UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MICROSOFT CORPORATION,
Petitioner,

v.

BRADIUM TECHNOLOGIES LLC,
Patent Owner.

PTAB Case No. IPR2017-01616
Patent No. 9,641,644 B2

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,641,644 B2

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Ex.1024	U.S. Patent Publication No. 2008/0294332 A1 to Levanon et al.
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Ex.1030	Barclay, T. et al., Microsoft TerraServer: A Spatial Data Warehouse, Microsoft Research, June 1999, Revised February 2000.
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Ex. 1037	Microsoft, Partners Announce Microsoft TerraServer – Global Atlas Is World's Largest Database on the Web, Microsoft News Center, posted June 24, 1998, available at https://news.microsoft.com/1998/06/24/microsoft-partners-announce-microsoft-terraserver-global-atlas-is-worlds-largest-database-on-the-web/#bMPkijPvjZ8sDgPw.97.
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I. INTRODUCTION

Pursuant to 35 U.S.C.§311 and 37 C.F.R. § 42.100, Microsoft Corporation ("Microsoft" or "Petitioner") petitions for *inter partes* review (IPR) of claims 1-65 of U.S. Patent No.9,641,644 ("the '644 Patent," Ex. 1001), owned by Bradium Technologies LLC ("Bradium" or "Patent Owner").

The '644 Patent broadly claims dividing large sets of imagery (*e.g*., geographic imagery) into "image parcels" at varying levels of detail to allow users to browse such imagery online. The cited Reddy and Hornbacker references show how this concept was well-known before the priority date of the '644 Patent.

Therefore, claims 1-65 are unpatentable under pre-AIA 35 U.S.C.§103.

II. MANDATORY NOTICES UNDER 37 C.F.R.§42.8(B)

<u>REAL PARTY IN INTEREST:</u> Petitioner is the only real party in interest, and there are no other real parties in interest under 35 U.S.C.§312(a)(2) and 37 C.F.R.§42.8(b)(1).

<u>RELATED MATTERS:</u> Four patents related to the '644 Patent, U.S. Patent Nos. 9,253,239 B2 ("the '239 Patent"), 7,139,794 B2 ("the '794 Patent"), 7,908,343 B2 ("the '343 Patent"), and 8,924,506 B2 ("the '506 Patent"), are being asserted against Petitioner in an ongoing patent infringement lawsuit brought by Patent Owner in *Bradium Techs.* v. *Microsoft*, 1:15-cv-00031-RGA, filed January 9, 2015. Bradium has accused Microsoft of infringing the '644 Patent (Ex. 1026)

but has not yet served Microsoft with a complaint alleging infringement of the ’644 Patent. Therefore, the 1-year time bar of 35 U.S.C. § 315(b) does not apply to this Petition.

Petitioner has previously filed IPR petitions challenging the four related patents in suit:

- ’794 Patent: IPR2015-01432, instituted Dec. 23, 2015, Final Written Decision issued Dec. 21, 2017
- ’343 Patent:
  - IPR2015-01434, institution denied Dec. 23, 2015
  - IPR2016-00448, instituted July 25, 2016
- ’506 Patent:
  - IPR2015-01435, institution denied Dec. 23, 2015
  - IPR2016-00449, instituted July 27, 2016
- ’239 Patent: IPR2016-01897, instituted April 5, 2017

<u>NOTICE OF COUNSEL AND SERVICE INFORMATION:</u> Pursuant to 37 C.F.R.§§42.8(b)(3), 42.8(b)(4) and 42.10(a), Petitioner appoints **Chun M. Ng** (Reg. No. 36,878) as its lead counsel, **Matthew C. Bernstein** (*pro hac vice*), **Patrick J. McKeever** (Reg. No.66,019), **Vinay P. Sathe** (Reg. No.55,595), **Evan S. Day** (Reg. No. 75,992), and **Miguel J. Bombach** (Reg. No. 68,636) as its back-up counsel. Lead counsel is at the address of 1201 Third Avenue, Suite 4900, Seattle,

WA 98101 and contact number of 206-359-6400. All back-up counsel are at the mailing address of Perkins Coie LLP, 11988 El Camino Real, Suite 350, San Diego, CA 92130, contact numbers of 858-720-5700 (phone) and 858-720-5799 (fax). All counsel for Petitioner may be reached at the following email for service and communications:

PerkinsServiceBradiumIPR@perkinscoie.com.

Pursuant to 37 C.F.R.§42.10(b), a Power of Attorney is concurrently filed.

III. REQUIREMENTS FOR *INTER PARTES* REVIEW

This Petition complies with all statutory requirements and requirements under 37 C.F.R.§§42.104, 42.105 and 42.15 and thus should be accorded a filing date as of the date of filing of this Petition pursuant to 37 C.F.R.§42.106.

A. GROUND FOR STANDING

Pursuant to 37 C.F.R.§42.104(a), Petitioner certifies that the ’644 Patent is available for IPR and that Petitioner is not barred or estopped from requesting IPR challenging claims of the ’644 Patent.

B. IDENTIFICATION OF CHALLENGE

Claims Challenged: Pursuant to 37 C.F.R.§§42.104(b) and 42.22, Petitioner requests that the Board institute an IPR trial on claims 1-65 of the ’644 Patent, and cancel all of these claims.

The Prior Art: The prior art references relied upon are Reddy (Ex. 1004) and Hornbacker (Ex. 1003) and are discussed in this Petition and the Declaration of Prof. William Michalson (Ex. 1005).

Supporting Evidence Relied Upon For The Challenge: The evidence includes the Michalson Declaration (Ex. 1005) and other supporting evidence in the Exhibit List. In addition, Petitioner intends to seek leave from the Board to depose Israeli co-inventor Yonatan Lavi through the Hague Convention.

Statutory Ground(s) Of Challenge And Legal Principles: Pursuant to 37 C.F.R.§42.104 (b)(2), the review of patentability of claims 1-65 is governed by pre-AIA 35 U.S.C.§§102 and 103. Further, statutory provisions of 35 U.S.C.§§311 to 319 and 325(d) govern this IPR.

Claim Construction: The ’644 Patent is an unexpired patent, and each claim shall be given “its broadest reasonable interpretation [BRI] in light of the specification of the patent in which it appears” to a person of ordinary skill in the art (POSITA). 37 C.F.R.§42.100(b); *Cuozzo Speed Techs. v. Lee,* 136 S. Ct. 2131, 2142-46 (2016).

How Claims Are Unpatentable Under Statutory Grounds: Pursuant to 37 C.F.R.§42.104 (b)(4), Section V explains how claims 1-65 are unpatentable and specifies where each claim element is found in the cited prior art.

IV. OVERVIEW OF THE ’644 PATENT

A. PRIORITY DATE OF THE ’644 PATENT

The ’644 Patent was granted on May 2, 2017 from non-provisional Application No.14/970,526 filed December 15, 2015 and makes priority claims to a chain of prior applications, including six earliest provisional applications filed December 27, 2000. Ex. 1001, cover pages 1 and 2. Therefore, the earliest priority date of the ’644 Patent is no earlier than December 27, 2000.

B. SUMMARY OF THE ’644 PATENT

The ’644 Patent discloses methods and systems for servers to respond to requests for image data received from a client computing device over network communication channels. Ex. 1001 at Abstract, 3:59-4:60; Ex. 1005, ¶¶98-106. Such requests are based on user-controlled image viewpoints. The user navigation commands are used to select certain parts of an image in a scene, resulting in requests to retrieve and display updated image data on the user’s computing device. *Id.* at Abstract, 1:42-47, 1:60-65, 3:64-4:10, 5:42-6:36, 7:63-8:5.

The “Background” of the ’644 Patent acknowledges the “well recognized problem” of reducing the latency for transmitting full resolution images over the Internet, so such images can be received at a user computing device on an “as needed” basis. The ’644 Patent describes “complex images” such as “geographic, topographic, and other highly detailed maps” as examples, but states that the "present invention is equally applicable to the efficient communications and display of other high resolution information." Ex. 1001 at 1:50-2:1; 5:42-62, 6:6-20, 7:9-22, and 12:13-20.

To address these perceived issues, the '644 Patent discloses "an efficient system and methods of optimally presenting image data on client systems with potentially limited processing performance, resources, and communications bandwidth." *Id.* at 3:59-63. Fig. 2 shows a preferred embodiment comprising a network image server system 30. *Id.*, 6:6-59.

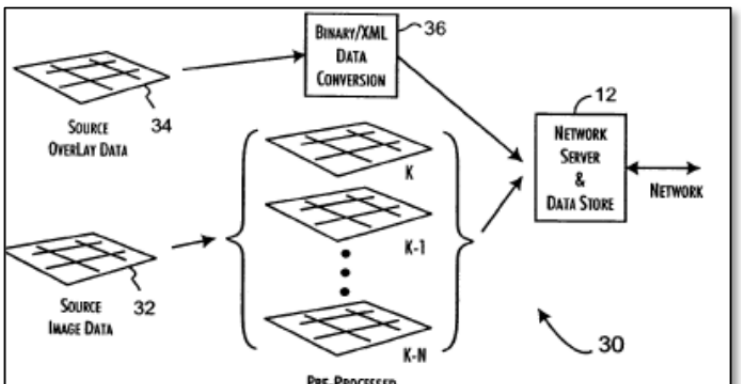


FIG. 2

The network image server system 30 stores a combination of source image data 32 and source overlay data 34. *Id.*, 6:6-7:8. The source image data 32 is typically high-resolution bitmap raster map or satellite imagery of geographic regions. *Id.*, 6:9-12. Overlay data is preferably a "discrete," "resolution-independent" data file, which may contain annotations such as street and landmark names, 2D and 3D objects, icons, decals, line segments, or other characters and graphics. *Id.*, 6:12-20; 7:18-21. Such overlay data may be stored in a previously known, open-source format such as Geography Markup Language (GML). *Id.*, 7:9-23.

In the preferred embodiment, "image data parcels are stored in conventional quad-tree data structures, where tree nodes of depth D correspond to the stored image parcels of resolution KD." *Id.*, 7:40-42. Such quad-tree structures are used to locate image parcels of appropriate resolution. *Id.*, 10:4-23.

The '644 patent discusses the client system software and architecture and the formats of data sent over the network in response to client requests. However, it does not describe in detail the architecture of the network server 12, other than mentioning that the server "operat[es] as a data store and server of image data" and "is responsive to requests received through a communications network, such as the Internet 14 generally…" and that the client relies on "HTML-based interactions with the server." *Id.*, 5:43-48, 7:29-31. As Prof. Michalson explains, a POSITA would therefore understand that the server system described by the '644 patent uses conventional network server architecture that would be known to a POSITA in connection with conventional Internet protocols. Ex. 1005, ¶¶171-172.

C. THE EXAMINER ERRED BY ALLOWING THE ’644 PATENT DESPITE CLAIM ELEMENTS TAUGHT BY THE REFERENCES CITED IN THIS PETITION

The challenged claims of the ’644 Patent are comparable to the claims of the ’239 Patent on which the Board has already instituted IPR, with the primary difference that the claims of the ’644 Patent are directed to a server, whereas the claims of the ’239 Patent are directed to a client device in the same client-server interaction.

Nevertheless, the Examiner allowed the ’644 Patent without substantively discussing any prior art references. In a July 27, 2016 Notice of Allowance, the Examiner cited the following claim language as the “primary reasons [*sic*] for allowance”:

> Process the source image data to obtain a series of K1-N derivative images of progressively lower image resolution, the series of K1-N derivative image comprising the first derivative image and the second derivative image, wherein series image K0 of the series of KN derivative images is subdivided into a regular array wherein each resulting image parcel of the array has a predetermined pixel resolution and a predetermined color or bit per pixel depth, resolution of the series K1-N of derivative images being related to resolution of the source image data or predecessor image in the series by a

factor of two, and the array subdivision being related by a factor of two.

The claim element language cited by the Examiner is virtually identical to claim language in the ’239 Patent. *See* Ex. 1002 (’239 Patent) at 13:5-17. In its decision to institute IPR of the ’239 Patent in IPR2016-01897, the Board stated that it was “persuaded” that Reddy in view of Hornbacker taught the nearly identical claim language in the ’239 Patent. IPR2016-01987, Paper 17 at 14-16 (April 5, 2017). Similar language also appears in the claims of the ’343 and ’506 Patents, for which the Board also instituted IPRs based on Reddy and Hornbacker. Ex. 1012 (’343 Patent) at 11:35-45; Ex. 1013 (’506 Patent) at 12:40-52; IPR2016-00448, Paper 9 at 26-29 (PTAB July 25, 2016); IPR2016-00449, Paper 9 at 26-29 (PTAB July 27, 2016).

