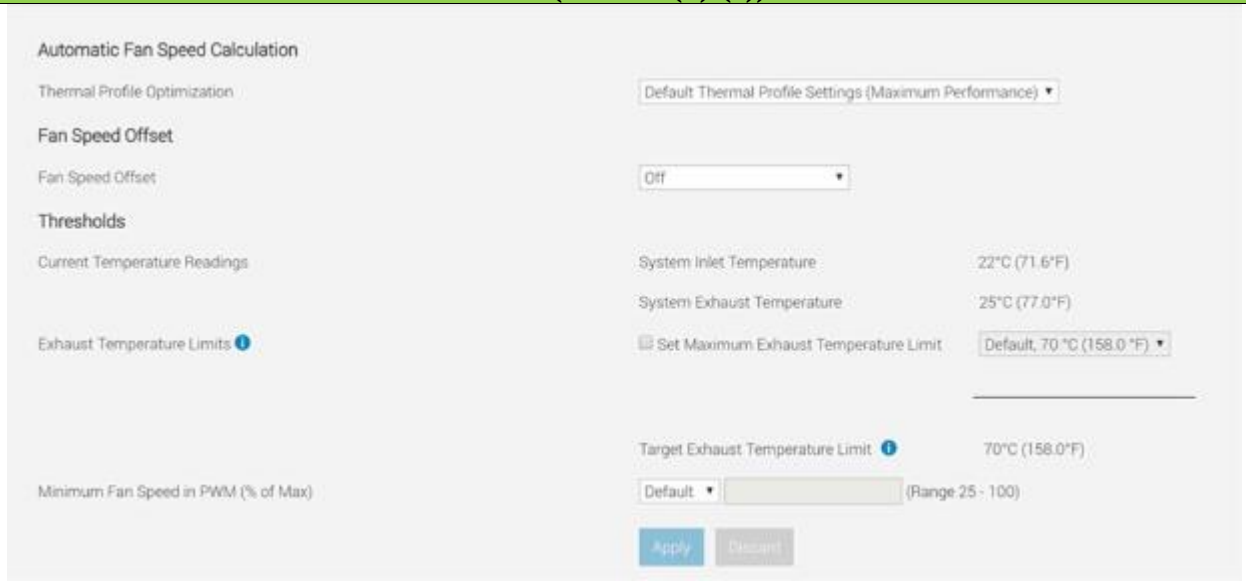
     NOTE: One exception to above statement is for fan speeds that are added for 3rd Party PCIe cards. The thermal algorithm provision airflow for 3rd party cards may be more or less than the actual card cooling needs and customer may fine tune the response for the card by entering the LFM corresponding to the 3rd Party Card.
  2. Custom Exhaust Temperature option limits exhaust temperature to customer desired settings.

