US008015259B2

(12) **United States Patent**
Swahn

(10) **Patent No.: US 8,015,259 B2**
(45) **Date of Patent: Sep. 6, 2011**

(54) **MULTI-WINDOW INTERNET SEARCH WITH WEBPAGE PRELOAD**

(76) Inventor: **Alan Earl Swahn**, North Andover, MA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1163 days.

(21) Appl. No.: **10/657,888**

(22) Filed: **Sep. 9, 2003**

(65) **Prior Publication Data**

US 2004/0049541 A1 Mar. 11, 2004

Related U.S. Application Data

(60) Provisional application No. 60/409,456, filed on Sep. 10, 2002.

(51) **Int. Cl.**
G06F 15/16 (2006.01)

(52) **U.S. Cl.** **709/217**

(58) **Field of Classification Search** 709/217
See application file for complete search history.

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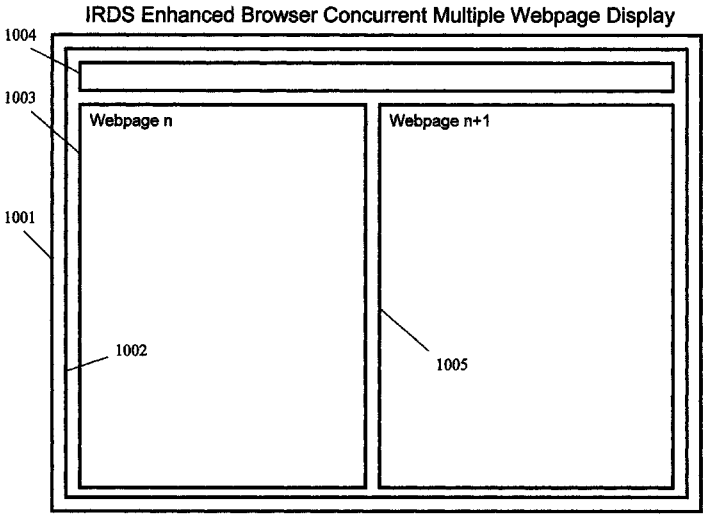
Primary Examiner — Aaron Strange
Assistant Examiner — Brian P Whipple
(74) *Attorney, Agent, or Firm* — Cherskov & Flaynik

(57) **ABSTRACT**

Methods are described to preload a plurality of webpages from a hyperlink list either previously saved or returned by one or more search engines, where said webpages are displayed on demand in a web browser. The web browser has been augmented to display multiple webpages simultaneously and to allow changing the number of webpages displayed. Any displayed portion of this plurality of webpages can be captured to a standard graphics format for later use. The viewing magnification factor can be changed for this plurality of webpages both globally for preloaded webpages not displayed and selectively for displayed webpages. The hyperlinks associated with any portion of this plurality of webpages can be saved as a list of hyperlinks (group bookmark) for later retrieval. A queue of favorite webpages can be dynamically created from this plurality of webpages by selecting one or more webpages and having the associated hyperlinks to said selected webpages appended to a queue of hyperlinks which is available for preloading, display, or saved as a group bookmark.

