UNITED STATES PATENT AND TRADEMARK OFFICE

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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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Ex parte AMARNATH PALAVALLI, KUMAR GAURAV,
PIYUSH BHARAT MASRANI, DATTATHREYA SATHYAMURTHY,
and GUY GINZBURG

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Appeal 2017-008171
Application 14/261,459
Technology Center 2100

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Before THU A. DANG, DENISE M. POTHIER, and JOYCE CRAIG,
Administrative Patent Judges.

POTHIER, *Administrative Patent Judge.*

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellants[1,2] appeal under 35 U.S.C. § 134(a) from the Examiner's
rejection of claims 1–21. App. Br. 1. We have jurisdiction under 35 U.S.C.
§ 6(b). We affirm.

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[1] Throughout this opinion, we refer to (1) the Final Office Action (Final
Act.) mailed April 26, 2016, (2) the Appeal Brief (App. Br.) filed November
28, 2016, (3) the Examiner's Answer (Ans.) mailed March 9, 2017, and (4)
the Reply Brief (Reply Br.) filed May 9, 2017.
[2] The real party in interest is listed as VMware, Inc. App. Br. 1.

Invention

Appellants' invention relates to media, "methods[,] and systems for calculating the cost of virtual machine central processors." Spec. ¶ 2; *see also id.*, Abstract.

Illustrative claim 8 is reproduced below:

> 8. A method stored in one or more data-storage devices and executed using one or more processors for determining cost per virtual processor unit for one or more virtual machines ("VMs") run on a multi-core processor, the method comprising:
> calculating a total number of computing cycles used by the one or more VMs based on utilization measurements of the multi-core processor by the one or more VMs in each of a number of time intervals;
> calculating a total number of virtual processor units used by the one or more VMs based on a count of virtual processor units by the one or more VMs in each of the number of time intervals;
> calculating a cost per virtual processor unit based on the total number of computing cycles, the total number of virtual processors units, and cost per computing cycle; and
> storing the cost per virtual processor unit in a data-storage device.

The Examiner relies on the following as evidence of unpatentability:

Zhang   US 2012/0185851 A1   July 19, 2012

Oleksiy Mazhelis et al., *Assessing Cloud Infrastructure Costs in Communications-Intensive Applications*, CLOSER 2011, pp. 277–293 (2012) ("Mazhelis").

The Rejections

Claims 1–21 are rejected under 35 U.S.C. § 101 as being directed to nonstatutory subject matter. Final Act. 2–3.

Claims 1–21 are rejected under 35 U.S.C. § 103(a) (pre-AIA) or § 103 as unpatentable over Zhang and Mazhelis. Final Act. 3–8.

THE PATENT-INELIGIBLE SUBJECT MATTER REJECTION

The Examiner finds independent claims 1, 8, and 15 are directed to an abstract idea. Final Act. 3; Ans. 8–9. The Examiner states the claims "do not include additional elements that are sufficient to amount to significantly more than the judicial exception because the generically recited computer elements . . . do not add a meaningful limitation to the abstract idea because they would be routine in any computer implementation." Final Act. 3; Ans. 9–10.

Appellants argue "[t]he Examiner has not addressed the preemption issue as required by the Supreme Court in *Alice*." App. Br. 8; Reply Br. 2–4, 7–10. Specifically, Appellants contend claims 1 through 21 "are directed to solving a particular problem" (App. Br. 9) "associated with running applications in VMs of a data center" (*id.* at 10 (citing Spec. ¶¶ 1–2)). *See* Reply Br. 9–10 (stating the claims are drawn "to a specific solution to a technical problem of calculating cost per virtual processor unit."). Appellants conclude "the elements describe[d] [in claims 1-21] describe specific operations that do not preempt inventive activity." App. Br. 10. Appellants argue the three "calculating" recitations in claims 1, 8, and 15 describe "a specific type of calculation that is an inventive concept." *Id.* at 10.

ISSUE

Under § 101, has the Examiner erred in rejecting claim 8 by finding that the claim is directed to patent ineligible subject matter?