Tellingly, in the five opportunities (three Patent Owner Preliminary Responses and two Patent Owner Responses) that Bradium has had to argue for the patentability of claims containing similar claim language over Reddy and Hornbacker, Bradium never once disputed that Reddy taught this claim language. *See generally* IPR2016-00448, Papers 8 and 20; IPR2016-00449, Papers 8 and 16; IPR2016-01897, Paper 9. Therefore, the prosecution history shows that the Examiner erred by allowing claims based on claim elements which are indisputably taught by the prior art in this Petition.

While Microsoft expects Bradium to argue that the Board should exercise its discretion to decline to review this Petition under 35 U.S.C. §325(d) because Bradium cited Reddy and Hornbacker in an Information Disclosure Statement, the Board should reject this argument. There is no specific discussion of Reddy or Hornbacker reflected in the prosecution history, and the Board has instituted review numerous times in similar situations where a highly relevant reference was cited but not substantively discussed. *See, e.g. Tandus Flooring, Inc. v. Interface, Inc.*, IPR2013-00527, Paper 12 at 3-4 (Feb. 14, 2014) ("The Board is not required by statute to reject a petition based upon previous consideration by the Office of certain arguments or prior art"); *Baker Hughes, Inc. v. Liquidpower Specialty Products, Inc.*, IPR2016-01901, Paper 10 at 10-12 (April 17, 2017) (granting institution even though primary prior art reference was discussed during prosecution where Petitioner's arguments were distinct and Petitioner's expert declaration was new evidence); *American Pharmaceuticals Ltd. v. Janssen Oncology, Inc.*, IPR2016-00286, Paper 14 at 17-18 (May 31, 2016) (granting institution based on prior art references considered during prosecution). Even if the Examiner had somehow found that the claim elements cited as reasons for allowance were novel over Reddy, for reasons not reflected in the prosecution history, the Board can and should review such decisions to correct errors in the patent process. *See Skky, inc. v. Mindgeek SARL et al.*, No. 2016-2018, slip op. at

11 (Fed. Cir. June 7, 2017) (no authority for "proposition that once an examiner concludes that claims are patentable over a reference, that reference may no longer be considered further in determining a claim's validity").

Moreover, the Board's previous findings that such claim elements *were* obvious over Reddy create a risk of conflicting statements from the Patent Office about whether such claimed features are novel features which Bradium is entitled to exclude others from practicing or simply a known feature in the prior art. Because this Petition shows that the claim language relied on by the Examiner, and all elements of the challenged claims, were taught by the prior art, institution of review is appropriate.

D. LEVEL OF ORDINARY SKILL IN THE ART

As Prof. Michalson explains, based on the pertinent technical field and problems described in the '644 Patent, particularly applications specific to Geographic Information Systems ("GIS"), a POSITA for the claimed technology would have a Master of Science or equivalent degree in electrical engineering or computer science, or alternatively a Bachelor of Science or equivalent degree in electrical engineering or computer science, with at least five years of experience in a field related to GIS or the transmission of digital image data over a computer network. Ex. 1005, ¶¶30-38. Prof. Michalson's conclusions that the claims of the '644 Patent are obvious would not change under other definitions of the level of ordinary skill in the art that have been proposed by Bradium in related proceedings. *Id.*, ¶¶39-40.

E. PROPOSED CLAIM CONSTRUCTION

Petitioner proposes constructions for certain claim terms pursuant to the BRI standard only to comply with 37 C.F.R.§§42.100(b) and 42.104(b)(3), and solely for purposes of this Petition. Thus, the proposed constructions do not necessarily reflect appropriate claim constructions in litigation and other proceedings where a different claim construction standard applies.

“Mobile Device” in claims 2, 23, and 45:

In its Decision instituting IPR of the ’239 Patent, the Board rejected Bradium’s proposed limiting construction of a “mobile device” and determined that the term needed no construction. IPR2016-01897, Paper 17 at 9-10 (April 5, 2017). Petitioner proposes that the same result (no construction necessary) is also appropriate here, or alternatively that the term be construed as “a device which is portable.” As the Board previously noted, “the word ‘mobile’ in the term ‘mobile device’ suggests a device that is portable.” *Id.* at 9. The specification of the ’644 Patent does not indicate that the various examples of a “small client” (*see, e.g.*, Ex. 1001 at 3:1-6) are intended to define or limit a “mobile device,” nor is it appropriate under the BRI to limit the construction of a term based solely on examples. Ex. 1005, ¶¶113-115.

All remaining claim terms: The proposed construction of all remaining claim terms under BRI is their plain and ordinary meaning. Ex. 1005, ¶116.

V. THERE IS A REASONABLE LIKELIHOOD THAT AT LEAST ONE CLAIM OF THE ’644 PATENT IS UNPATENTABLE

A. THE CITED REFERENCES ARE PRIOR ART

Reddy (Ex. 1004) was published in the March/April 1999 issue of IEEE Computer Graphics and Applications and thus is a self-authenticating periodical on its face and is prior art under at least 35 U.S.C.§102(b). *See, e.g. Ericsson v. Intellectual Ventures,* IPR2014-00527, Paper 41 at 10-13 (PTAB May 18, 2015) (taking Official Notice of reliability of IEEE publications). The Board previously determined that Reddy was prior art to the related ’343 and ’506 Patents in IPR2016-00448, Paper 9 at 12-14, and IPR2016-00449, Paper 9 at 12-13. Prof. Michalson explains that a POSITA would rely on the IEEE publication markings contained in Reddy as reliable evidence that Reddy was published in 1999. Ex. 1005, ¶109. Reddy was also cited by several publications prior to the priority date of the ’644 Patent. Exs.1007, 1008.

Hornbacker (Ex. 1003) is a PCT Publication published on August 19, 1999, and thus is prior art under at least 35 U.S.C.§102(b).

B. GROUND 1: CLAIMS 1-65 ARE UNPATENTABLE UNDER 35 U.S.C.§103(A) OVER REDDY AND HORNBACKER

In each of claims 1-65, the claimed subject matter as a whole is rendered obvious by Reddy in view of Hornbacker.

Reddy, the primary reference, teaches or suggests all elements of these claims regarding online browsing of large-scale geographic imagery in 2D or 3D by dividing images into tiles at varying resolutions. Reddy, however, does not specify explicitly how requests for image tiles would identify the locations and zoom levels of image tiles. Hornbacker, however, teaches specific methods by which a POSITA could implement the teachings of Reddy to identify specific needed tiles.

As discussed further below, a POSITA would have combined the teachings in Reddy and Hornbacker in the manner claimed by claims 1-65 based on underlying trends and motivations in the art, as well as specific teachings in both references. For example, as Prof. Michalson explains, the concept of an "image pyramid," the hierarchy of tiles of derivative images varying between levels by powers of two as claimed by the '644 Patent, was well-known in the art for decades and applied in online systems such as Microsoft's TerraServer prior to the earliest asserted priority date of the '644 Patent. Ex. 1005, ¶¶56-60. Simply put, the '644 Patent's inventors did not invent image pyramids, online or otherwise. Prof. Michalson further explains that the '644 Patent relies on already well-known technology in the fields of network communications, computer graphics, and GIS. Ex. 1005, ¶¶ 41-97.

1. REDDY AND HORNBACKER SHOW THAT THE PURPORTED SOLUTIONS CLAIMED BY THE ’644 PATENT WERE NOT NOVEL IN THE TECHNICAL FIELD

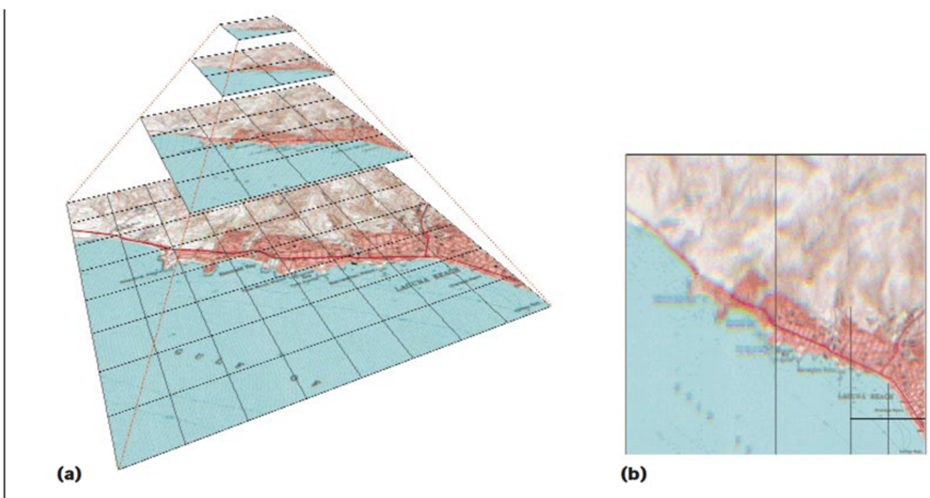
a. REDDY

Reddy, by SRI International researchers, describes methods for viewing large amounts of geographic data over a network, such as the TerraVision II software system. Previous SRI work had designed a TerraVision software program for three-dimensional visualization of terrain (including aerial imagery) over a high-speed ATM network, along with supporting server architecture. Ex. 1004, ¶38; Ex. 1005, ¶¶122-123. Reddy teaches that by 1999, the authors had developed methods to improve on the original TerraVision and supporting servers by (1) allowing the user to browse online geographic information in the standard Virtual Reality Markup Language (VRML), therefore allowing compatibility with data from other sources; and (2) enabling use of a standard personal computer, including a laptop, to access data over the Web rather than a specialized high-speed network. Ex. 1004, ¶¶9, 31, 39, 48; Ex. 1005, ¶¶124, 133-141. Such teachings could be implemented, for example, in the TerraVision II program capable of operating on a “PC connected to the Internet,” or on a plug-in to enable a standard browser to access the same data. According to Reddy, the ability to use a diverse range of devices and networks of varying capabilities enables its teachings to be used in scenarios such as “distributed, time-critical conditions,” including military mission planning, battle damage assessment, and emergency relief efforts. Ex. 1004, ¶48.

Reddy teaches that the online VRML information accessed by the browser may include information such as digital elevation information, aerial, satellite, or map imagery, and features such as place names, buildings, or roads. *Id.*, ¶¶2, 24-26. Such VRML browsing methods enable a user to visualize large geographic databases in 3D from a simulated perspective. For example, a user can zoom in on a 3D model of earth viewed from space and “fly” all the way down to see a particular building, with terrain and map imagery data appearing at increasingly higher resolutions as the user progressively approaches a point on the map. *Id.*, ¶3.

Reddy enables this resolution-dependent viewing by using a quad-tree structure in which one tile or node at a given resolution or level of detail branches off to four (2x2) tiles or nodes at the next higher level. The quad-tree structure links several data types, including elevation data, terrain imagery and other features that may be overlaid on a map. *Id.*, ¶¶9-26 and Fig. 3. Image tiles are organized into a “pyramid,” a multiresolution hierarchy of image tiles in which (1) each tile has the same pixel dimensions, (2) a tile at a given level of the pyramid maps onto four tiles at the next higher level, and (3) the resolution (area covered by one pixel) varies by a factor of two between subsequent levels. *Id.*, ¶¶14-17. The resolution levels in the hierarchy facilitate a 3D perspective view by allowing higher resolution tiles to be selectively retrieved for locations closer to the viewpoint. For example, Fig. 1(a) depicts the image pyramid, while Fig. 1(b) shows the tiles of differing resolutions used to form a view when the user is positioned in the lower-right hand corner of the map (*id.*, ¶15-17):

1 An example image pyramid showing (a) four different resolutions of an original image, where each level is segmented into 128 × 128 pixel tiles, and (b) how this structure can be used to alter the image resolution in different regions.



When the viewpoint approaches a terrain region, the quad-tree structure is used to load and display more detail "progressively… in a coarse-to-fine fashion," allowing the user to "interact with the scene while higher resolution imagery and elevation loads." *Id.*, ¶¶21, 44. The tile pyramid structure in Reddy's Fig. 1(a) is similar to Fig. 2 of the '644 Patent:

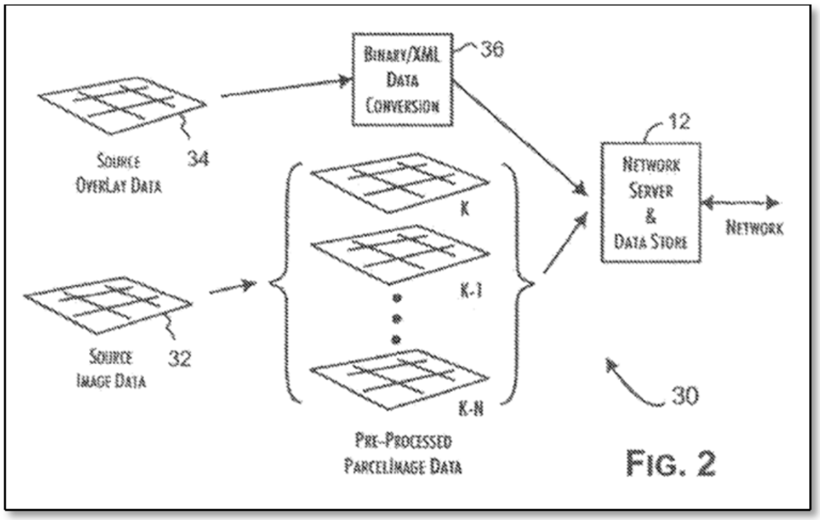


FIG. 2

Accordingly, Reddy illustrates that the industry recognized the challenges in disseminating "massive terrain data sets" and "many millions of polygons and many gigabytes of imagery" of 3D maps and spatial data over the Web in response to a user request by web browser. Reddy teaches the use of a web browser to navigate VRML structures easily and efficiently, and further acknowledges that the time required to download and render such a model without viewpoint-specific optimization would prohibit any real-time interaction using then-existing VRML browsers. *Id.*, Title, Abstract, ¶¶5-7, 12.