18 Claims, 27 Drawing Sheets



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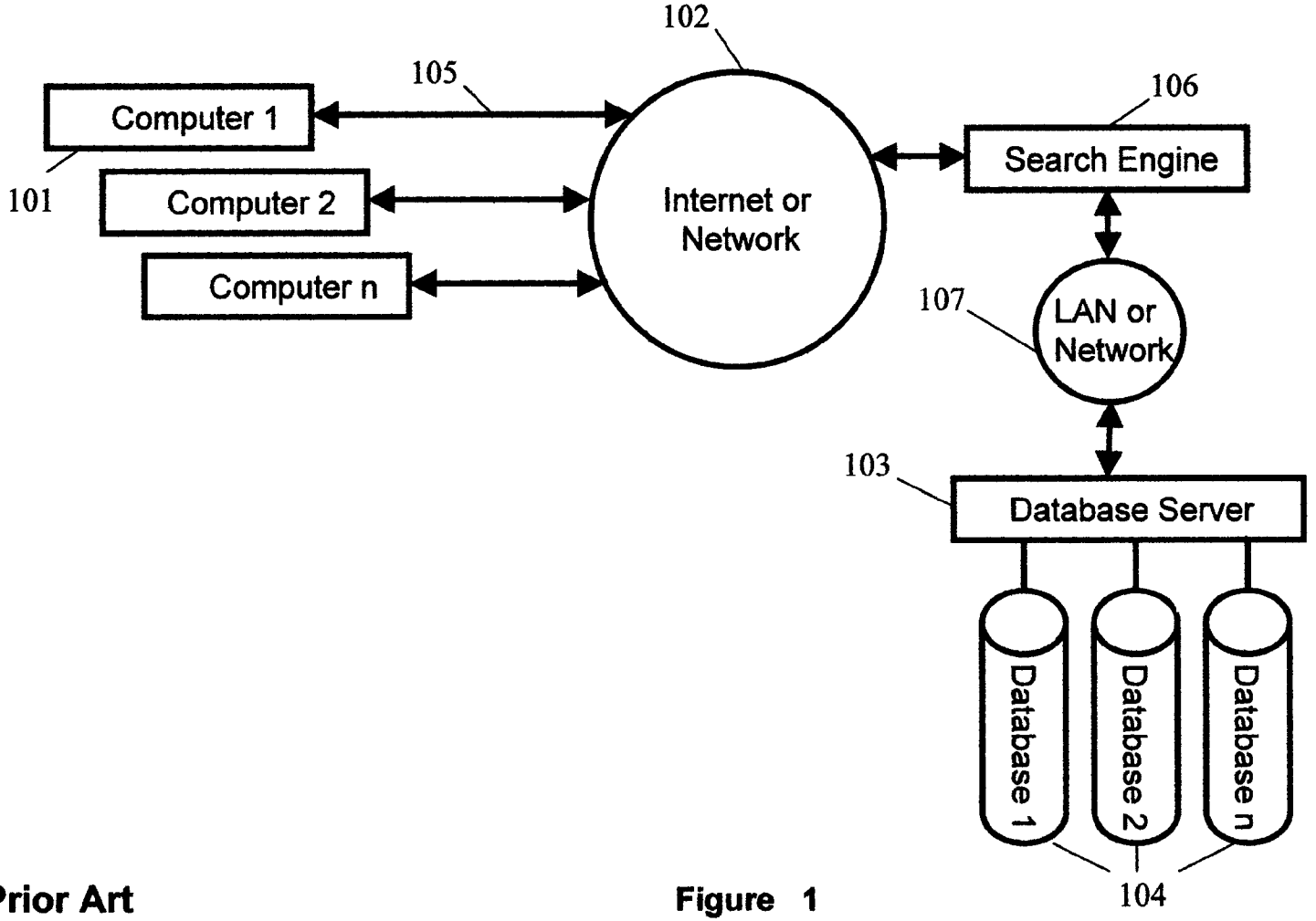
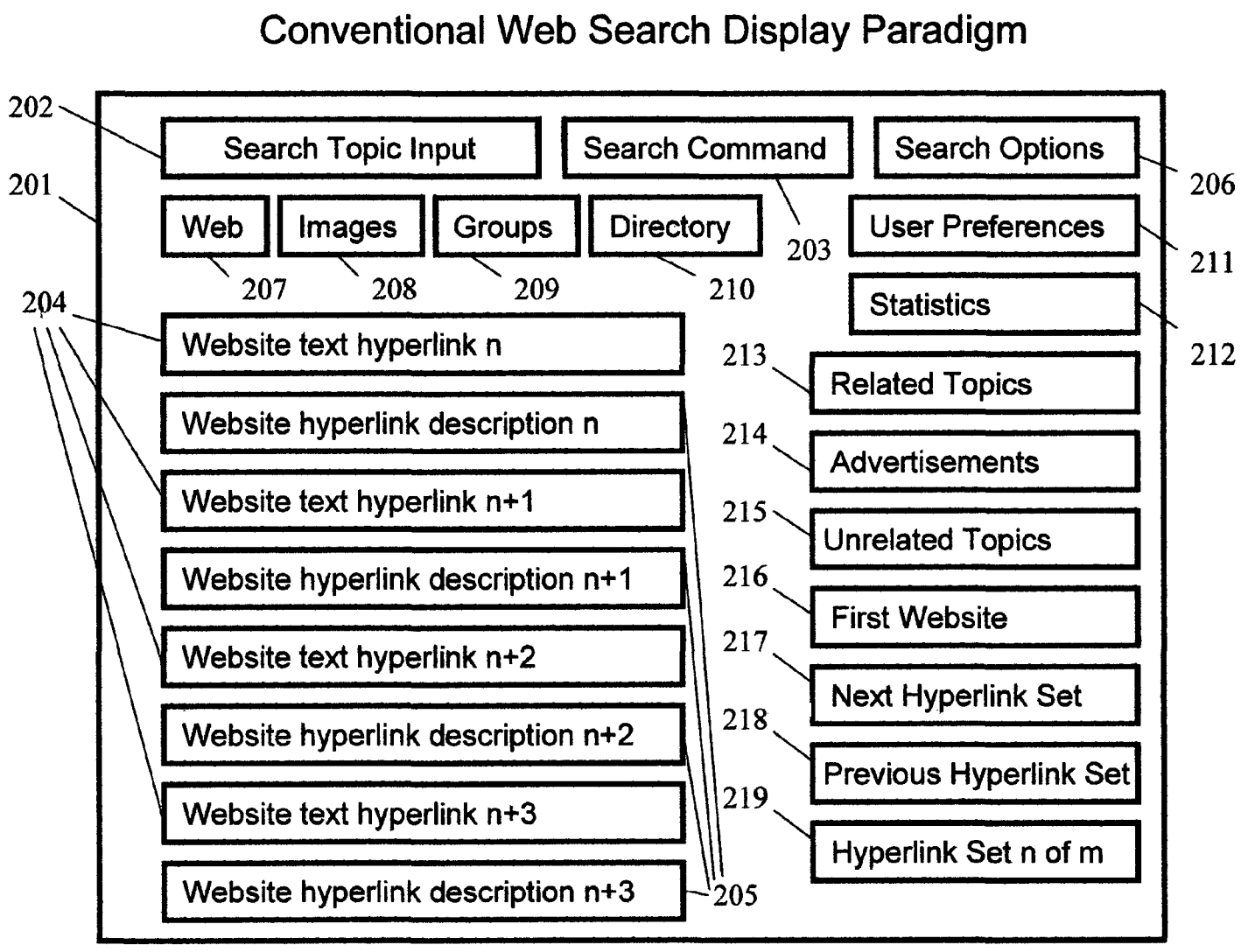
Conventional Network Based Information Search Paradigm



