

[0104] Reference is now made to FIG. 5, which is a simplified flowchart of operation of a document viewer in accordance with a preferred embodiment of the present invention. Illustrated in FIG. 5 is a sample interactive viewing session during which a client interactively views a document containing a high quality image stored on a server computer. In the sample session illustrated a user views an initial page of the document with an image. The user clicks to zoom in on the page, then navigates to move to the right and then advances to a next page.

[0105] At step 510 a user clicks on a URL for a document file in a web page. At step 520 the user's client computer issues a request to a document manager for the document file. At step 530 the document manager transmits the requested image to the client as an image-less document.

[0106] At step 540 the client computer requests from the image server an initial image at a screen resolution. Such a request is preferably an IIP request. The IIP request may be a server-side processing request containing a CVT command, requesting a specific image portion at a specific image resolution. In this case the image server carries out the necessary image processing to return a single image corresponding to the image portion and pixel resolution requested by the client computer. Alternatively, the IIP request may be a client-side processing request containing one or more TIL commands, requesting specific image tiles from specific resolution layers. In this case the image server fetches and transmits the desired tile data, and the client computer is responsible for handling the image tiles it receives. If the image data is not stored in an MRT file format, then the server must perform on-the-fly processing to generate tiles in all but the highest resolution layer.

[0107] At step 550 the image server transmits data for the screen resolution version to the client computer. As mentioned hereinabove, the transmitted image data may comprise a single image portion, or alternatively it may comprise a plurality of image tiles. At step 560 the client computer receives the transmitted image data, embeds the screen resolution image into an initial page of the document, and displays the initial page with the screen resolution image embedded. If the transmitted image data consists of a plurality of image tiles, then at step 560 the client computer may also process the image tiles to combine them together into a single image portion. Alternatively, the client computer may embed the tiles individually into the initial page of the document, without first combining them together.

[0108] At step 570 the user, while viewing the initial page of the document, clicks to zoom in on a portion of the displayed page. The zoom can be activated, for example, by the user clicking on an icon such as a magnifying glass, or by clicking at a location within the page, or both. At step 580 the client computer requests from the image server an appropriate zoomed portion of the initial image, corresponding to the zoomed portion of the page to be displayed. As mentioned hereinabove, such request may include a server-side processing command, such as the IIP CVT command, or alternatively it may include a client-side processing command, such as the IIP TIL command. At step 590 the image server transmits data for the zoomed portion of the initial image to the client computer. At step 600 the client computer receives the transmitted image data, embeds the zoomed portion of the initial image into the initial page of the

document, and displays the zoomed portion of the initial page that was requested. As mentioned hereinabove, at step 600 the client computer may also process the transmitted image data in order to combine image tiles.

[0109] At step 610 the user, while viewing the zoomed portion of the initial page, clicks to move rightward within the displayed page. Since the client computer displays only a portion of the initial document page, the user must navigate to see other portions of this page. At step 620 the client computer requests from the image server an appropriate zoomed portion of the initial image, corresponding to the rightward zoomed portion of the initial page. At step 630 the image server transmits data for the rightward zoomed portion of the initial image to the client computer. At step 640 the client computer receives the transmitted image data, embeds the rightward zoomed portion of the initial image into the initial page of the document, and displays the rightward zoomed portion of the initial page that was requested.

[0110] At step 650 the user, while viewing the rightward zoomed portion of the initial page, clicks to advance to the next page within the document. In the embodiment illustrated in FIG. 5, the next page appears at the same portion and zoom factor as the current page. However, it should be apparent to those skilled in the art that other choices can be implemented, such as resetting the view of the next page to the default view of the first page. At step 660 the client computer requests an appropriate portion of the next image from the image server. At step 670 the image server transmits data for the zoomed portion of the next image to the client computer. At step 680 the client computer receives the transmitted image data, embeds the zoomed portion of the next image into the next page of the document, and displays a portion of the next page.

[0111] Caching

[0112] The present invention uses caching in order to achieve improved performance. One of the advantages of client-side processing over server-side processing is the ability to cache responses. As described above, client-side processing operates by transmitting individual tiles from the server to the client, and these tiles can be cached by the client as they are received, thereby obviating the need to transmit them again. The tile cache can be built up on the client, and as each additional interactive navigational request is processed, the client can determine which tiles among the tiles necessary to fulfill the request are already present in cache, and request from the server only those tiles that are not available. Thus, for example, when a user pans slightly to the right, only the newly exposed tiles have to be transmitted from the server to the client.

[0113] The success of caching stems from the fact that a user interactively navigating through a large image typically returns to the same image data in a recurrent fashion. Zooming in and out, and panning up, down, left and right, typically lead through some of the same image data. This phenomenon is atypical for media such as video for which the usual viewing mode is simply to play the frames of the video forward, and the same data is usually not accessed more than once in a single session.

[0114] Image-Less Documents

[0115] The image-less documents of the present invention are created by means of a fragmenting tool that converts a