     NOTE: It is important to note that with certain configurations and workloads, it may not be physically possible to reduce exhaust below a desired set point (e.g. Custom exhaust setting of 45C with a high inlet temp {e.g. 30C} and a loaded config {high system power consumption, low airflow}).
  3. Sound Cap option is new in the 14th generation of PowerEdge server. It limits CPU power consumption and controls fan speed and acoustical ceiling. This is unique for acoustical deployments and may result in reduced system performance.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User’s Guide, 201-202; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).  Figure 3 How options can be combined with MFS and Offset set simultaneously If Low Offset and 40% MFS are applied, Fan Speed follows the red dotted line based on Inlet Ambient. PowerEdge Custom Cooling Fan Options, 9.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Each of the options that are described earlier can be toggled independently and set at the same time. For example, low Fan Speed Offset, and Exhaust of 50°C and Minimum Fan Speed of 20% can be set concurrently. The algorithm calculates the appropriate fan speed that meets all the customization requests. See the screenshots that follow for an example of such settings.  Figure 16 Setting multiple custom control options PowerEdge Custom Cooling Fan Options, 18-19. This is a software limitation that may require access to the underlying source code. Accordingly, pursuant to Paragraph 3(a)(i) of the Discovery Order, Cloud Byte may supplement these contentions with additional information after Dell’s source code has been produced.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
9[d] 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.	The Accused Dell ’632 Products, by a determining unit, determine 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. *See supra*, claims 1[d], 8[h], and 9[c]. *See, e.g.*, Thermal Manage – Feature Overview Thermal Manage allows customers to customize the thermal operation of their PowerEdge servers with the following benefits: • Optimize server-related power and cooling efficiencies across their datacenters. • Integrates seamlessly with OpenManage Enterprise Power Manager for optimized management experience. • Provides a state-of-the-art PCIe cooling management dashboard. Represented in the following diagram (See figure 1) and listed below is a summary of the features and its utilities. 1. **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. 2. **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. 3. **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. 4. **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. 5. **PCIe airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards.  *Figure 1 displays the features and its utilities.* iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	 iDRAC Thermal Manage Features.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	Viewing sensor information The following sensors help to monitor the health of the managed system: • **Batteries** — Provides information about the batteries on the system board CMOS and storage RAID On Motherboard (ROMB). ⓘ **NOTE:** The Storage ROMB battery settings are available only if the system has a ROMB with a battery. • **Fan** (available only for rack and tower servers) — Provides information about the system fans — fan redundancy and fans list that display fan speed and threshold values. • **CPU** — Indicates the health and state of the CPUs in the managed system. It also reports processor automatic throttling and predictive failure. • **Memory** — Indicates the health and state of the Dual In-line Memory Modules (DIMMs) present in the managed system. • **Intrusion** — Provides information about the chassis. • **Power Supplies** (available only for rack and tower servers) — Provides information about the power supplies and the power supply redundancy status. ⓘ **NOTE:** If there is only one power supply in the system, the power supply redundancy is set to **Disabled**. • **Removable Flash Media** — Provides information about the Internal SD Modules; vFlash and Internal Dual SD Module (IDSDM). ○ When IDSDM redundancy is enabled, the following IDSDM sensor status is displayed — IDSDM Redundancy Status, IDSDM SD1, IDSDM SD2. When redundancy is disabled, only IDSDM SD1 is displayed. ○ If IDSDM redundancy is initially disabled when the system is powered on or after an iDRAC reset, the IDSDM SD1 sensor status is displayed only after a card is inserted. ○ If IDSDM redundancy is enabled with two SD cards present in the IDSDM, and the status of one SD card is online while the status of the other card is offline. A system reboot is required to restore redundancy between the two SD cards in the IDSDM. After the redundancy is restored, the status of both the SD cards in the IDSDM is online. ○ During the rebuilding operation to restore redundancy between two SD cards present in the IDSDM, the IDSDM status is not displayed since the IDSDM sensors are powered off. ⓘ **NOTE:** If the host system is rebooted during IDSDM rebuild operation, the iDRAC does not display the IDSDM information. To resolve this, rebuild IDSDM again or reset the iDRAC. ○ System Event Logs (SEL) for a write-protected or corrupt SD card in the IDSDM module are not repeated until they are cleared by replacing the SD card with a writable or good SD card, respectively. ⓘ **NOTE:** When iDRAC firmware is updated from versions prior to 3.30.30.30, the iDRAC need to be reset to defaults for IDSDM settings to appear in the Server Administrator's Platform Event Filter. • **Temperature** — Provides information about the system board inlet temperature and exhaust temperature (only applies to rack servers). The temperature probe indicates whether the status of the probe is within the preset warning and critical threshold value. • **Voltage** — Indicates the status and reading of the voltage sensors on various system components. iDRAC User’s Guide, 116; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x);