Reddy thus addresses the same problems that are purportedly addressed by the '644 Patent: "optimiz[ing] image delivery over limited bandwidth communication channels," and "optimally presenting image data on client systems with potentially limited processing performance, resources, and communications bandwidth." Ex. 1001 at Title, 3:59-63. Reddy further provides solutions to those problems, some embodied by the TerraVision II browser, that made it "possible to represent massive, distributed terrain databases in VRML" and allowed users "to navigate efficiently around these structures using either a standard VRML browser or our specialized TerraVision II browser." *Id.*, ¶49. *See also* Ex. 1005, ¶¶122-143.

b. HORNBACKER

Hornbacker likewise addresses "Network and system performance problems that previously existed when accessing large image files from a network file server… by tiling the image view so that computation and transmission of the view data can be done in an incremental fashion." Ex. 1003 at Abstract, 2:15-3:30, 4:24-8:15; Figs.1-2, 13:28-14:11, 14:26-28. Hornbacker teaches methods to request and deliver large image data sets for viewing by a client with limited resources. *Id.*, Abstract, 2:15-3:30. Hornbacker's objects of its invention include "efficient use of the network," "greater speed of image display in response to requests from the workstations," and "to minimize the computing resources required by a client workstation." *Id*, 2:15-3:30.

Like Reddy, Hornbacker teaches displaying portions of very large images retrieved over a network from a server. *Id.* The images are divided by a tiling process on the server into 128x128 pixel view tiles, which are organized into a hierarchy of tiles at differing resolutions spaced by factors of two. *Id.*, 6:13-19;

7:11-15. Such image tiles are retrieved by the client using HTTP requests targeted to particular Universal Resource Locators (URLs). *Id*., 5:3-8, 5:16-25.

Hornbacker further discloses requesting data on the network in response to user-controlled image viewpoints. When a user shifts the view on the screen, a request for the new data of the shifted view is made and the requested data is transmitted to the Web browser to present the shifted view. Ex. 1003, 7:11-8:6, 8:16-23, 10:7-28; 13:11-16 and 19: 15-21.

Hornbacker further teaches that individual tiles are requested, using a scheme which uniquely identifies the tile by scale and position (row and column) within the larger picture, and incorporates that identifying information into the URL sent by the client to the server. *Id.*, 8:30-9:19. By using image tiling and caching according to the preferred method, relatively small amounts of data needs to be transmitted when the user selects a new view of an image. The server sends the requested image in the request format to the workstation and then allows viewing of the image from the local copy of the image file. *Id.*, 13:17-14:28. *See also* Ex. 1005, ¶¶144-147.

2. A POSITA WOULD HAVE BEEN MOTIVATED TO COMBINE REDDY AND HORNBACKER

A POSITA, who is "a person of ordinary creativity, not an automaton," would have been guided by the teachings in Reddy and Hornbacker to combine them in the manner claimed by claims 1-65. *ClassCo v. Apple*, No. 2015-185, *Slip*

Op. at 8 (Fed. Cir. 2016) citing *KSR v. Teleflex,* 550 U.S. 398, 421 (2007); *Belden v. Berk-Tek*, 805 F.3d 1064, 1074-75 (Fed. Cir. 2015). The Board has thrice recognized that a POSITA would have been motivated to combine Reddy and Hornbacker in instituting grounds on substantially similar claims of the ’343, ’506, and ’239 patents. *See* IPR2016-00448, Paper 9 at pages 21-22; IPR2016-00449, Paper 9 at pages 20-22; IPR2016-01897, Paper 17 at pages 24-29.

Reddy teaches an overall system which enables a standard computer (such as a PC or laptop) to access large-scale geographic information databases (comprising multi-resolution “tiled” image pyramids like those described in the ’644 Patent) via the Internet and view that information in 3D. While Reddy describes browsing techniques to request tiles based on a user viewpoint and suggests that tiles may be located by HTTP requests directed to particular URLs (Ex. 1004, ¶¶21, 26, 52), Reddy does not explain exactly how tiles are located. Hornbacker, however, does just that. It explains, in detail, techniques (such as the structure of HTTP requests to identify a particular tile at a desired location and resolution, and how source images are processed into a series of derivative images) which would assist a POSITA in implementing the browsing techniques discussed by Reddy. Ex. 1003 at 5:16-6:19, 8:30-9:19, 11:19-28; Ex. 1005, ¶154.

Therefore, a POSITA would recognize that the system for specifying and locating tiles in Hornbacker would improve the similar system of Reddy, and the combination of techniques (requesting tiles in a 3D browser like that taught by Reddy, with the identification scheme described by Hornbacker) would be well within the skill of a POSITA. *ClassCo*, 2015-185 at 8, *KSR.*, 550 U.S. at 401; *Belden*, 805 F.3d at 1074-75.

A POSITA would look to Hornbacker to improve the system of Reddy in this manner because the references are analogous art. Both references address common technical issues in visualizing large amounts of data obtained over a network, using a client viewing device with much smaller memory than the database which stores the imagery data. *See* Ex. 1005, ¶¶148-151. Both references also address similar problems to be solved (*e.g.*, optimizing and prioritizing use of bandwidth, determining which portions of a larger set of image data to request, etc.), and therefore a POSITA familiar with the teachings of Reddy would be motivated to consider the analogous teachings of Hornbacker in order to solve the same problems.

The teachings of Hornbacker regarding features such as locating image tiles using HTTP requests based on position and level of detail are readily applicable to online mapping references (like Reddy) because online maps represent a scenario in which a client needs to access a large amount of imagery stored on a server—more than what may be stored at one time on a client. The European counterpart of Hornbacker, EP1070290, specifically cites and discusses several online mapping references in the description of the prior art. Ex. 1006 at ¶¶6-7. Ex. 1005, ¶146.

The similarity of the navigation methods taught by Reddy and Hornbacker would also lead a POSITA to combine them. For example, Hornbacker discloses that the client browser enables the user to change their viewpoint by clicking on an area of the image to send a specific request to a server to deliver a different area of the image or to change the resolution (Ex. 1003 at 5:16-6:19 and 12:24-27; *see also* 6:13-8:6), as well as to change the view in other ways such as increasing or decreasing the view scale, shifting the view area, or changing the view size (*id*. at 13:11-16). These client navigation methods are similar to the "fly over" view taught by Reddy because both references utilize a client web browser to request specific image tiles from the server based on client inputs. Therefore, a POSITA seeking to efficiently design a browser-based system for requesting map or other large-scale imagery based on user input, as in Reddy, would combine the teachings of Reddy with the teachings in Hornbacker explaining how particular tiles can be specified and requested based on URLs. Ex. 1005, ¶154.

A POSITA would also combine Reddy and Hornbacker to form a system that can deliver online map data to a mobile device. Reddy teaches the need for a system that can operate with a conventional computing device or mobile platform (such as a laptop) in "distributed, time-critical conditions" (such as military or emergency relief scenarios), which would frequently encounter conditions of limited bandwidth. Ex. 1004, ¶48, Ex. 1005, ¶151. While Reddy teaches using a laptop computer to run the TerraVision geographic browser, the need taught by Reddy to access geographic data in a distributed environment would lead a POSITA to implement the same software on other mobile or portable devices such as the palm-top computers taught by Hornbacker which were capable of operating on limited bandwidth connections (*e.g.*, 28.8 Kbytes/second). Ex. 1003, 13:28-14:2, 14:26-28; Ex. 1005, ¶¶151-153. Because both Reddy and Hornbacker rely on similar network and Internet technologies to request and retrieve images, a POSITA would have a reasonable expectation of success in making this modification. Ex. 1005, ¶152.

Further reasons to combine Reddy and Hornbacker are discussed below as to certain individual claim elements. *See also* Ex. 1005, ¶¶ 117-121, 148-155 (discussing motivations to combine). As discussed below, claims 1-65 are invalid as obvious over Reddy in view of Hornbacker. Ex. 1005, ¶¶8-10, 107-108.

a. CLAIM 1

Claim 1, Preamble: A method of retrieving images over a network communication channel for display on a user computing device, the method comprising steps of:

The preamble of claim 1 is taught by Reddy. Reddy teaches a system for transmitting "massive" terrain data sets including satellite and aerial imagery (images) over the Internet or the Web (network communication channel). *See, e.g.*, Ex. 1004 at p. 30 (subtitle), ¶¶1, 5, 9, 10, 12, 31. Reddy teaches a client that can be implemented with a stand-alone program or a plug-in for a standard web browser (Ex. 1004, ¶¶31, 32), and on a user computing device such as a PC connected to the Internet or a laptop machine, which makes the system particularly useful in "military mission planning… emergency relief efforts, and other distributed time-critical conditions." *Id.*, ¶48. Reddy teaches that tiling enables a user to visualize a scene utilizing a much smaller amount of downloaded data than the full-resolution underlying image. *Id*., ¶16.

Reddy further teaches displaying images based on the retrieved image data on a user computing device, such as a PC or laptop: Fig. 1(b) shows a displayed image on a user's device screen where the image is segmented into regions of different resolutions based on the retrieved data; Fig. 2 shows a displayed image on a user's device screen using a tiled pyramid structure to display terrain geometry to show higher resolutions in a closer terrain than a distant terrain; and Fig. 5 shows a screenshot of a 3-D view of a location on the user screen in the TerraVision system. *Id*., ¶¶16-18, 38; *see also* Fig. 4 and ¶26.

5 Screenshot of the TerraVision system.

Ex. 1005, ¶¶156-164.

<u>1.A: receiving at one or more servers a first request from the user computing device, over one or more network communication channels, the first request being for a first update data parcel corresponding to a first derivative image of a predetermined image, the predetermined image corresponding to source image data, the first update data parcel uniquely forming a first discrete portion of the predetermined image,</u>

The ’644 Patent describes using a series of derivative images K_1, K_2, …$K_{1\text{-}N}$ of progressively lower resolutions produced by processing the original image data 32 and dividing such derivative images into tiles. Ex. 1001, 6:21-36, Fig. 2 (reproduced and annotated below), 7:40-43, 9:52-10:34, Figs. 8-10.

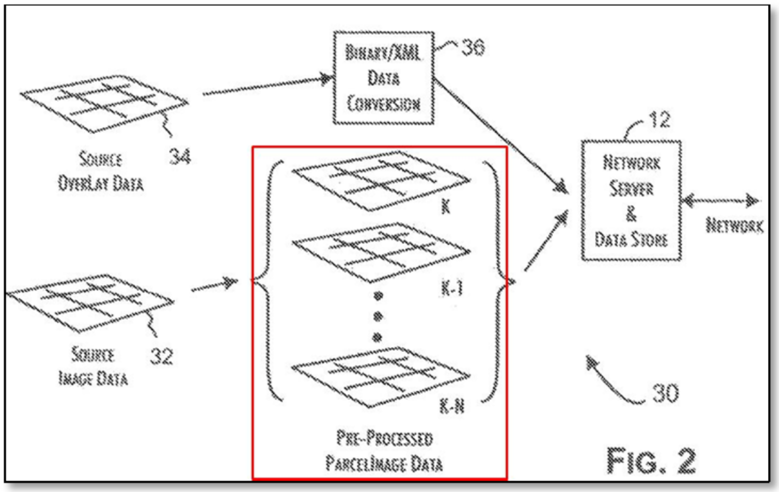
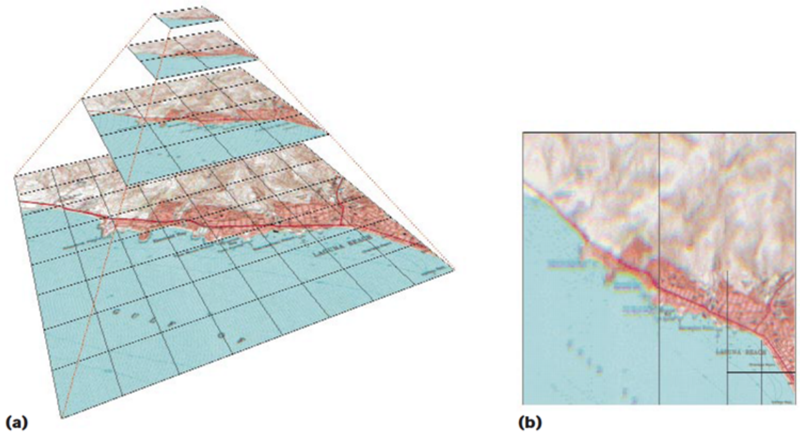