ANALYSIS

Based on the record before us, we find no error in the Examiner's rejection of representative claim 8.[3] Under 35 U.S.C. § 101, a patent may be obtained for "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof." The Supreme Court has "'long held that this provision contains an important implicit exception: Laws of nature, natural phenomena, and abstract ideas are not patentable.'" *Alice Corp. Pty. Ltd. v. CLS Bank Int'l*, 134 S. Ct. 2347, 2354 (2014) (quoting *Ass'n for Molecular Pathology v. Myriad Genetics, Inc.*, 133 S. Ct. 2107, 2116 (2013)). As noted by Appellants (App. Br. 6), the Supreme Court in *Alice* reiterated the two-step framework previously set forth in *Mayo Collaborative Services* v. *Prometheus Laboratories, Inc.*, 132 S. Ct. 1289, 1300 (2012), "for distinguishing patents that claim laws of nature, natural phenomena, and abstract ideas from those that claim patent-eligible applications of those concepts." *Alice*, 134 S. Ct. at 2355.

The first step in that analysis is to determine whether the claims are directed to one of those patent-ineligible concepts, such as an abstract idea. Abstract ideas may include, but are not limited to, fundamental economic practices, methods of organizing human activities, an idea of itself, and

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[3] Appellants argue claims 1, 3–8, 10–15, and 17–21 as a group. App. Br. 4–12. We select claim 8 as representative. *See* 37 C.F.R. § 41.37(c)(1)(iv).

mathematical formulas or relationships. *Id.* at 2355–57. If the claims are
not directed to a patent-ineligible concept, the inquiry ends. Otherwise, the
inquiry proceeds to the second step where the elements of the claims are
considered "individually and 'as an ordered combination' to determine
whether the additional elements 'transform the nature of the claim' into a
patent-eligible application." *Id.* at 2355 (quoting *Mayo*, 132 S. Ct. at 1298,
1297). Applying the two-step framework to claim 8, we conclude the claim
is not directed to a patent-eligible subject matter.

Regarding the first step, we agree with the Examiner that claim 8
is directed to an abstract idea involving mathematical algorithms or is
analogous to a method of organizing human behavior (e.g., calculating and
storing information). *See* Final Act. 2–3; *see also* Ans. 9. In essence, the
abstract idea in claim 8 involves calculating a cost per virtual processor unit
for virtual machines (VM(s)) running on a multi-core processor. App. Br.
19–20 (Claims App.); *see also* Spec. ¶¶ 4, 20 (discussing calculating the cost
of using a VM). That is, claim 8 recites "[a] method stored in one or more
data-storage devices and executed using one or more processors for
determining cost per virtual processor unit for one or more virtual machines
('VMs') run on a multi-core processor." App. Br. 19–20 (Claims App.).

Claim 8's method for determining a cost per virtual processor unit or
vCPU for VMs running on a multi-core processor involves three steps of
"calculating" values (e.g., "a total number of computing cycles used by the
one or more VMs," "a total number of virtual processor units used by the
one or more VMs . . . in each of a number of time intervals," and "a cost per
virtual processor unit") and one step of "storing" the desired "cost per virtual
processor unit." *Id.* (Claims App.). According to the disclosure, this "cost

per virtual processor unit" for VM(s) is calculated using formulas 4, 6, and 8. *See* Final Act. 3; *see also* Spec. ¶¶ 33, 35, 37. As such, the method "executed using one or more processors for determining cost per virtual processor unit" involves performing mathematical calculations. *See* Final Act. 3.

The courts warn that claims do not become patent ineligible under § 101 simply because they use mathematical formulas. *See* App. Br. 8 (quoting from *Diamond v. Diehr*, 450 U.S. 175 (1980) (stating "a claim drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses a mathematical formula, computer program, or digital computer.")). In that sense, the Examiner's statement that the claims are abstract "since they comprise mathematical formulas or relations" (Final Act. 2–3) simplifies the analysis of patent ineligibility under § 101. However, the Examiner further relies on *Gottshalk v. Benson*, 409 U.S. 63 (1972), *Parker v. Flook*, 437 U.S. 584 (1978), and *In re Grams*, 888 F.2d 835 (Fed. Cir. 1989) in concluding claim 8, which contains mathematical algorithms, is an abstract idea. *See* Ans. 9.

In the Reply Brief, Appellants contend "the Examiner does not explain how the [above] assertion [containing *Benson*, *Flook*, and *Grams* citations] is relevant." Reply Br. 9. To clarify, the court in each of these cases illustrates claims containing and performing mathematical formulas/algorithms are directed to an abstract idea and are patent-ineligible applications under 35 U.S.C. § 101. *See Benson*, 409 U.S. at 71-72, *Flook*, 437 U.S. at 593-95, and *Grams*, 888 F.2d at 839-40.