Prior Art

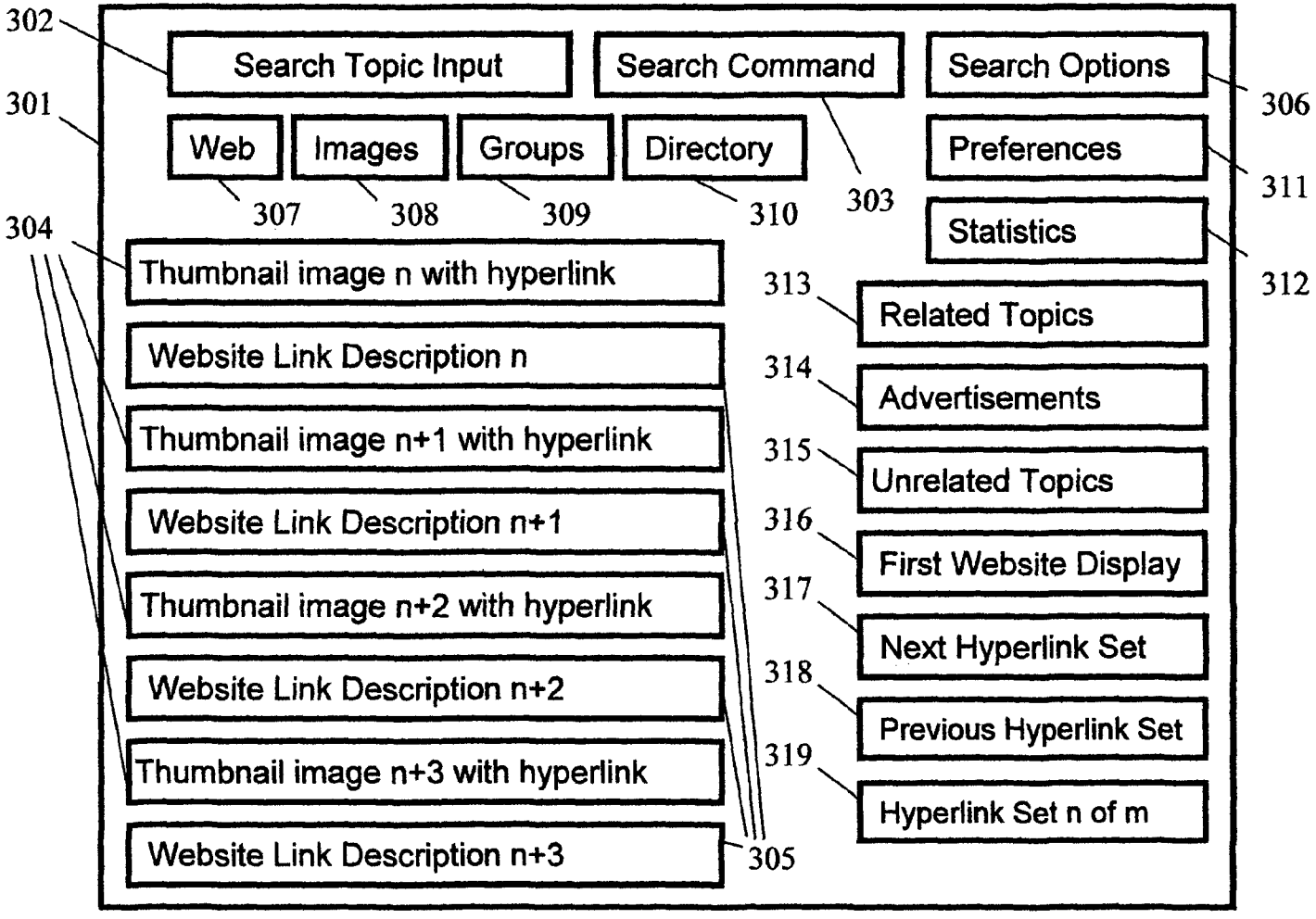
Figure 1



Prior Art

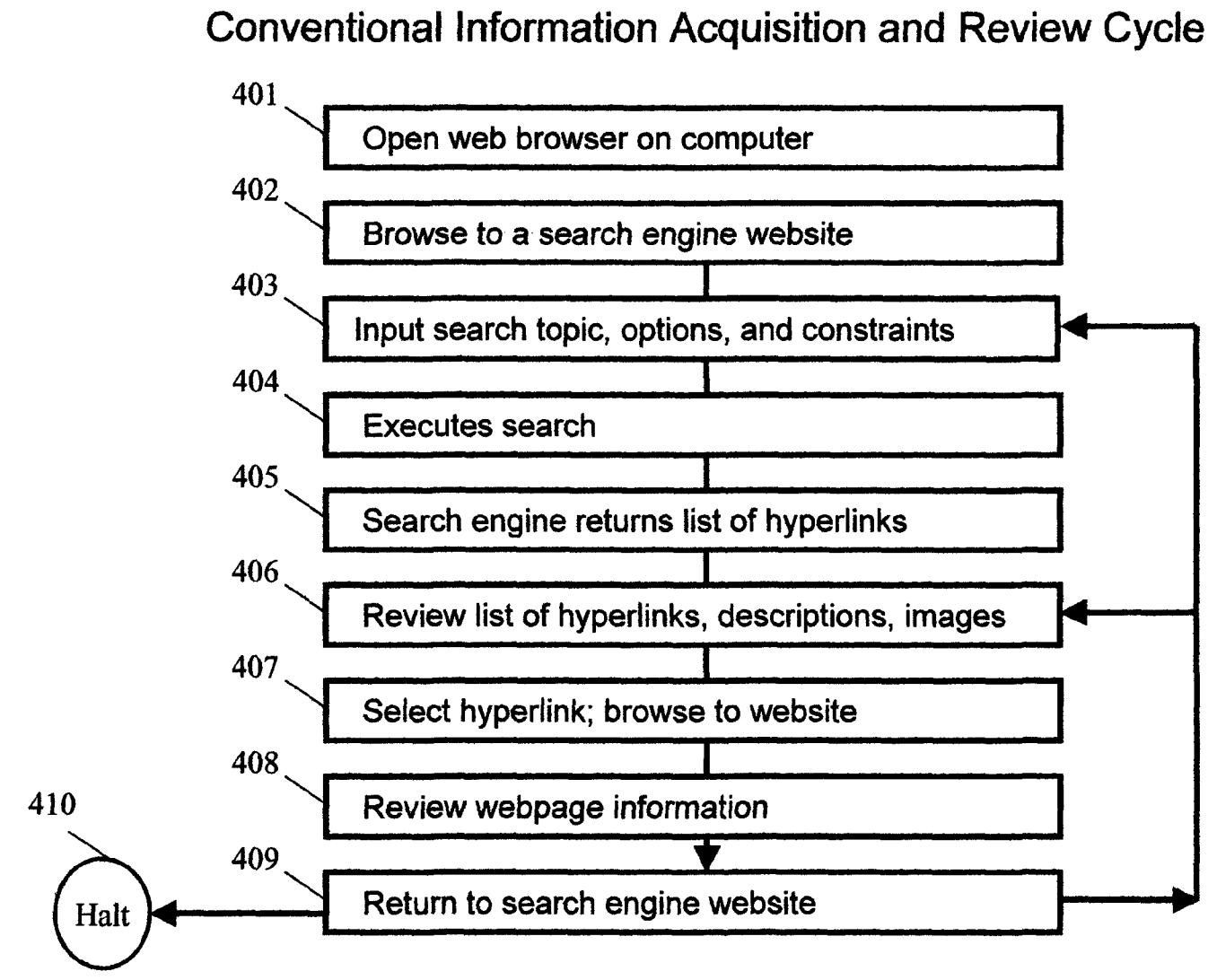
Figure 2

Conventional Image Search Display Paradigm



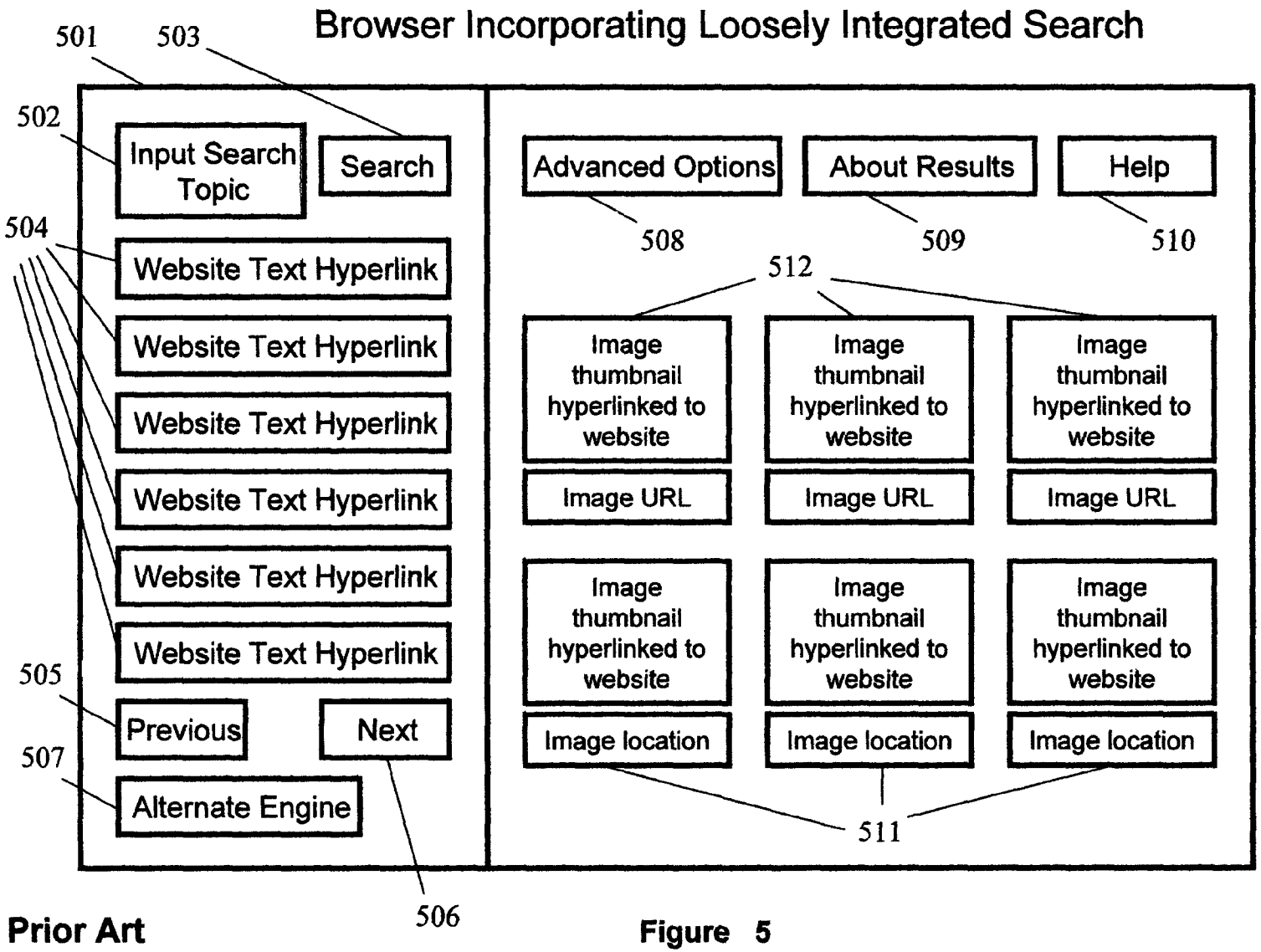