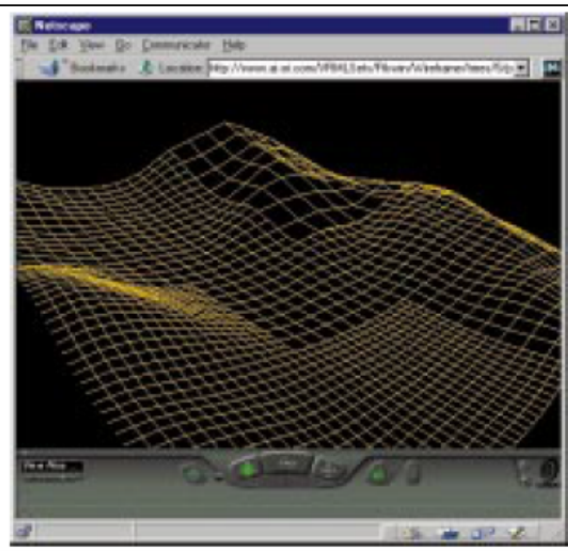
FIG. 2

Similarly, Reddy teaches that a predetermined image (*e.g.*, satellite or aerial imagery or other geographic data) corresponding to the source image data is processed into a multi-resolution "pyramid" of derivative images by repeatedly "down-sampl[ing]" the image data to lower resolutions at each level. Figs. 1(a) and (b) of Reddy (below) illustrate using tiled derivative images of an original image at different resolutions (1(a)) to render a view of different regions in different resolutions of a scene or image, *i.e.*, the lower-right corner in high resolution with the surrounding regions displayed in progressively lower resolutions (1(b)). Ex. 1004, ¶¶14-24, 41-46, Figs.1-3.



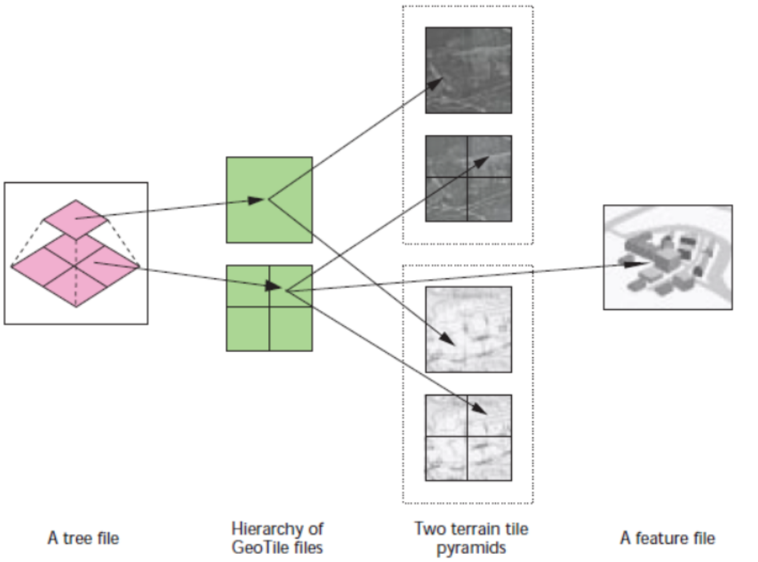
1 An example image pyramid showing (a) four different resolutions of an original image, where each level is segmented into 128×128 pixel tiles, and (b) how this structure can be used to alter the image resolution in different regions.

Fig. 2 in Reddy shows using discrete tiled derivative images to display terrain so that closer regions are represented in higher fidelity (more polygons) than a distant terrain region.



2 Using a tiled pyramid structure to represent terrain geometry. Closer terrain is represented in higher fidelity (more polygons) than distant terrain.

Fig. 3 in Reddy illustrates a tree file structure for the tiled derivative images.



3 The relationship between tree, geotile, terrain tile, and feature files. Unidirectional arcs represent inline links to files over the network. Bold rectangles delineate file boundaries.

Reddy teaches that the system is implemented in conjunction with a web browser, and that tiles are requested based on the user's selected view (Ex. 1004, ¶¶3, 10, 14-17, 31, 34-38, 42, 44-46, Figs.1, 5). The tiles may be requested by URL. *Id.*, ¶¶21, 26, 52. Reddy's system utilizes "geotiles," which contain links to terrain tiles such as satellite, aerial, and map imagery. Ex. 1004, ¶22, Fig. 3.

As Prof. Michalson explains, the conventional web browsers taught by Reddy operate by sending HTTP requests for content specified by URLs over a network. Ex. 1005, ¶169. Therefore, a POSITA would understand Reddy, in view of the knowledge of a POSITA concerning Internet technologies and VRML, to teach that the geographic image server receives requests from a browser on a user computing device to retrieve geotiles containing URL links to imagery files. Ex. 1004, ¶¶19, 21; Ex. 1005, ¶171. These teachings are analogous to the '644

Patent's use of "HTML-based interactions with the server." Ex. 1001, 7:29-33; Ex. 1005, ¶¶172. Such image tiles correspond to the claimed "update data parcel." Ex. 1005, ¶165.

Although Reddy primarily describes the functionality of the client, as Prof. Michalson explains, a POSITA would recognize in view of Reddy's teachings of requesting image data over the Internet that a server necessarily receives and responds to the issued requests. Ex. 1005, ¶171. As discussed above in section IV.B and further explained by Prof. Michalson, the '644 Patent contains no detailed description of the server system architecture and describes the server primarily in terms of the data which is stored and sent in response to client requests, which is also described in detail by Reddy and Hornbacker. Ex. 1005, ¶172. Therefore, a POSITA would understand that the teachings of Reddy disclose and enable a server to the same extent as the '644 Patent. *Id.*

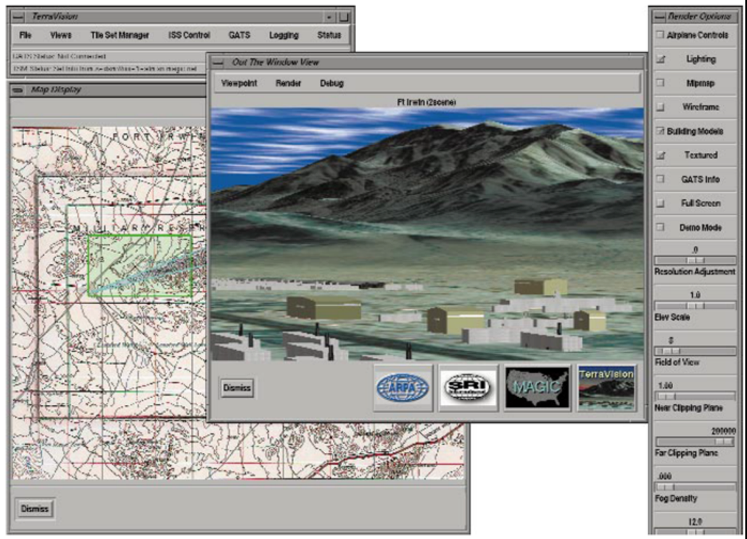
Hornbacker likewise teaches that image data is represented by discrete tiled derivative images of different resolutions. Ex. 1003 at Abstract, 3:10-27, 6:13-19, 7:26-8:6, 8:30-9:28, 10:24-28, 12:24-13:10 and 18:20-23. Hornbacker explains in further detail how such tiles on the server may be located via URL requests that identify a tile by characteristics such as resolution, location, etc. *See, e.g.,* Ex. 1003, Abstract, 3:10-27, 5:16-25, 6:13-19, 7:26-8:6, 8:30-9:28, 10:24-28, 12:24-13:10.

A POSITA would recognize that the teachings of the two references solving similar problems in closely related fields could be considered in combination when designing a display system addressing a similar problem. Specifically, a POSITA facing the problem identified by Reddy, which includes how to identify the tiles desired to render a particular geographic view, would look to the solution taught by the analogous Hornbacker reference of requesting tiles using URLs based on identifying tile coordinates and other viewing characteristics to efficiently specify needed tiles. *See also* Ex. 1005, ¶¶173-175. *ClassCo*, 2015-185 at 8, *KSR.*, 550 U.S. at 401; *Belden*, 805 F.3d at 1074-75. Ex. 1005, ¶¶ 165-175.

<u>1.B: wherein the first update data parcel is selected based on a first user-controlled image viewpoint on the user computing device relative to the predetermined image,</u>

Reddy teaches that a user/operator may navigate to a viewpoint using either a 2-D pan-and-zoom display or 3-D simulated viewpoint, which the system uses to request and receive data from the server. Ex. 1004, ¶¶2-3, 10, 13-17, 21, 31, 34-38, 42, 44-46, Figs.1, 5. Tiles of appropriate resolution are selected based on the user's proximity to the tile in question. *Id.*, ¶¶12-17, 19-22, 29, 42-46, Figs. 1, 4-5. A POSITA would recognize these teachings to disclose that the update data parcel (terrain tiles) are selected based on a user-controlled image viewpoint relative to a predetermined image (the source imagery/map data that the user is viewing). Ex. 1004, ¶3; Ex. 1005, ¶176.

Fig. 5 in Reddy is a screenshot illustrating a user-selected viewpoint:



5 Screenshot of the TerraVision system.

(Ex. 1004 at Fig. 5); *see also* Fig. 1(b) and ¶16 (illustrating/stating that distant imagery is rendered at lower resolution than near imagery).

When a user zooms into a target region, progressively higher resolution data is downloaded and displayed. Ex. 1004, ¶3. In Reddy, the client fetches and displays data for the region that the user is viewing. Ex. 1004, ¶17. Thus, a user's computer issues requests for specified data from a server for the appropriate resolution and location based on the user's viewpoint, in the form of image tiles corresponding to an element of the image array ("update data parcel"). As discussed regarding claim element 1.A above, Reddy teaches that the requests for data on the network are generated in response to user-controlled image viewpoints on the user computing device. Reddy teaches that the view is updated by requesting updated data parcels following changes in user-controlled image viewpoints. Ex. 1004, ¶37; Ex. 1005, ¶¶176-177.

1.C: sending the first update data parcel from the one or more servers to the user computing device over the one or more network communication channels, the step of sending the first update data parcel being performed in response to the first request;

As discussed regarding claim 1, preamble and element 1.A, Reddy teaches a system for browsing geographic data over the Internet (communications channel), which means that the server sends image tiles (update data parcels) in response to requests. As Prof. Michalson explains, a POSITA would recognize that in the client-server interaction described in Reddy, the server sends the tiles after they are requested by the client user computing device. Ex. 1005, ¶178.

1.D: receiving at the one or more servers a second request from the user computing device, over the one or more network communication channels, the second request being for a second update data parcel corresponding to a second derivative image of the predetermined image, the second update data parcel uniquely forming a second discrete portion of the predetermined image, wherein the second update data parcel is selected based on a second user-controlled image viewpoint on the user computing device relative to the predetermined image, the second user-controlled image viewpoint being different from the first user-controlled image viewpoint;

This claim limitation differs from claim elements 1.A and 1.B only in that it claims a second request, which corresponds to a second update data parcel, second derivative image, second discrete portion of the predetermined image, and second viewpoint rather than a first request (and so on), and the second viewpoint is different from the first.

Reddy teaches this element through its discussion of a user navigating through a scene, *e.g.*, by zooming in or "flying" over an image, which results in requests for imagery for the appropriate location and zoom level. When the user changes the viewpoint, the client initiates a request to retrieve updated data parcels. Ex. 1004, ¶¶3, 36-38. Reddy specifically discloses, and it would further be obvious to a POSITA, that more detailed tiles are requested as a user approaches a region. *Id.*, ¶21; Ex. 1005, ¶¶179-180.

1.E: sending the second update data parcel from the one or more servers to the user computing device over the one or more network communication channels, the step of receiving the second update data parcel being performed in response to the second request;

This claim element is nearly identical to claim element 1.C, except that it relates to the second update data parcel rather than the first. As Prof. Michalson explains, it would be obvious to a POSITA in view of Reddy that subsequent tiles requested based on changes in the user-controlled image viewpoint would be sent in the same manner as the "first" tile, and therefore the discussion above regarding claim element 1.C applies. Ex. 1005, ¶181.

1.F: processing the source image data to obtain a series of $K_{1\text{-}N}$ derivative images of progressively lower image resolution, the series of $K_{1\text{-}N}$ derivative images comprising the first derivative image and the second derivative image,

Reddy teaches that source imagery (*e.g.*, satellite and aerial imagery) is processed into a multi-resolution "pyramid" of images (series $K_{1\text{-}N}$) by repeatedly "down-sampl[ing]" the image data to lower resolutions at each level. Ex. 1004,

¶¶14-24, 41-46; Figs.1-3. Reddy discloses that the required terrain data may be either pre-computed (offline) or generated "on the fly" by parsing the URL path name to generate the necessary VRML data. *Id.*, ¶52.