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x). **Configuring warning threshold for inlet temperature** You can modify the minimum and maximum warning threshold values for the system board inlet temperature sensor. If reset to default action is performed, the temperature thresholds are set to the default values. You must have Configure user privilege to set the warning threshold values for the inlet temperature sensor. https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Optimizing system performance and power consumption** The power required to cool a server can contribute a significant amount to the overall system power. Thermal control is the active management of system cooling through fan speed and system power management to make sure that the system is reliable while minimizing system power consumption, airflow, and system acoustic output. You can adjust the thermal control settings and optimize against the system performance and performance-per-Watt requirements. Using the iDRAC Web interface, RACADM, or the iDRAC Settings Utility, you can change the following thermal settings: • Optimize for performance • Optimize for minimum power • Set the maximum air exhaust temperature • Increase airflow through a fan offset, if required • Increase airflow through increasing minimum fan speed Following are the list of features in thermal management: • **System Airflow Consumption**: Displays the real-time system airflow consumption (in CFM), allowing airflow balancing at rack and datacenter level. • **Custom Delta-T**: Limit air temperature rise from inlet air to exhaust to right-size your infrastructure level cooling. • **Exhaust Temperature Control**: Specify the temperature limit of the air exiting the server to match your datacenter needs. • **Custom PCIe inlet temperature**: Choose the right input inlet temperature to match 3rd party device requirements. • **PCIe Airflow settings**: Provides a comprehensive PCIe device cooling view of the server and allows cooling customization of 3rd party cards. iDRAC User's Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x). **Modifying thermal settings using iDRAC web interface** To modify the thermal settings: 1. In the iDRAC Web interface, go to **Configuration** > **System Settings** > **Hardware Settings** > **Cooling Configuration**. 2. Specify the following: • **Thermal Profile Optimization** — Select the thermal profile: ○ **Default Thermal Profile Settings (Minimum Power)** — Implies that the thermal algorithm uses the same system profile settings that is defined under **System BIOS** > **System BIOS Settings** > **System Profile Settings** page. By default, this option is set to **Default Thermal Profile Settings**. You can also select a custom algorithm, which is independent of the BIOS profile. The options available are: ○ **Maximum Performance (Performance Optimized)** : ▪ Reduced probability of memory or CPU throttling. ▪ Increased probability of turbo mode activation. ▪ Generally, higher fan speeds at idle and stress loads. ○ **Minimum Power (Performance per Watt Optimized)**: ▪ Optimized for lowest system power consumption based on optimum fan power state. ▪ Generally, lower fan speeds at idle and stress loads. ○ **Sound Cap** — Sound Cap provides reduced acoustical output from a server at the expense of some performance. Enabling Sound Cap may include temporary deployment or evaluation of a server in an occupied space, but it should not be used during benchmarking or performance sensitive applications. **NOTE:** Selecting **Maximum Performance** or **Minimum Power**, overrides thermal settings associated to System Profile setting under **System BIOS** > **System BIOS Settings.System Profile Settings** page. • **Maximum Exhaust Temperature Limit** — From the drop-down menu, select the maximum exhaust air temperature. The values are displayed based on the system. The default value is **Default, 70°C (158 °F)**. This option allows the system fans speeds to change such that the exhaust temperature does not exceed the selected exhaust temperature limit. This cannot always be guaranteed under all system operating conditions due to dependency on system load and system cooling capability. iDRAC User’s Guide, 64; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

'632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

	• **Thresholds**
	  ○ **Maximum PCIe Inlet Temperature Limit** — Default value is 55°C. Select the lower temperature of 45°C for third party PCIe cards which require lower inlet temperature.
	  ○ **Exhaust Temperature Limits** — By modifying the values for the following you can set the exhaust temperature limits:
	  ▪ **Set Maximum Exhaust Temperature Limit**
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	  ○ **Minimum Fan Speed in PWM (% of Max)** — Select this option to fine tune the fan speed. Using this option, you can set a higher baseline system fan speed or increase the system fan speed if other custom fan speed options are not resulting in the required higher fan speeds.
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	  The allowable range for minimum fan speed PWM is dynamic based on the system configuration. The first value is the idle speed and the second value is the configuration max (Depending on the system configuration, the maximum speed may be up to 100%.).
	  System fans can run higher than this speed as per thermal requirements of the system but not lower than the defined minimum speed. For example, setting Minimum Fan Speed at 35% limits the fan speed to never go lower than 35% PWM.
	  NOTE: 0% PWM does not indicate fan is off. It is the lowest fan speed that the fan can achieve.
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	iDRAC User's Guide, 65; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))

Multi-Vector Cooling

Multi-Vector Cooling implements multi-prong approach to Thermal Controls in Dell EMC Server Platforms. You can configure multi-vector cooling options through iDRAC web interface by navigating to **Configuration** > **System Settings** > **Hardware Settings** > **Fan Configuration**. It includes (but not limited to):

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- Intelligent and adaptive closed loop control algorithm optimizes fan response to maintain component temperatures. It also conserves fan power, airflow consumption, and acoustics.

- Using fan zone mapping, cooling can be initiated for the components when it requires. Thus, it results maximum performance without compromising the efficiency of power utilization.
- Accurate representation of slot by slot PCIe airflow in terms of LFM metric (Linear Feet per Minute - an accepted industry standard on how PCIe card airflow requirement is specified). Display of this metric in various iDRAC interfaces allows user to:
  1. know the maximum LFM capability of each slot within the server.
  2. know what approach is being taken for PCIe cooling for each slot (airflow controlled, temperature controlled).
  3. know the minimum LFM being delivered to a slot, if the card is a 3rd Party Card (user defined custom card).
  4. dial in custom minimum LFM value for the 3rd Party Card allowing more accurate definition of the card cooling needs for which the user is better aware of through their custom card specification.
- Displays real-time system airflow metric (CFM, cubic feet per minute) in various iDRAC interfaces to the user to enable datacenter airflow balancing based on aggregation of per server CFM consumption.
- Allows custom thermal settings like Thermal Profiles (Maximum Performance vs. Maximum Performance per Watt, Sound Cap), custom fan speed options (minimum fan speed, fan speed offsets) and custom Exhaust Temperature settings.
  1. Most of these settings allow additional cooling over the baseline cooling generated by thermal algorithms and do not allow fan speeds to go below system cooling requirements.