Prior Art

Figure 3



Prior Art

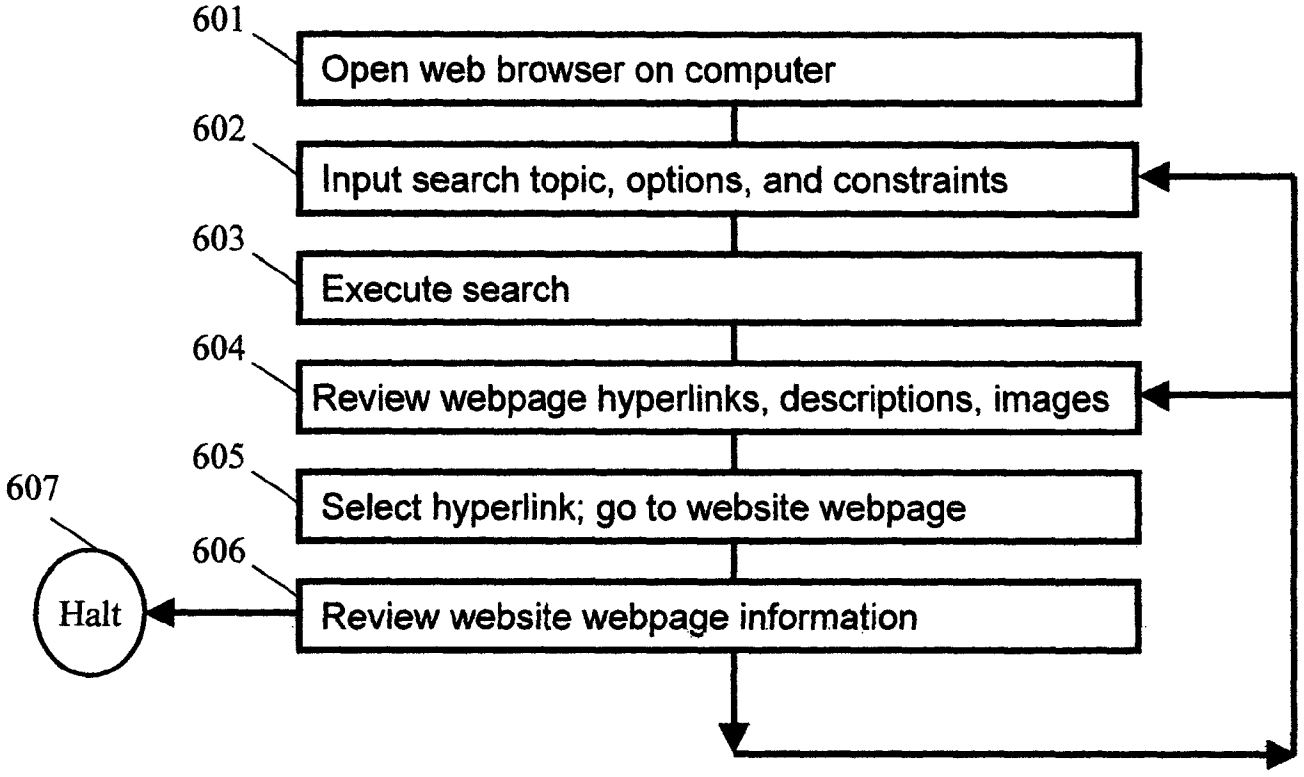
Figure 4



Prior Art

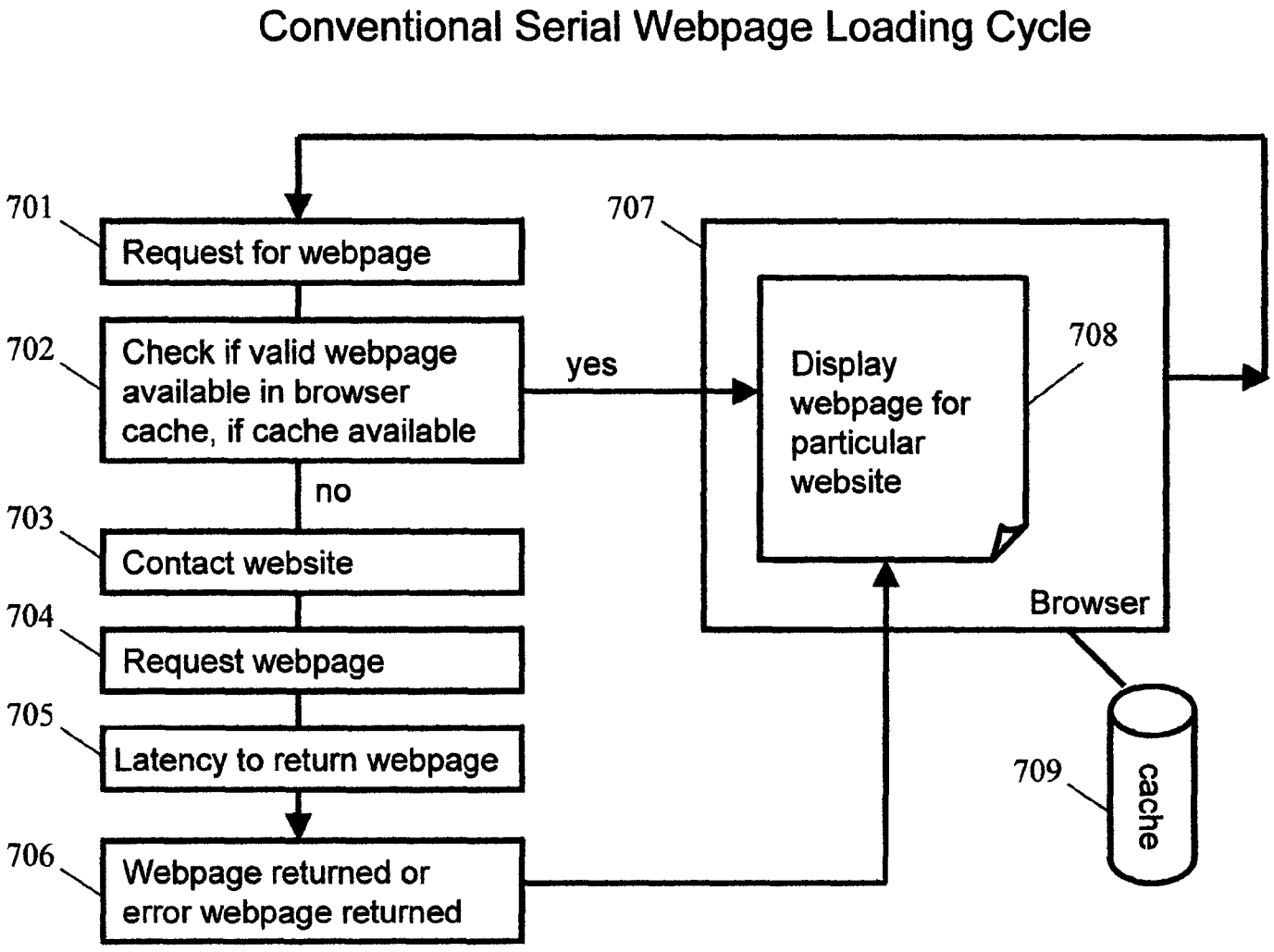
Figure 5

Conventional Information Acquisition and Review Cycle for a Browser Incorporating Loosely Integrated Search



Prior Art

Figure 6



Prior Art

Figure 7

Information Retrieval and Display System ("IRDS")
IRDS Enhanced Browser or Add-on to Conventional Browser