Hornbacker further discloses that view tiles are generated at the server by an image tiling routine that divides a given image into a grid of smaller images, which are further computed for distinct resolutions. The view tiles may either be pre-processed at the server (pre-cached) or newly computed in response to a request. Ex. 1003, Abstract, 3:10-27, 5:3-8, 5:16-8:26, 8:30-9:28, 10:3-10 and 24-28, 11:19-28, 12:21-13:10, 13:26-14:6 and 18:20-23.

A POSITA, facing the issue identified by Reddy of how to prepare geographic data to be provided by a server in response to a request, would be led by Reddy's teaching of processing "on the fly" (at the server) based on URLs, to consider the detailed teachings in Hornbacker about how such on-demand processing of map information could be implemented either in advance or on the fly. A POSITA would recognize that the tiling pipeline on the server (remote computer) of Hornbacker provides an advantageous way to prepare a series of geographically-linked images in a "pyramid" as described by Reddy. Ex. 1005, ¶¶182-185

1.G: wherein series image K_0 of the series of $_{K1\text{-}N}$ derivative images is subdivided into a regular array

Reddy teaches a tiled image pyramid in which "each level is segmented into" an array of tiles, so that each tile at a given level maps onto four tiles at the next higher level. Ex. 1004, ¶¶12-16. Fig. 1 shows an "image pyramid" generated from an original image K_0 (bottom level) which itself is subdivided into a regular array of 8x8 tiles. *Id.*, ¶15. The next two levels are similarly subdivided into regular arrays of 4x4 and 2x2 tiles. This teaching is substantially identical to the '644 Patent's disclosure in Fig. 2 and at 6:21-36 of the division of source image data into derivative images of progressively lower image resolution. Hornbacker also discloses using a similar array of view tiles. Ex. 1003, Abstract, 3:10-27, 5:3-8, 5:16-8:26, 8:30-9:28, 10:3-10 and 24-28, 11:19-28, 12:21-13:10, 13:26-14:6 and 18:20-23; Ex. 1005, ¶186.

1.H: wherein each resulting image parcel of the array has a predetermined pixel resolution and a predetermined color or bit per pixel depth;

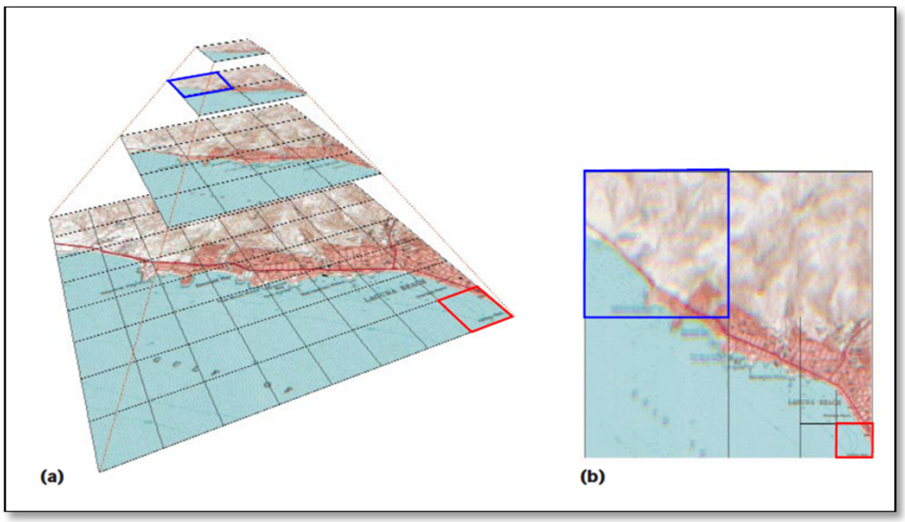
Reddy teaches that within each pyramid image, "all tiles have the same pixel dimensions." Ex. 1004, ¶¶15-16, Fig. 1. For example, each tile in the pyramid in Fig. 1(a) is 128x128 pixels. This disclosure is comparable to the teachings in '644 Patent at 6:21-36. Ex. 1005, ¶187.

A POSITA reading Reddy in light of the existing knowledge in the art would further recognize that Reddy teaches the use of image data having a fixed color or bit per pixel depth. For example, Reddy teaches the use of known imagery formats such as Portable Bitmap (PBM) and LAS, which a POSITA would recognize as formats having a fixed bit per pixel depth. Ex. 1004, p. 31 (sidebar); Ex. 1005, ¶188. Additionally, a POSITA would recognize that the size of the data representing an uncompressed tile is simply the product of the bit depth (bits/pixel) multiplied by the pixel dimensions. For example, a 128x128 pixel tile (16,384 pixels) with 8-bit RGB color (*i.e.*, one byte for each of the three colors) would occupy approximately 49 Kbytes (8 bits/byte) on disk. Ex. 1005, ¶189. Reddy discloses that the example in Fig. 1 takes up 491 Kbytes for 10 tiles and 3.1 Mbytes for the full high-resolution (1024x1024 pixel) image. Ex. 1004 at ¶¶15-16. A POSITA would understand from this teaching that the data parcel size for each tile is the same because each tile has a bit depth of 24 bits per pixel, or 8-bit RGB (red, green, blue) color, yielding the total sizes in ¶16. *Id*.; Ex. 1005, ¶190. This teaching is comparable to the support for this claim element in the ’644 Patent (Ex. 1001 at 6:26-32) which teaches that a 64x64 pixel parcel with a 16-bit color depth has a resulting data parcel size of approximately 8 Kbytes. Ex. 1005, ¶191.

This element would also be obvious in view of Hornbacker, which explicitly teaches the use of tiles have a predetermined pixel resolution and color or bit per pixel depth. Hornbacker teaches using GIF compression with a fixed size (for monochrome tiles before compression) of 2 KB. A POSITA would recognize that this teaching also reflects a fixed data parcel size that is dependent on the number of bits per pixel (color depth). Ex. 1003, 6:20-7:3; Ex. 1005, ¶192. A POSITA would recognize that the same principles would apply to color and grayscale images; *e.g.*, while an 8-bit grayscale image would take up 8 times the space of a similarly proportioned monochrome (1 bit) image and an 8-bit RGB image would be three times larger in turn, in each case the use of constant pixel resolution and constant bit depth results in constant size on disk for the data parcel. Ex. 1005, ¶193.

Like Reddy, Hornbacker teaches that tiles are preferably fixed as 128x128 pixel image files, and that fixed size tiling (as to pixel dimensions) allows more efficient use of the caching mechanism and identifying and locating tiles. Ex. 1003, 6:20-7:25, 13:26-14:6. Therefore, a POSITA would combine Reddy and Hornbacker to obtain the advantages taught by Hornbacker of fixed size tiling in the system taught by Reddy. Ex. 1005, ¶192.

In IPR2015-01432, the Board construed “image parcel” as “an element of an image array, with the image parcel being specified by the X and Y position in the image array coordinates and an image set resolution index.” The Board’s construction of “image parcel” is met by the tiles of Reddy, particularly in view of specific teachings in Hornbacker for how to locate and identify tiles at a specified location and resolution. Reddy teaches that tiles are retrieved for a particular view based on their position in relation to the viewpoint and their resolution. Ex. 1004, ¶¶16-17. A POSITA would recognize that the browser taught by Reddy would need to specify the location and resolution level within the “pyramid” (*i.e.*, the resolution index) of the tiles within the view. Ex. 1005, ¶194. For example, to compose the view shown in Fig. 1(b), the browser would need to retrieve the image tiles shown at a specified location (x, y) and resolution at the user device screen, *e.g.*, the browser would retrieve (*inter alia*) the tile shown in red from the lower right-hand corner of the pyramid at the highest resolution and the tile shown in blue from the upper left-hand corner of the pyramid at a resolution two steps lower:



Reddy further teaches that the methods of locating and retrieving tiles taught therein can be used to retrieve data expressed in a variety of geocentric or local coordinate systems. Ex. 1004, ¶¶27, 29-30 and sidebar, p. 35. As Prof. Michalson explains, a POSITA would recognize these teachings in Reddy to indicate that the browsing methods can be applied to many different coordinate systems, including local coordinate systems or systems such as Universal Transverse Mercator, which indicate coordinates based on X, Y location at the local level on the user device screen. Ex. 1005, ¶¶195-200.

Hornbacker explicitly teaches a method to locate "image parcels" based on x, y location and an image set resolution index for displaying on the user device screen according to the Board's prior construction. Specifically, tiles may be located based on tile name URLs which incorporate a scale (resolution index) and "tile number" based on the row and column (x, y position) of the tile for displaying by the web browser on the user computing device screen. Ex. 1003, 8:30-9:19. As Prof. Michalson explains, a POSITA would recognize that the teachings in Reddy to retrieve tiles based on location and resolution could readily be implemented using a system incorporating location and resolution into requests for specified URLs like that taught by Hornbacker. Ex. 1005, ¶200. The scale specifies the resolution of a tile and is therefore a resolution index. *Id*. To the extent that Bradium argues otherwise, (*see, e.g.*, IPR2016-00449, Paper 8 (PO Preliminary Response) at 51-54, argument rejected at Paper 9 (Institution Decision) at 38-39), Prof. Michalson explains that the "image parcels" are disclosed by or are obvious in view of Hornbacker's view tile name format even under Bradium's apparent narrower construction because the Tile Number and Scale values in Hornbacker specify the x, y location and resolution for displaying on the user computing device screen and the alleged differences previously argued by Bradium are simply predictable minor variations of the tile name format well within the skill of a POSITA. Ex. 1005, ¶200. *ClassCo*, 2015-185 at 8, *KSR.*, 550 U.S. at 401; *Belden*, 805 F.3d at 1074-75.

<u>1.I</u>: <u>resolution of the series $K_{1\text{-}N}$ of derivative images being related to resolution of the source image data or predecessor image in the series by a factor of two, and the array subdivision being related by a factor of two;</u>

Reddy teaches processing image data into a multiresolution image pyramid by progressively down-sampling the image data to produce layers at ¼ the resolution of the prior layer (*i.e.*, ½ the width x ½ the height = ¼ resolution). Ex. 1004, ¶¶14-15. For example, a 1024x1024 original image gets down-sampled to 512x512 pixels, then 256x256 pixels, and so on. Ex. 1004, ¶¶14-15, Fig. 1. Because "all tiles have the same pixel dimensions," each progressively lower resolution layer image includes ¼ the number of tiles from the previous layer. *Id.*, ¶15. The preferred embodiment of the '644 Patent teaches the same "factor of four" relationship between images in the series. Ex. 1002, 6:21-36. Reddy thus discloses that resolution and array subdivision are thus varied in relation and that a fixed tile size of 128 x 128 pixels is maintained. Ex. 1005, ¶201.

Hornbacker likewise teaches that images are divided into tiles at fixed pixel dimensions (*e.g.*, 128x128 pixel tiles) for each resolution. Ex. 1003, 6:13-7:25, 8:7-15. Hornbacker teaches that "if the view being displayed is reduced 2 to 1, then each view tile will represent a 256 x 256 pixel area of the image file that has been scaled down to 128 pixels." Because each tile is 128 x 128 pixels, the 256 x 256 image area (2x2 tiles) would be reduced to one tile (*i.e.*, 1/4 array subdivision) and ¼ the resolution (128x128 pixels). Thus, Hornbacker also discloses that resolution and array subdivision are varied in relation and a fixed tile size of 128 x 128 pixels is maintained. Hornbacker teaches that fixed size tiling is beneficial both to enable efficient use of caching (Ex. 1003 at 7:14-15), and to allow the data transfer size to remain constant even if the size of the view image is increased (*id.* at 14:2-16).

In view of the similar disclosures of both references and the goal of Reddy to deliver a smooth viewing experience (including 2D pan and zoom and 3D flythroughs, Ex. 1004 ¶¶3, 38) over a limited bandwidth network, a POSITA would recognize the advantage of utilizing tiles which are fixed size both as to pixel dimensions and as to byte size, to provide constant smooth streaming of imagery as the user navigates through the 3D environment. Ex. 1005, ¶¶202-203.

b. CLAIM 23

Claim 23 recites substantially similar claim elements to claim 1, except that in lieu of a method as in claim 1, claim 23 recites a generic "computer system" comprising "a processor and a memory," components of any server, which is configured to perform the claimed steps. As Prof. Michalson explains, the claimed "computing system" is obvious in view of the same teachings of Reddy in view of Hornbacker discussed as to claim 1 and further discussed below. Ex. 1005, ¶204.