Appellants further assert "the elements [in claim 8] describe specific operations that do not preempt inventive activity." *See* App. Br. 10. In

particular, Appellants argue claim 8 addresses "a specific type of problem associated with running applications in VMs of a data center" (App. Br. 10) and does not preempt inventive activity (*id.*). Appellants contend claims 1 through 21 "are directed to solving a particular problem" (*id.* at 9) "associated with running applications in VMs of a data center" (*id.* at 10 (citing Spec. ¶¶ 1–2)). *See* Reply Br. 9–10 (stating the claims are drawn "to a specific solution to a technical problem of calculating cost per virtual processor unit.")

As noted in *Flook*, claims may not "cover every conceivable application of [a] formula" (e.g., not wholly preempt a mathematical algorithm) and still be found to be patent ineligible.[4] Thus, even presuming claim 8 does not cover every conceivable application of the recited mathematical algorithms such that there remains uses for the formulas in the public domain (*see* App. Br. 10), this alone is insufficient to demonstrate claims are patent eligible under § 101. *See id.* That is, limiting the use of an abstract idea to a particular technology environment (e.g., determining the cost per vCPU for VMs running on a multi-core processor) is not enough for patent eligibility.[5] Moreover, reciting a specific operation (e.g., calculating a specific value) or application (e.g., determining cost per virtual processor unit), without more, is also not enough to transform claim 8 into statutory subject matter under § 101.[6]

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[4] *See Flook*, 437 U.S. at 586-87, 589.
[5] *See Alice*, 134 S.Ct. at 2358.
[6] *See Electric Power Group, LLC v. Alstom S.A.*, 830 F.3d 1350, 1353 (Fed. Cir. 2016) (stating "limiting the claims to a particular technological environment . . . is, without more, insufficient to transform them into

We thus are not persuaded by Appellants' assertion that claim 8 "describes a specific type of calculation that is an inventive concept." App. Br. 10. Also, claims involving specific calculations that are based on other calculations, like claim 8's step of calculating a cost per vCPU based on the calculated number of computing cycles and total number of vCPUs used by VMs, may be patent-ineligible under § 101.[7] Accordingly, we are not persuaded that a result obtain in one step used to compute another or final step makes a claim patent eligble under § 101. *See* Reply Br. 6.

Notably, claim 8 does not recite what is done with the determined costs per virtual processor unit. App. Br. 19–20 (Claims App.). The Specification indicates the cost of using a *VM* may be used to predict *VM* costs. *See* Spec. ¶ 4. This disclosure, however, does not demonstrate and Appellants have not shown sufficiently that claim 8's method is directed to a more efficient solution for determining cost per virtual processor unit for one or more VMs running on a multi-core processor such that the claim improves on an existing technological process.

As for step (2) of the *Alice/Mayo* framework, claim 8 involves analyzing information similar to those steps people go through in their mind (e.g., performing three calculations) without significantly more.[8] Also, the additional step of storing a calculated value (e.g., "the cost per virtual processor unit") is directed to an abstract idea, including organizing human activities, without significantly more and does not transform the nature of

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patent-eligible applications of the abstract idea at their core."); *see also Alice*, 134 S.Ct. at 2358.

[7] *See Digitech Image Techs LLC v. Electronics for Imaging Inc.*, 758 F.3d 1344, 1351 (Fed. Cir. 2014); *Grams*, 888 F.2d at 836, 839-40.

[8] *See also Electric Power*, 830 F.3d at 1354.

claim 8 into a patent-eligible application.[9] In contrast with *Diamond v. Diehr*, 450 U.S. 175 (1980), claim 8 does not recite a method which transforms an article into a different state or thing. *See id.* at 187-88, 192-93. Rather, the claim determines a cost per virtual processor unit, based on certain values, some of which are calculated, for one or more VMs running on a multi-core processor.