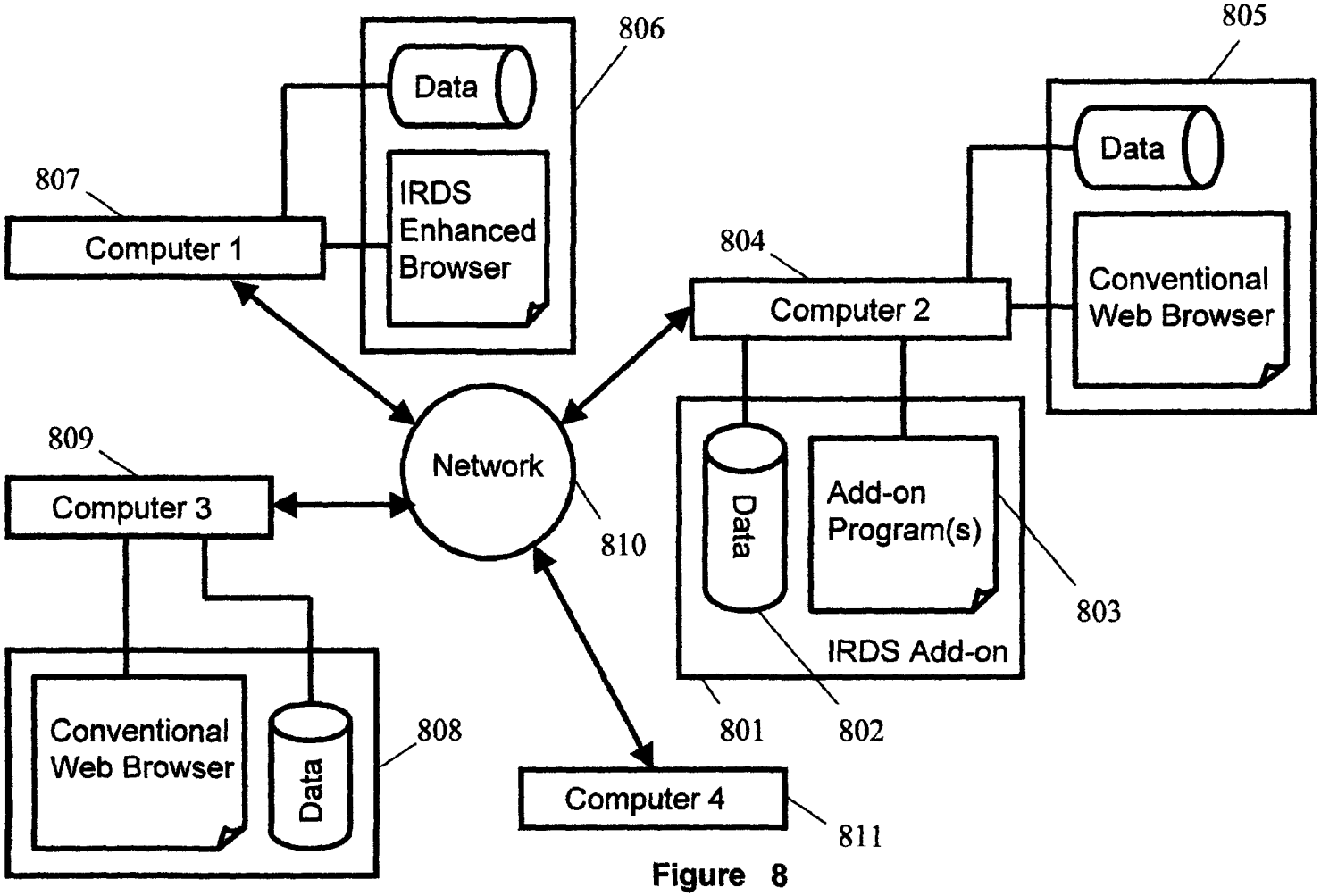


Figure 8

IRDS Enhanced Browser Single Webpage Display

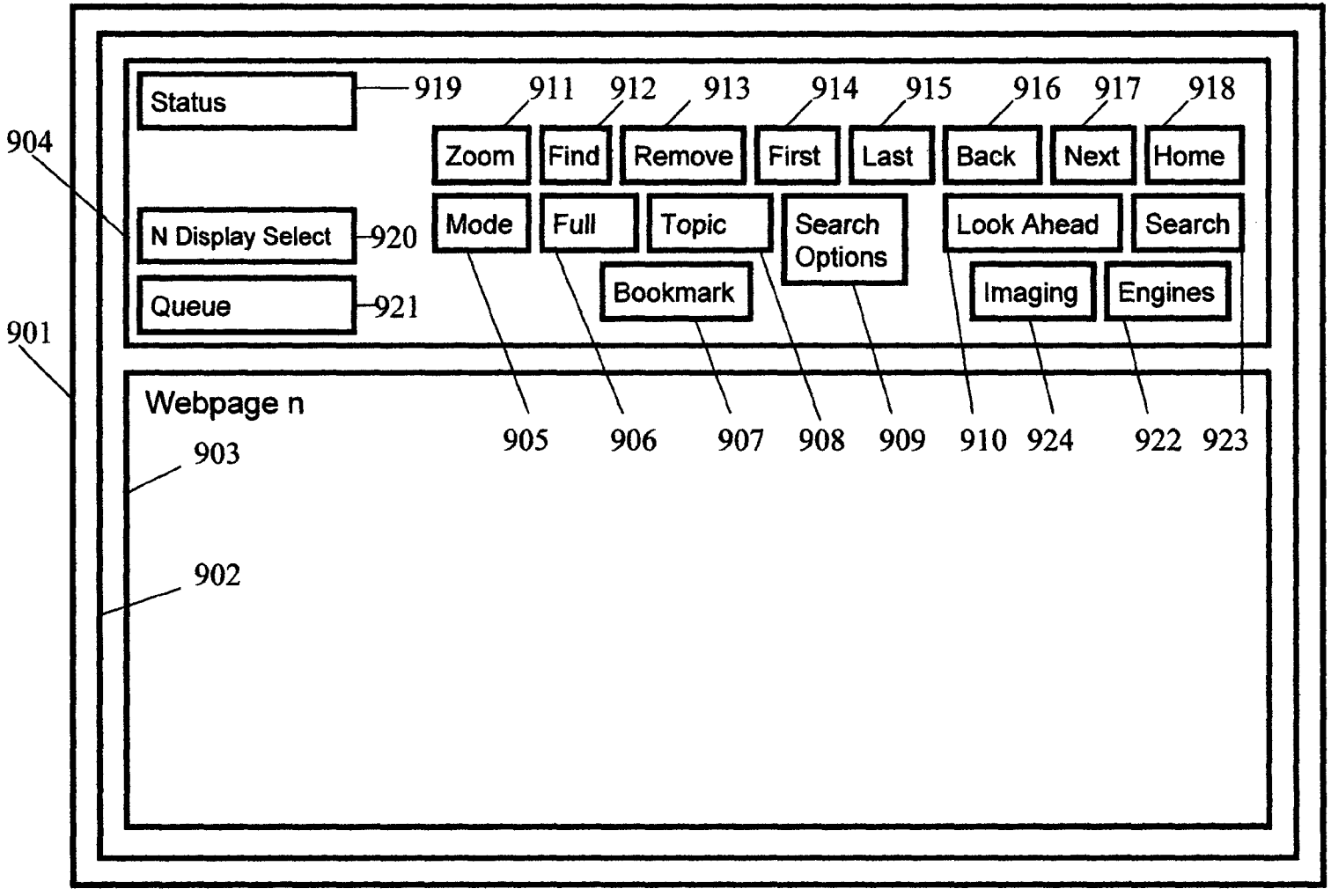


Figure 9