Claim 23, Preamble: A computing system for providing images over one or more network communication channels for display on a user mobile device;

The preamble of claim 23 is obvious for the same reasons discussed above as to the preamble of claim 1. A POSITA would also combine Reddy and Hornbacker to form a device that can access online map data from a mobile device, such as a laptop computer or personal digital assistant (PDA).

Although the term "mobile device" does not appear in the specification of the '644 Patent, the '644 Patent teaches that the client software system can be downloaded either to a "conventional" computer system or to "portable devices, such as PDAs, tablets, and webphones." Ex. 1001, 4:27-30. Similarly, Reddy teaches that its system may be implemented on a browser on a laptop machine, which is a mobile (portable) computing device. Ex. 1004, ¶48. Reddy further teaches the need for a flexible system capable of operating with commonly used web browsers in a "distributed, time-critical environment" such as a disaster response where both mobility and the ability to access data using limited bandwidth are desired. *Id.* Hornbacker's teaching of a web-browser plug-in capable of operating on a "palm-top computer," which a POSITA would recognize as synonymous with a "PDA" (Portable Digital Assistant) described in the '644

Patent at 4:27-30, meets the need for a device capable of operating in such an environment. Ex. 1003, 13:28-14:2, 14:26-28; Ex. 1005, ¶¶205-207.

As discussed previously, Reddy and Hornbacker both teach similar techniques using multiresolution image pyramids to enable downloading large sets of imagery over a bandwidth constrained system. A POSITA considering the problems articulated by Reddy (*i.e*. viewing large data sets on a bandwidth-constrained device) would therefore look to the similar teachings of Hornbacker to solve those problems using solutions such as the use of compression to reduce byte size of image tiles. Ex. 1005, ¶¶148, 153. Hornbacker teaches a system for using graphical web browsers on client systems to request for and retrieve large images divided into tiles from a computer network server using HTTP (web) server software. Ex. 1003, Abstract, 2:15-3:30, 4:24-8:15; Figs.1-2, 13:28-14:11, 14:26-28. Hornbacker specifically teaches that the tiled view format allows the size of view tiles to be shrunk to as little as 512 bytes (6:20-7:1), and viewed using a "low bandwidth 28.8 kilobaud modem network" with "much lower demand on the network connection." *Id.*, 13:28-14:11. These improvements taught by Hornbacker would further improve the ability to use the system of Reddy on a mobile device with limited bandwidth (*e.g.*, the PDA taught by Hornbacker) in, for example, the types of disaster response scenarios described by Reddy. Ex. 1005, ¶¶207-208. A POSITA would recognize that Reddy teaches methods of browsing geographic image data that can be applied to a wide variety of devices, including various mobile devices. For example, although the teachings of Reddy are not limited to specific embodiments, the authors of Reddy by 1999 had ported the TerraVision II software to the Windows NT operating system, which could operate on a wide variety of computing systems including laptops and embedded devices. Ex. 1014 at 2, Ex. 1005, ¶¶209-213.

<u>Claim 23.A</u>: <u>wherein the computing system comprises a processor and a memory;</u>

As Prof. Michalson explains, a POSITA would recognize that a server as described in claim 1 would necessarily and obviously include a processor (to perform the claimed steps) and a memory (to store tiles and instructions for performing the claimed steps). Ex. 1005, ¶214.

The remainder of claim 23 repeats claim limitations from claim 1 and is therefore rendered obvious by the corresponding limitations discussed above. Ex. 1005, ¶¶215-223.

<u>Claim 23.B</u>: <u>wherein the computing system is configured to receive a first request from the user mobile device, over one or more network communication channels, the first request being for a first update data parcel corresponding to a first derivative image of a predetermined image, the predetermined image corresponding to source image data, the first update data parcel uniquely forming a first discrete portion of the predetermined image,</u>

See claim 1.A.

23.C: wherein the first update data parcel is selected based on a first user-controlled image viewpoint on the user mobile device relative to the predetermined image,

See claim 1.B.

23.D: send the first update data parcel to the user mobile device over the one or more network communication channels, the step of sending the first update data parcel being performed in response to the first request;

See claim 1.C.

23.E: receive a second request from the user mobile device, over the one or more network communication channels, the second request being for a second update data parcel corresponding to a second derivative image of the predetermined image, the second update data parcel uniquely forming a second discrete portion of the predetermined image, wherein the second update data parcel is selected based on a second user-controlled image viewpoint on the user computing device relative to the predetermined image, the second user-controlled image viewpoint being different from the first user-controlled image viewpoint;

See claim 1.D.

23.F: send the second update data parcel to the user mobile device over the one or more network communication channels, in response to the second request;

See claim 1.E.

23.G: process the source image data to obtain a series of $K_{1\text{-}N}$ derivative images of progressively lower image resolution, the series of $K_{1\text{-}N}$ derivative images comprising the first derivative image and the second derivative image,

See claim 1.F.

23.H: wherein series image K_0 of the series of $_{K1\text{-}N}$ derivative images is subdivided into a regular array

See claim 1.G.

23.I: wherein each resulting image parcel of the array has a predetermined pixel resolution and a predetermined color or bit per pixel depth;

See claim 1.H.

23.J: resolution of the series K_{1-N} of derivative images being related to resolution of the source image data or predecessor image in the series by a factor of two, and the array subdivision being related by a factor of two;

See claim 1.I.

c. CLAIM 44

Claim 44 recites substantially similar claim elements to claim 1, except that claim 44 recites a machine-readable storage medium with program code stored in the medium for performing the method steps recited in claim 1. As Prof. Michalson explains, because a server as described in Reddy requires operating instructions in the form of stored code to operate, the claimed “storage medium” with program code is obvious in view of the same teachings of Reddy in view of Hornbacker discussed as to claim 1 and further discussed below. Ex. 1005, ¶224.

Claim 44, Preamble: An article of manufacture comprising a non-transitory machine-readable storage medium with program code stored in the medium, the program code, when executed by at least one processor of one or more servers configures the one or more servers to:

As Prof. Michalson explains, the preamble of claim 44 simply recites a storage medium to store the program code which executes the following steps, and a POSITA would necessarily expect such a storage medium to be present in view of the claimed client-server systems described by Reddy and Hornbacker. Ex. 1005, ¶224. Indeed, the ’644 Patent itself does not explicitly describe a storage medium for storing server program code, nor where the program code for the servers is stored. *Id*. For this claim limitation to be supported by the specification of the ’644 Patent, a POSITA would have to assume that such a storage medium and program code were necessarily present based on the disclosures of the capabilities of the server in the specification. *See In re Fox*, 471 F.2d 1405, 1407 (CCPA 1973) (prior art knowledge “deducible from the fact that [specification] assumes anyone desiring to carry out the process would know of the equipment and techniques to be used, none being specifically described”). Therefore, the claimed “storage medium” storing “program code” is taught or suggested by Reddy in view of Hornbacker to the same extent that it is supported by the specification of the ’644 Patent. *Id.*, ¶¶224-225.

The remainder of claim 44 repeats claim limitations from claim 1 and is therefore rendered obvious by the corresponding limitations discussed above. Ex. 1005, ¶¶226-234.

Claim 44.A: receive a first request from the user computing device, over one or more network communication channels, the first request being for a first update data parcel corresponding to a first derivative image of a predetermined image, the predetermined image corresponding to source image data, the first update data parcel uniquely forming a first discrete portion of the predetermined image,

See claim 1.A.

44.B: wherein the first update data parcel is selected based on a first user-controlled image viewpoint on the user computing device relative to the predetermined image,

See claim 1.B.

44.C: send the first update data parcel to the user computing device over the one or more network communication channels, in response to the first request;

See claim 1.C.

44.D: receive a second request from the user computing device, over the one or more network communication channels, the second request being for a second update data parcel corresponding to a second derivative image of the predetermined image, the second update data parcel uniquely forming a second discrete portion of the predetermined image, wherein the second update data parcel is selected based on a second user-controlled image viewpoint on the user computing device relative to the predetermined image, the second user-controlled image viewpoint being different from the first user-controlled image viewpoint;

See claim 1.D.

44.E: send the second update data parcel to the user computing device over the one or more network communication channels, in response to the second request;

See claim 1.E.

44.F: process the source image data to obtain a series of K_{1-N} derivative images of progressively lower image resolution, the series of K_{1-N} derivative images comprising the first derivative image and the second derivative image,

See claim 1.F.

44.G: wherein series image K_0 of the series of $_{K1-N}$ derivative images is subdivided into a regular array

See claim 1.G.

44.H: wherein each resulting image parcel of the array has a predetermined pixel resolution and a predetermined color or bit per pixel depth;

See claim 1.H.

44.I: resolution of the series K_{1-N} of derivative images being related to resolution of the source image data or predecessor image in the series by a factor of two, and the array subdivision being related by a factor of two;

See claim 1.I.

d. DEPENDENT CLAIMS 2-22, 24-43, AND 45-65

Dependent claims 2-22, 24-43, and 45-65 contain very similar language to dependent claims 2-19 and 23-25 of the ’239 Patent for which the Board has previously instituted IPR. IPR2016-01897, Paper 17 at 16-24 (PTAB April 5, 2017). Additionally, these dependent claims consist of three substantially identical groups with only minor differences in wording based on which of the three independent claims each claim depends on. Ex. 1005, ¶¶236-237. Therefore, similar dependent claims are discussed below at the same time to avoid redundancy, with the minor differences between claims noted in brackets and color-coded.

Claim [2]*[45]*: [A method]*[An article of manufacture]* as in claim [1]*[44]*, wherein the user computing device comprises a mobile device connected to the one or more servers by the one or more network communication channels.

The relevant teachings of Reddy in view of Hornbacker regarding the claimed “mobile device” are discussed above as to claim 23, preamble. Ex. 1005, ¶238.

Claim [3][24]*[46]*: [A method] [A computing system] *[An article of manufacture]* as in claim [2][23]*[45]*, wherein the first user-controlled image viewpoint is determined based at least in part on first navigational input of the user [computing] [mobile] *[computing]* device, and the first request is

prepared by a processing control block of the user [computing] [mobile] *[computing]* device based at least in part on the first user-controlled image viewpoint.

As discussed above regarding claim element 1.B, Reddy teaches that a user may select an image viewpoint and a user can "fly" and zoom into an area of interest. *See, e.g.*, Ex. 1004, ¶3. As Prof. Michalson explains, it would be obvious to a POSITA that in order for a user to control the image viewpoint as described in Reddy, a navigational input would be necessary. Reddy further teaches that using simultaneous map and viewpoint displays, a user can click on the map (another navigational input) to move the viewpoint directly to that location. Ex. 1004, ¶37. Hornbacker likewise teaches that the user-controlled image viewpoint can be determined or changed by a shift in the user's view on the screen of the user computing device. Ex.1003, 7:11-8:6, 8:16-23, 10:7-28; 13:11-16 and 19:15-21. Ex. 1005, ¶¶239-242.

As Prof. Michalson explains, this element would be obvious in view of the teachings of Reddy to use a geographic browser like the TerraVision II system to request particular tiles based on user navigational inputs. Reddy describes as an example a scenario in which a user navigates from space to a target region (Ex. 1004, ¶3). As described in more detail above regarding claim element 1.A, it would be obvious to a POSITA that the system described in Reddy would typically and preferably operate by generating requests (such as HTML tile requests) based on the user navigational inputs and viewpoint. The '644 Patent does not precisely define a "processing control block," but describes the claimed control block as part of an architecture "preferably implemented by software plug-in or application executed by the client system… and that utilizes basic software and hardware services provided by the client system." Ex. 1001 at Fig. 3 and 7:24-37. A POSITA would likewise recognize that a portion of the software program executing on a client system described in Reddy performs the step of preparing requests based on viewpoint and therefore corresponds to the claimed control block. Ex. 1005, ¶243.

Claim [4][25]*[47]*: [A method] [A computing system] *[An article of manufacture]* as in claim [3][24]*[46]*, wherein the first request is prepared based at least in part on altitude and attitude of the first viewpoint relative to the predetermined image.

Reddy's example scenario in ¶3 describes a user zooming in from space, "flying" over mountains, and approaching a target building. A POSITA would recognize that the described scenario would require determining an altitude and attitude of the image viewpoint. Ex. 1005, ¶244. Reddy specifically teaches that user viewpoints are "altitude-based" in ¶36. Reddy further shows two screenshots in Figs. 4-5 of photorealistic terrain using a terrain browser, in which the terrain in Fig. 5 appears to be viewed from a relatively much shallower angle and a lower altitude than in Fig. 4:

5 Screenshot of the TerraVision system.

A POSITA would recognize that these two images show scene views from different attitudes, and would further recognize that a user of a virtual environment would desire the ability to select the view angle or attitude that best presents a scene for a particular purpose. Ex. 1005, ¶¶245-246. Fig. 5 also shows an option to select "airplane controls," which a POSITA would recognize as disclosing the ability to control attitude, since standard airplane controls control the attitude of an aircraft. Ex. 1005, ¶¶247-248. Finally, Reddy teaches that TerraVision "supports 6-degrees-of-freedom input devices," which a POSITA would understand to control pitch, roll, and yaw (*i.e.*, attitude) in addition to lateral and vertical (altitude) position. Ex. 1004, ¶38, Ex. 1005, ¶248.