     NOTE: One exception to above statement is for fan speeds that are added for 3rd Party PCIe cards. The thermal algorithm provision airflow for 3rd party cards may be more or less than the actual card cooling needs and customer may fine tune the response for the card by entering the LFM corresponding to the 3rd Party Card.
  2. Custom Exhaust Temperature option limits exhaust temperature to customer desired settings.

     NOTE: It is important to note that with certain configurations and workloads, it may not be physically possible to reduce exhaust below a desired set point (e.g. Custom exhaust setting of 45C with a high inlet temp {e.g. 30C} and a loaded config {high system power consumption, low airflow}).
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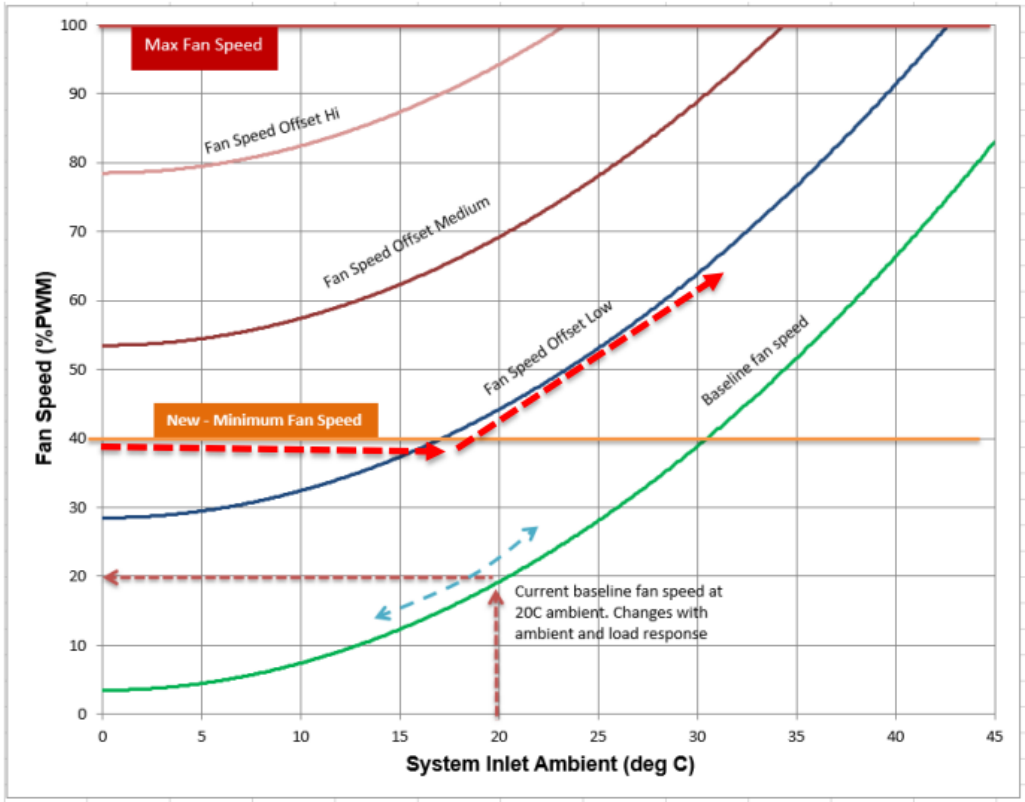
’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	iDRAC User’s Guide, 201-202; *see also* https://dl.dell.com/content/manual19433380-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 5.x); https://dl.dell.com/content/manual32079624-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 6.x); https://dl.dell.com/content/manual71585839-integrated-dell-remote-access-controller-9-user-s-guide.pdf?language=en-us (firmware version 7.x).  Figure 3 How options can be combined with MFS and Offset set simultaneously If Low Offset and 40% MFS are applied, Fan Speed follows the red dotted line based on Inlet Ambient. PowerEdge Custom Cooling Fan Options, 9.

’632 Patent Claim[2] (P.R. 3-1(a))	Accused Instrumentalities And Where Each Claim Element Is Found[3] (P.R. 3-1(b)-(c))
	This is a software limitation that may require access to the underlying source code. Accordingly, pursuant to Paragraph 3(a)(i) of the Discovery Order, Cloud Byte may supplement these contentions with additional information after Dell’s source code has been produced.