Granted, the claims invoke processors and storage devices (*see* App. Br. 19 (Claims App.)) to calculate and store values and to assist in determining the cost of using VM(s), which has indirectly been described as difficult. *See* Spec. ¶¶ 4 (discussing "assessing the cost of IT services . . . may be difficult to determine"), 20. The steps of claim 8 also may require computer programming to execute the recited calculations using one or more processors. However, such recitations do not contain an inventive concept sufficient to transform the generically recited processors and storage devices into a patent eligible application.[10] For example, the Specification provides inadequate evidence that anything other than conventional tools (e.g., generic processors and storage devices) are used to calculate and to store the recited, determined "cost per virtual processor unit" in claim 8. *See* Spec. ¶¶ 3, 21–24, Figs. 1–2. Accordingly, claim 8 does not transform an unpatentable abstract idea into patentable-eligible process under § 101.[11]

The Specification explains VMs "have been introduced to lower data center capital investment in facilities and operational expenses and reduce energy consumption." Spec. ¶ 4. The Specification also states "[e]nterprises

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[9] *See Smart Systems Innovations LLC v. Chicago Transit Authority*, 873 F.3d 1364, 1372 (Fed. Cir. 2017); *see also Alice*, 134 S. Ct. at 2355.
[10] *See Alice*, 134 S.Ct. at 2358.
[11] *See Flook*, 437 U.S. at 589-90.

that purchase IT services and IT service providers seek methods and systems for calculating and predicting the cost of VMs." *Id.* Yet, claim 8 is not directed to calculating the cost of VMs, lowering capital investment, or reducing energy consumption. App. Br. 19–20 (Claims App.). Nor is there sufficient evidence that such a process would involve anything other than conventional or routine tools as previously stated.

The Specification also does not purport to improve on the functioning of a multi-core processor, processors, storage devices, virtual processors, or VMs. Nor is claim 8 directed to improving on these devices or their functions. App. Br. 19–20 (Claims App.). Rather, as previously discussed, claim 8 amounts to nothing more than instructions to implement an abstract idea (i.e., determining the cost per virtual processor unit for one or more virtual machines running on a multi-core processor) with routine tools/activities. The additional step of storing the determined value merely implements conventional storage devices. As such, claim 8 recites computers (e.g., storage devices and processors) invoked merely as tools to accomplish the claimed invention (e.g., to determine a cost per virtual processor unit),[12] which is insufficient to be considered an inventive concept of an abstract idea.[13]

Accordingly, although claim 8 may be "associated with running applications in VMs of a data center" (App. Br. 10 (citing Spec. ¶¶ 1–2)), this association does not amount to significantly more than the recited abstract idea of determining costs per virtual processor unit for one or more virtual machines running on a multi-core processor. When considering the

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[12] *See Smart Systems*, 873 F.3d at 1372-73.
[13] *See Electric Power*, 830 F.3d at 1355.

elements of claim 8 both individually and as an ordered combination as discussed above, we determine the additional elements do not transform claim 8's nature into a patent-eligible application.

Claim 1 recites a "system" having processors(s) and data-storage device(s) similar to claim 8. App. Br. 18 (Claims App.). Independent claim 15 is a "non-transitory computer-readable medium" having instructions to implement a method similar to claim 8. *Id.* at 21–22 (Claims App.). These claims recite conventional processors, storage devices, and media, and do not transform the claims into patent-eligible subject matter. We refer to the above analysis for more details.

Concerning dependent claims 2, 9, and 16, Appellants further argue claims 2, 9, and 16 "are described in sufficiently specific terms as to not prohibit inventive activity and, therefore, are not a drafting effort designed to monopolize a building block of innovation." *Id.* at 11. These claims recite more detailed calculations related to how the "total number of computing cycles used by the one or more VMs over the period of time" is computed. *See, e.g., id.* at 20 (Claims App.). As noted above, even if a claim does not wholly pre-empt every application of its algorithms/formulae, this alone is insufficient to demonstrate claims are patent eligible under § 101. Moreover, similar to claims 1, 8, and 15, the limitations in claims 2, 9, and 16 perform mathematical calculations analogous to a method of organizing human behavior and do not amount to significantly more than the abstract idea of determining the cost per virtual processor unit discussed above related to claims 1, 8, and 15.

For the foregoing reasons, Appellants have not persuaded us of error in the rejection of independent claim 1, 2, 8, 9, 15, and 16 and remaining dependent claims 3–7, 10–14, and 17–21, which are not separately argued.