Claim [5][26]*[48]*: [A method] [A computing system] *[An article of manufacture]* as in claim [3][24]*[46]*, wherein the second user-controlled image viewpoint is determined based at least in part on second navigational input of the user [computing] [mobile] *[computing]* device, and the second request is prepared by the processing control block of the user [mobile] computing device based at least in part on the second user-controlled image viewpoint.

The additional elements of these claims are substantially similar to claim 3, except for the recitation of a "second" viewpoint and navigational input. A POSITA would recognize that when a user makes inputs to change the viewpoint (*e.g.*, flying over or zooming in on a target as in ¶3), the system described in Reddy would calculate a new viewpoint and prepare a second request based on the viewpoint in a similar manner to the first request. Ex. 1005, ¶249.

Claim [6][27]*[49]*: [A method][A computing system]*[An article of manufacture]* as in claim [5][26]*[48]*, wherein the first request is prepared based at least in part on altitude and attitude of the first viewpoint relative to the predetermined image, and the second request is prepared based at least in part on altitude and attitude of the second viewpoint relative to the predetermined image.

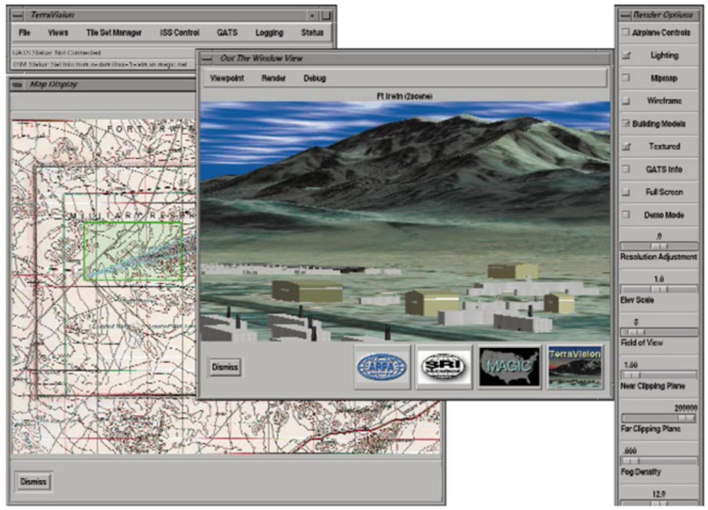
A POSITA would recognize that in Reddy, requests for update data parcels are based on the three-dimensional altitude and the attitude of a viewpoint relative to the source image in a 3D virtual environment, at least for the reasons described as to claim 4. A POSITA would further recognize that as a user navigates through a scene and moves to a new viewpoint, as discussed above as to claim 5, the browser software of Reddy would prepare the first and second requests based on first and second viewpoints in the same manner. Ex. 1005, ¶250.

Claim [7][28]*[50]*: [A method][A computing system]*[An article of manufacture]* as in claim [6][27]*[49]*, wherein the predetermined image is an image of a geographic area.

Reddy repeatedly teaches terrain data sets designed to be viewed by the browser, including geographic information, such as maps, aerial or satellite imagery or digital elevation models of a region. Ex. 1004, ¶¶1-3, 12, 14, 19-20, 22-48, Figs.1-5; Ex. 1005, ¶251.

Claim [8][29]*[51]*: [A method][A computing system]*[An article of manufacture]* as in claim [6][27]*[49]*, wherein the first navigational input comprises first three dimensional coordinate position data and first rotational position data, and the second navigational input comprises second three-dimensional position data and second rotational position data.

It would be obvious to a POSITA that displaying a perspective view from a viewpoint, which is discussed as to claim element 1.B, would require at least x, y, and z (altitude) coordinates, as well as direction of view (rotational position data). Ex. 1005, ¶252. A POSITA would recognize that Figs. 3-5 of Reddy all depict perspective views of a scene from a defined viewpoint (with x, y, and z coordinates) in a particular direction. *Id.* Reddy further teaches specifically that a user can use a map display, shown in a separate window from the perspective view, to move directly to a particular location. Ex. 1004, ¶37. Fig. 5 of Reddy shows how the perspective view on the left corresponds to the map on the right, with a green square in the map showing the area of interest and a blue wedge showing the view angle (rotational position data) from the viewpoint:



5 Screenshot of the TerraVision system.

It would further be obvious to a POSITA that a user of the system described in Reddy could select a second viewpoint comprising (x, y, z) position data and rotation in the same manner as the first viewpoint. Ex. 1005, ¶253.

Claim [9][30]*[52]*: [A method][A computing system]*[An article of manufacture]* as in claim [5][26]*[48]*, wherein the first navigational input comprises first lateral x dimension position data, first lateral y dimension position data, and first rotational position data, and the second navigational input comprises second lateral x dimension position data, second lateral y dimension position data, and second rotational position data.

The teachings discussed above regarding claim 8 also apply to these claims. Ex. 1005, ¶254.

Claim [10][31]*[53]*: [A method][A computing system]*[An article of manufacture]* as in claim [3][24]*[46]*, wherein the first update data parcel comprises first overlay data for the first derivative image.

Reddy teaches that terrain tile files are linked to “feature files,” which may contain information such as cultural features, roads, and terrain or other annotations (Ex. 1004, ¶¶22-26), while an example in the introduction describes a user viewing 3D buildings and information about the buildings (*id.*, ¶3), all of which correspond to the claimed "overlay data." Ex. 1005, ¶¶255-256. Fig. 4 shows an example where at least buildings and roads are overlaid on the image:

Prof. Michalson further explains that a POSITA would recognize that the types of feature file information discussed in Reddy, *e.g.*, ¶25, would preferably be overlaid on a map in order to provide the maximum benefit of the information. Ex. 1005, ¶¶257-260.

Claim [11][32]*[54]*: [A method][A computing system]*[An article of manufacture]* as in claim [10][31]*[53]*, wherein the first overlay data comprises first text annotation relating to at least one item selected from the group consisting of: one or more street names, one or more building names, and one or more landmarks.

Reddy teaches that the feature files include information such as annotations, Ex. 1004, ¶¶6, 22, 25-26, and that the user in the example case in the introduction can access annotations about a target building, *id.*, ¶3. As Prof. Michalson explains, it would be obvious to a POSITA that since the purpose of Reddy is to visualize geographic information and the system supports annotations, text annotations such as street or building names and landmarks would be a likely use for the system and a POSITA would be driven to include such information as an option in feature files in order to provide usable information to the user. Ex. 1005, ¶261.

Claim [12][33]*[55]*: [A method][A computing system]*[An article of manufacture]* as in claim [10][31]*[53]*, wherein the first overlay data comprises graphic data representing a three-dimensional object.

Reddy teaches that the overlay data contained in feature files can include, for example, three-dimensional buildings and vehicles. Ex. 1004, ¶¶3, 6, 18, 22, 26, 38, Fig. 5; Ex. 1005, ¶262.

Claim [13][34]*[56]*: [A method][A computing system]*[An article of manufacture]* as in claim [10][31]*[53]*, wherein the first overlay data comprises graphics data describing at least one object in more than two dimensions.

Relevant teachings discussed above for Claim 12 apply here. Ex. 1005, ¶263.

Claim [14][35]*[57]*: [A method][A computing system]*[An article of manufacture]* as in claim [10][31]*[53]*, wherein the first overlay data comprises one or more graphical icons.

Reddy teaches that data contained in feature files may include features such as weather data, *e.g.*, wind vectors (Ex. 1004, ¶25), and that the system may be used in military mission planning (*id.*, ¶48). As Prof. Michalson explains, a

POSITA would recognize that such weather data would typically rely on icons (such as wind vectors), and that military mission planning uses would lead a POSITA to incorporate military operational graphics. Ex. 1005, ¶264.

Claim [15][36]*[58]*: [A method][A computing system]*[An article of manufacture]* as in claim [10][31]*[53]*, wherein the second update data parcel comprises second overlay data for the second derivative image.

Reddy teaches that feature files are linked to the hierarchy of geotile files, which also include terrain tiles (derivative images). Ex. 1004, Fig. 3, ¶¶22-23, 25-26. Therefore, a POSITA would recognize that use of the system described in Reddy would result in a request for different feature file overlay data when the user navigates to an area represented by a different geotile from the first. Ex. 1005, ¶265.

Claim [16][37]*[59]*: [A method][A computing system]*[An article of manufacture]* as in claim [15][36]*[58]*, wherein the first overlay data and the second overlay data are in a resolution-independent format.

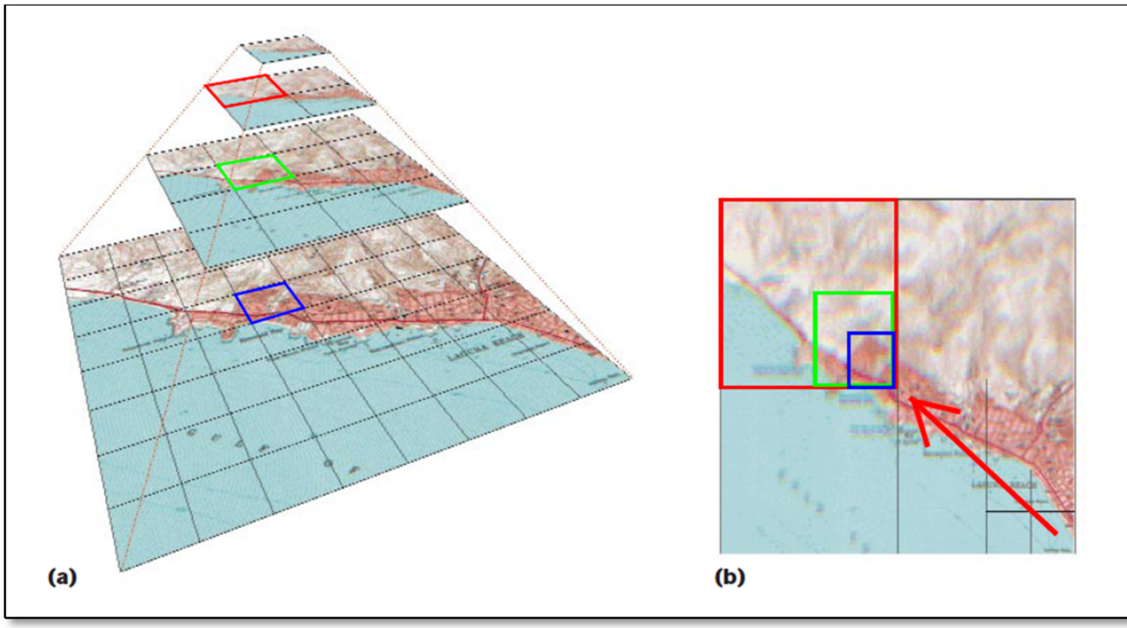
Reddy teaches that features in feature files, such as roads, weather, buildings, and terrain annotations, are stored in such a way that there are links to the appropriate features in all relevant geotiles, which "does not constrain the cultural features to the same resolution range as the terrain." Ex. 1004, ¶¶26-27. Therefore, the features (overlay data) are independent of resolution because the same features may be accessed at different resolutions. Ex. 1005, ¶266.

Claim [17][38]*[60]*: [A method][A computing system]*[An article of manufacture]* as in claim [10][31]*[53]*, wherein the first overlay data comprises first text annotation relating to at least one item selected from the group consisting of: one or more street names, one or more building names, and one or more landmarks.

Relevant teachings discussed above regarding claim 11 apply to these claims. Ex. 1005, ¶¶267-268.

Claim [18][39]*[61]*: [A method][A computing system]*[An article of manufacture]* as in claim [2][23]*[45]*, wherein the first derivative image includes the second derivative image, the second derivative image has a higher level of detail than the first derivative image, and the first request is received [by the computing system] before the second request by [the one or more servers] [the computing system] [the one or more servers].

Reddy teaches that "when the user approaches a region of terrain, more detail is progressively loaded and displayed in a coarse-to-fine fashion," while Fig. 1 and the accompanying text at ¶¶12-17 teach that the resolution is viewpoint-dependent, so that distant imagery is rendered at lower resolution than near imagery. Therefore, it would be obvious to a POSITA that when a user moves toward a point on the map, the browser would first request and download lower resolution (coarser) tiles for particular areas, then request higher resolution tiles as the user moves closer to that point. For example, as shown below in Fig. 1 (annotated), as the viewpoint moved along the path shown by the arrow, the browser would first request the lower-resolution tile shown in red, then the tiles shown in green, then blue, which are successively higher resolution tiles included in the red tile. Ex. 1005, ¶¶269-270.

