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TITLE OF THE INVENTION

OPTIMIZATION OF IMAGE PARCEL SIZE FOR FAST QUALITY BUILD-UP
OF DATA PACKETS STREAMED OVER LIMITED AND NARROWBAND
COMMUNICATION CHANNELS

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ENCLOSED APPLICATION PARTS (check all that apply)

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Drawings No. of sheets: 5 Power of Attorney

Declaration Assignment and Cover Sheet

Other: Return-Receipt Post Card

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

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US Government agency and Contract: _____

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1 OPTIMIZATION OF IMAGE PARCEL SIZE FOR
2 FAST QUALITY BUILD-UP OF DATA PACKETS
3 STREAMED OVER LIMITED AND
4 NARROWBAND COMMUNICATION
5 CHANNELS
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18 Background of the Invention

19 The present invention is generally related to the delivery of high-resolution
20 highly featured graphic images over limited and narrowband communications
21 channels.
22

23 Summary of the Invention

24 The objective is to display a two-dimensional pixel map, a 16-Bit RGB color
25 image in the preferred embodiments, of very large dimensions and permitting the
26 viewing of the image from a dynamic three-dimensional viewpoint. Multiple such

1 images are remotely hosted for on-demand selection and transfer to a client
2 system for viewing.

3 Images, as stored by the server, may individually range from gigabytes to
4 multiple terabyte in total size. A correspondingly large server storage and
5 processing system is contemplated. Conversely, client systems are contemplated
6 to be conventional personal computer systems and, in particular, mobile, cellular,
7 embedded, and handheld computer systems, such as personal digital assistants
8 (PDAs) and internet-capable digital phones, with relatively limited to highly
9 constrained network communications capabilities. For most wireless applications,
10 conventional narrowband communications links have a bandwidth of less than
11 approximately three kilobytes of data per second. Consequently, transmittal of
12 entire images to a client system in reasonable time is infeasible as a practical
13 matter.

14
15 Description of the Invention

16 For purposes of the present invention, each image (Figure 1) is at least
17 logically defined in terms of multiple grids of image parcels with various levels of
18 resolutions (Figure 2) that are created through composition of information from
19 all level of resolutions, and stored by the server to provide an image for transfer
20 to a client system (Figure 3). Composed and separate static and dynamically
21 created layers are transferred to client system in parcels in a program selectable
22 order to optimize for fast quality build-up of the image presented to a user of the
23 client system, particularly when the parcels are streamed over a narrowband
24 communication link.

1 The multiple layers of an image allow the selectivity to incorporate
2 topographical, geographical, orientational, and other terrain and mapping
3 related information into the image delivered. Other layers, such as geographic
4 grids, graphical text overlays, and hyperlink selection areas, separately provided
5 or composed, aid in the useful presentation and navigation of the image as
6 presented by the client system and viewed by the user.

7 Compositing of layers on the server enables the data transfer burden to be
8 reduced, particularly in analysis of the requirements and capabilities of the client
9 system and the connecting communications link. Separate transfer of layers to the
10 client system allows the client system selectivity in managing and presentation of
11 the data to the user.

12 The system and methods of the present invention are designed to, on
13 demand, select, process and immediately transfer data parcels to the client
14 system, which immediately processes and displays a low-detail representation of
15 the image requested by the client system. The system and methods immediately
16 continue to select, process and sequentially transfer data parcels that, in turn, are
17 processed and displayed by the client system to augment the presented image
18 and thereby provide a continuously improving image to the user.

19 Selection of the sequentially transferred data is, in part, dependent on the
20 progressive translation of the three-dimensional viewpoint as dynamically
21 modified on the client system during the transfer process. This achieves the
22 above-stated objective while concurrently achieving a good rendering quality for
23 continuous fly-over of the image as fast as possible, yet continuously building the
24 image quality to the highest resolution of the image as stored by the server.

1 To optimize image quality build-up over limited and narrowband
2 communication links, the target image, as requested by the client system, is
3 represented by multiple grids of 64x64 image pixels (Figure 4) with each grid
4 having some corresponding level of detail. That is, each grid is treated as a
5 sparse data array that can be progressively revised to increase the resolution of
6 the grid and thereby the level of detail presented by the grid. The reason for
7 choosing the 64x64 pixel dimension is that, using current image compression
8 algorithms, a 16-bit 64x64 pixel array image can be presented as a 2KByte data
9 parcel. In turn, this 2KByte parcel is the optimal size, subject to conventional
10 protocol and overhead requirements, to be transmitted through a 3KByte per
11 second narrowband transmission channel. Using a smaller image array, such as
12 32x32, would create a 0.5KByte parcel, hence causing inefficiencies due to packet
13 transmission overhead, given the nature of current wireless communications
14 protocols.

15 Image array dimensions are preferably powers of two so that they can be
16 used in texture mapping efficiently. Each parcel, as received by the client system,
17 is preferably immediately processed and incorporated into the presented image.
18 To do so efficiently, according to the present invention, each data parcel is
19 independently processable by the client system, which is enabled by the selection
20 and server-side processing used to prepare a parcel for transmission. In addition,
21 each data parcel is sized appropriate to fit within the level-1 cache, or equivalent,
22 of the client system processor, thereby enable the data processing intensive
23 operations needed to process the data parcel to be performed without extended
24 memory access delays. In the preferred embodiment of the present invention,

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