THE OBVIOUSNESS REJECTION OVER ZHANG AND MAZHELIS

Regarding independent claim 1, the Examiner finds that Zhang teaches all its limitations, except for the last "calculating" step. Final Act. 3–4 (citing Zhang ¶¶ 22–24, 48, 53–60). The Examiner turns to Mazhelis in combination with Zhang to teach the last "calculating" step. *Id*. at 4–5 (citing Mazhelis 283, ¶¶ 2–5, Abstract).

Among other arguments, Appellants argue Zhang does not teach the first "calculating" limitation or "calculating a total number of computing cycles used by the one or more VMs based on utilization measurements of the multi-core processor by the one or more VMs in each of a number of time intervals." App. Br. 12–14; Reply Br. 10–11.

ISSUE

Under § 103, has the Examiner erred in rejecting claim 1 by finding Zhang and Mazhelis collectively would have taught or suggested a "calculating a total number of computing cycles used by the one or more VMs based on utilization measurements of the multi-core processor by the one or more VMs in each of a number of time intervals?"

ANALYSIS

Based on the record before us, we are persuaded of error in the rejection. Zhang teaches using various information, including resource

utilization information 120, the information embodied in DFG (directed factor graph) model 140, and "per-VM resource utilization information" 150. Zhang ¶ 48, *cited in both* Final Act. 4 and Ans. 10–11. Zhang explains the latter information, per-VM resource utilization information 150, indicates various other information, including "utilization of the CPU for each virtual machine 112 in terms of CPU cycles," and this information is "within a specified time interval." Zhang ¶ 48. The Examiner states paragraph 48 in Zhang suggests "calculating a total number of computing cycles used by the one or more VMs based on utilization measurements of the . . . processor by the one or more VMs in each of a number of time intervals." Ans. 10–11. We disagree.

Because the recitation "a number of time intervals" is broad and does not specify the "number," Zhang's discussion of computing information within a specified time interval teaches information 150 is based on "a number of time intervals" as recited. *See* Zhang ¶ 48; *see also* Spec. ¶ 5 (stating the total number of compute cycles is calculated "over a period of time"), *cited in* Ans. 9. Zhang also teaches information that indicates CPU usage for each virtual machine in terms of CPU cycles or is based on CPU cycles. *See id.* However, claim 1 recites "calculating a total number of computing cycles used by one or more VMs based on" certain information— not calculating certain information based on computing cycles as Zhang teaches. *Compare* App. Br. 18 (Claims App.) *with* Zhang ¶ 48.

Possibly, the Examiner asserts Zhang suggests the "total number of computing cycles" is calculated in order to determine the taught per-VM physical resource information 150, which indicates CPU usage for each VM in *terms of CPU cycles. See* Final Act. 4; *see also* Ans. 10–11. To extent

this is the Examiner's position, the discussion in paragraph 48 does not further suggests that a "total number of computing cycles used by the one or more VMs" is calculated as specifically recited. App. Br. 18 (Claims App.). Rather, Zhang's paragraph 48 at best suggests the CPU usage is based on CPU cycles but does not suggest further determining *the total number* of computing cycles. *See* Zhang ¶ 48; *see also* Reply Br. 11.

Nor does this cited section of Zhang suggest that any such calculated, total computing cycles used by the VM(s) is based on a processor's usage measurements by any virtual machine as further recited in claim 1. App. Br. 18 (Claims App.). Instead, this cited section of Zhang is silent on how any such "CPU cycles" are calculated. *See* Zhang ¶ 48. The Examiner also fails to explain adequately how cited paragraphs 53 through 60 (Final Act. 3–4; Ans. 10–11) address how or whether the total number of CPU cycles discussed in paragraph 48 are determined. *See* Zhang ¶¶ 48, 53–60; *see also* App. Br. 12–14.

The rejection does not rely on Mazhelis to cure the above-noted deficiency. *See* Final Act. 3–5; Ans. 10–11.

For the foregoing reasons, Appellants have persuaded us of error in the rejection of (1) independent claim 1, (2) independent claims 8 and 15, which recite commensurate limitations, and (3) dependent claims 2–7, 9–14, and 16–21 for similar reasons.

DECISION

We affirm the rejection of claims 1–21 under § 101.

We reverse the rejection of claims 1–21 under § 103.

Because we have affirmed at least one ground of rejection with respect to each claim on appeal, the Examiner's decision is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

<u>AFFIRMED</u>