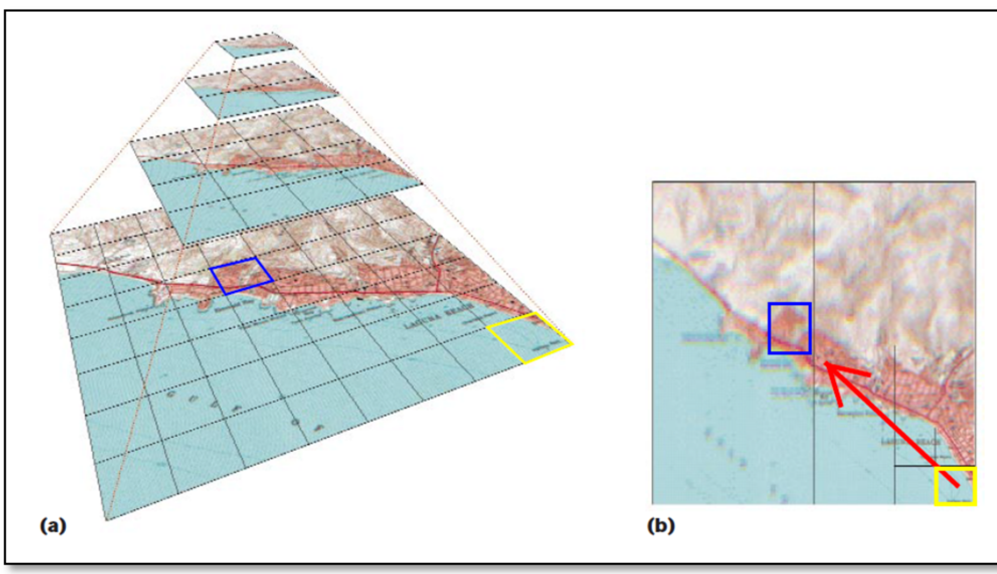


Claim [19][40]*[62]*: [A method][A computing system]*[An article of manufacture]* as in claim [2][23]*[45]*, wherein the second derivative image includes the first derivative image, the second derivative image has a lower level of detail than the first derivative image, and the first request is received [by the computing system] before the second request by [the one or more servers] [the computing system] [the one or more servers].

These claims are similar to claim 18. As Prof. Michalson explains, a POSITA would recognize that the system of Reddy would request lower-resolution derivative versions of the same terrain area if a user backed or zoomed away from a particular point on the map. For example, if the user began by viewing the image from the lower right-hand corner of Fig. 1(b), but then zoomed out to see a broader view of the California coastline, the browser would request lower resolution tiles covering the same area as the high resolution tiles shown in the lower right of Fig. 1(b). Ex. 1005, ¶271.

Claim [20][41]*[63]*: [A method][A computing system]*[An article of manufacture]* as in claim [2][23]*[45]*, wherein the first derivative image does not include the second derivative image, and the second derivative image does not include the first derivative image.

As Prof. Michalson explains, it would be obvious to a POSITA that the browser taught by Reddy would request different derivative images from the original source which are not derivative images of each other, such as different tiles at the same zoom level, as the user moves through an image. For example, if the user moved in the manner shown in the arrow below, the browser would first request the first derivative tile shown in yellow, then the tile shown in blue. Ex. 1005, ¶272.



Claim [21]*[64]*: [A method]*[An article of manufacture]* as in claim [2]*[45]*, wherein the one or more servers comprise at least two servers.

Claim 42: A computing system as in claim 23 implemented on a plurality of servers.

Reddy notes in the background section that "VRML offers cartographers and geographers the potential to disseminate 3D maps and spatial data over the World Wide Web" (Ex. 1004, ¶3), that "Terravision was designed to enable interactive visualization of massive terrain databases that can be distributed over a high-speed wide-area network" (*id.*, ¶38), and that the system is "particularly useful in military mission planning and battle damage assessment, emergency relief efforts, and other distributed time-critical operations" (*id.*, ¶48). As Prof. Michalson explains, a POSITA would interpret the repeated use of "distributed" in Reddy to indicate that geographic data stored on the system may be distributed across multiple servers, and that the system described in Reddy would be ideally suited to retrieving geographic information from more than one server either because multiple sources of data are being used (*e.g.*, to composite different information sources in a military or disaster relieve scenario) or because a large terrain database is stored in a distributed manner over multiple servers. Ex. 1005, ¶¶273-276.

Moreover, Hornbacker explicitly teaches that "[t]ypical networks include many workstations served by one, *and sometimes more than one,* network server, the server functioning as a library to maintain files which can be accessed by the workstations." Ex. 1003 at 5:13-15. Additionally, a POSITA at the time of the effective filing date of the '644 Patent would know that distributed server systems could retrieve data faster by enabling multiple items (*e.g.*, map tiles) to be read from disk and sent simultaneously. For example, Fuller *et al*., "The MAGIC Project: From Vision to Reality," a 1996 IEEE Network publication describing an earlier version of TerraVision designed by SRI, teaches that using "multiple coordinated workstation-based data servers" can "compensate[] for the performance limitations of current disk technology." Ex. 1011 at 18. In view of this background knowledge, a POSITA would recognize the benefits of distributing the storage of tiles on remote servers as taught by Reddy to more than one network server, as taught by Hornbacker. Ex. 1005, ¶¶277-279.

Additionally, a POSITA would recognize that the specification of the '644 Patent discusses its preferred embodiments in the context of a "server," and contains no discussion of how or why its teachings would be implemented on multiple servers, other than a passing reference to different servers having tiles of different sizes. Ex. 1005, ¶279.

Claim [22][43]*[65]*: [A method] [A computing system] *[A method (sic)]* as in claim [2][23]*[45]*, wherein each image parcel is of a fixed byte size.

A POSITA reading Reddy in light of the existing knowledge in the art would recognize that Reddy teaches the use of tiles having a fixed byte size. The size of the data representing an uncompressed tile is simply the product of the bit depth (bits/pixel) multiplied by the pixel dimensions. For example, a 128x128 pixel tile (16,384 pixels) with 8-bit RGB color (one byte for each of three colors) would occupy approximately 49 Kbytes (8 bits/byte) on disk. Ex. 1005, ¶280. Reddy teaches at ¶16 that the example in ¶15 and Fig. 1 takes up 491 Kbytes for 10 tiles, and 3.1 Mbytes for the full high-resolution (1024x1024) image. A POSITA would understand from this teaching that the data parcel size for each tile is the same because each tile has a bit depth of 24 bits per pixel, or 8-bit RGB (red, green, blue) color, yielding the sizes in ¶16. Ex. 1005, ¶281. This teaching is similar to the support for this claim element in the ’644 Patent at 6:26-32, which teaches that a 64x64 parcel with a 16-bit color depth has a resulting data parcel size of approximately 8 Kbytes. Ex. 1005, ¶282.

Similarly, Hornbacker teaches the use of GIF compression with a fixed size (for monochrome tiles before compression) of 2 KB. Ex. 1003, 6:20-7:3. A POSITA would recognize that this teaching also reflects a fixed data parcel size that is dependent on the number of bits per pixel (color depth). A POSITA would recognize that the same principles would apply to color and grayscale images; *e.g.*, while an 8-bit grayscale image would take up 8 times the space of a similarly proportioned monochrome (1-bit) image and an 8-bit RGB image would be three times larger in turn, in each case the use of constant pixel resolution and constant bit depth results in constant size on disk for the data parcel. Ex. 1005, ¶283.

C. NO SECONDARY INDICIA OF NON-OBVIOUSNESS

While Petitioner is not obligated to pre-emptively address Bradium's arguments in this Petition,[1] Bradium may make some or all of the same secondary indicia arguments here as it did in other IPRs regarding different patents. In IPR2016-00448 and IPR2016-00449, Bradium's secondary indicia of non-obviousness arguments relied solely on the testimony of Isaac Levanon, a witness with a 50% interest in Bradium, who admitted to being unable to read software source code, and failed to explain the nexus between any of Bradium's asserted evidence and the claims of any Bradium patent, including the '644 Patent application that was then pending. Ex. 1019 at 10:6-15:13, 31:19-22, 38:23-39:14. Not only has Bradium failed to show a nexus with *any* Bradium patent in any IPR, but Bradium has never in any forum alleged any nexus between any secondary indicia of non-obviousness and any claim of the '644 Patent and Bradium has

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[1] *See, e.g. Shenzhen Liown Electronics Co. Ltd. v. Disney Enterprises, Inc.*, IPR2015-01656, Paper 35 (PTAB Sep. 2, 2016), *citing Prometheus Labs v. Roxane Labs.* 805 F.3d 1092, 1101-02 (Fed. Cir. 2015) (burden of production shifts to Patent Owner upon *prima facie* showing of obviousness).

never even produced in any forum any technical documentation showing how any product that allegedly embodied any of the Bradium patents actually practiced the claims of those patents. Therefore, at this stage of the proceeding there is no evidence of secondary indicia of non-obviousness of any claim of the ’644 Patent.

Petitioner reserves the right to respond when and if Bradium raises actual secondary indicia arguments.

VI. CONCLUSION

Claims 1-65 are obvious and therefore unpatentable.

Dated: June 21, 2017

Respectfully submitted,

/Chun M. Ng/

Lead Counsel
Chun M. Ng, Reg. No. 36,878

Back-up Counsel
Matthew C. Bernstein, *Pro Hac Vice*
Patrick J. McKeever, Reg. No.66,019
Vinay P. Sathe, Reg. No.55,595
Evan S. Day, Reg. No. 75,992
Miguel J. Bombach, Reg. No. 68,636

Attorneys for Microsoft Corporation

PERKINS COIE LLP
1201 Third Avenue Suite 4900
Seattle, WA 98101-3099
(206) 359-6400

11988 El Camino Real, Suite 350
San Diego, CA 92130
(858) 720-5700

CERTIFICATION OF WORD COUNT UNDER 37 C.F.R.§42.24(d)

Under the provisions of 37 C.F.R.§42.24(d), the undersigned hereby certifies that the word count for the foregoing *Petition for Inter Partes Review* of U.S. Patent No. 9,641,644 B2 totals 13,952, excluding the parts exempted by 37 C.F.R.§42.24(a). Accordingly, this Petition is under the word count limit of 14,000 words.

This word count was made by using the built-in word count function tool in the Microsoft Word software Version 2010 used to prepare the document.

Dated: June 21, 2017

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/Chun M. Ng/

Lead Counsel
Chun M. Ng, Reg. No. 36,878

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Vinay P. Sathe, Reg. No.55,595
Evan S. Day, Reg. No. 75,992
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Attorneys for Microsoft Corporation

PERKINS COIE LLP
1201 Third Avenue Suite 4900
Seattle, WA 98101-3099
(206) 359-6400

11988 El Camino Real, Suite 350
San Diego, CA 92130
(858) 720-5700

CERTIFICATE OF SERVICE

The undersigned hereby certifies that true copies of the foregoing PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,641,644 B2 and supporting materials (Exhibits 1001-1015, 1018-1026, 1030-1042 and Power of Attorney) have been served in their entirety this 21st day of June, 2017 by FedEx® on Patent Owner at the correspondence address for the attorney of record for the ’644 Patent shown in USPTO PAIR:

Bradium Technologies LLC
75 Montebello Road
Suffern, NY 10901

Courtesy copies are also being served via electronic mail on the attorneys of record for the *inter partes* review petition of the related ’239 Patent, PTAB Case No. IPR2016-01897:

LEAD COUNSEL	BACK-UP COUNSEL
Christopher J. Coulson ccoulson@kenyon.com ANDREWS KURTH KENYON LLP One Broadway New York, NY 10004-1007 Bradiumiprservice@kenyon.com	Michael N. Zachary mzachary@kenyon.com ANDREWS KURTH KENYON LLP 1801 Page Mill Road, Ste 210 Palo Alto, CA 94304
	Clifford Ulrich culrich@kenyon.com ANDREWS KURTH KENYON LLP One Broadway New York, NY 10004-1007

and via e-mail to the attorneys of record for Plaintiff in the concurrent litigation:

Christopher J. Coulson ccoulson@kenyon.com ANDREWS KURTH KENYON LLP One Broadway New York, NY 10004-1007	Michael N. Zachary mzachary@kenyon.com ANDREWS KURTH KENYON LLP 1801 Page Mill Road, Ste 210 Palo Alto, CA 94304
John C. Phillips, Jr. jcp@pgmhlaw.com PHILLIPS GOLDMAN MCLAUGHLIN & HALL P.A. 1200 North Broom Street Wilmington, DE 19806	David A. Bilson dab@pgmhlaw.com PHILLIPS GOLDMAN MCLAUGHLIN & HALL P.A. 1200 North Broom Street Wilmington, DE 19806

Dated: June 21, 2017

Respectfully submitted,

/Chun M. Ng/

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Patrick J. McKeever, Reg. No.66,019
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Evan S. Day, Reg. No. 75,992
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Seattle, WA 98101-3099
(206) 359-6400

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San Diego, CA 92130
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