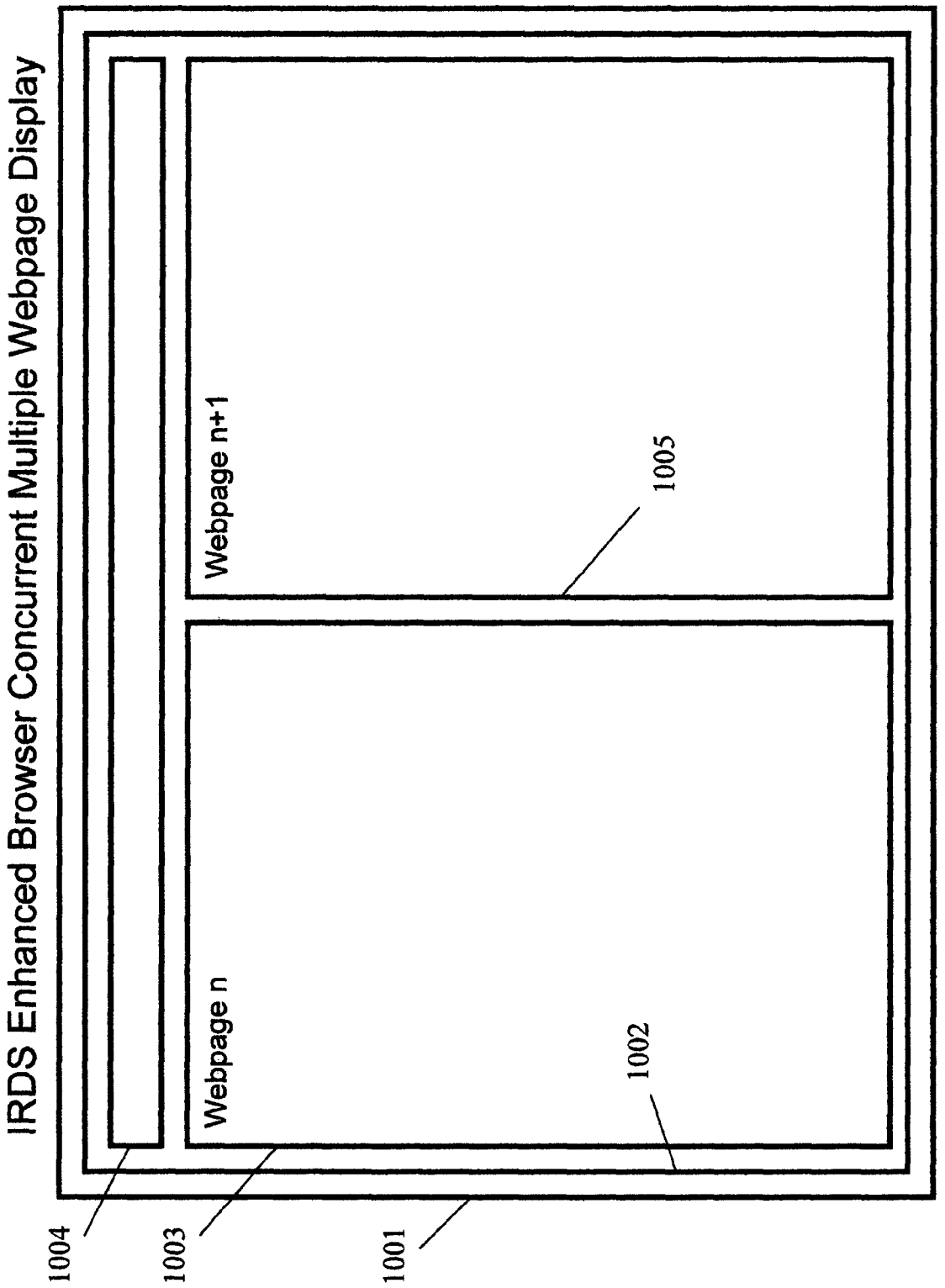

IRDS Enhanced Browser Concurrent Multiple Webpage Display
Webpage n+1
Webpage n
1005
1002
1004
1003
1001

Figure 10

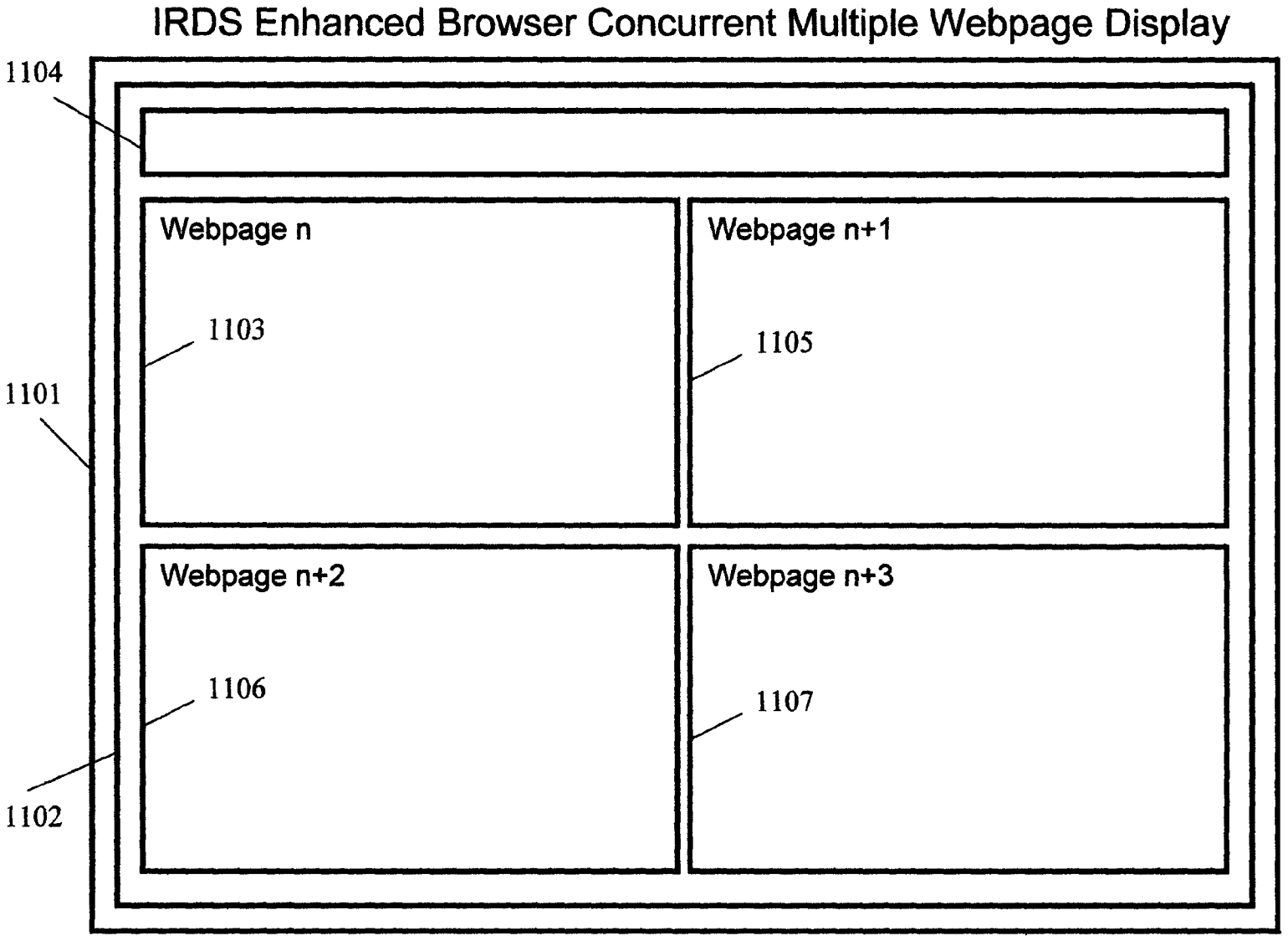

IRDS Enhanced Browser Concurrent Multiple Webpage Display
1104
Webpage n
1103
Webpage n+1
1105
1101
Webpage n+2
1106
Webpage n+3
1107
1102

Figure 11

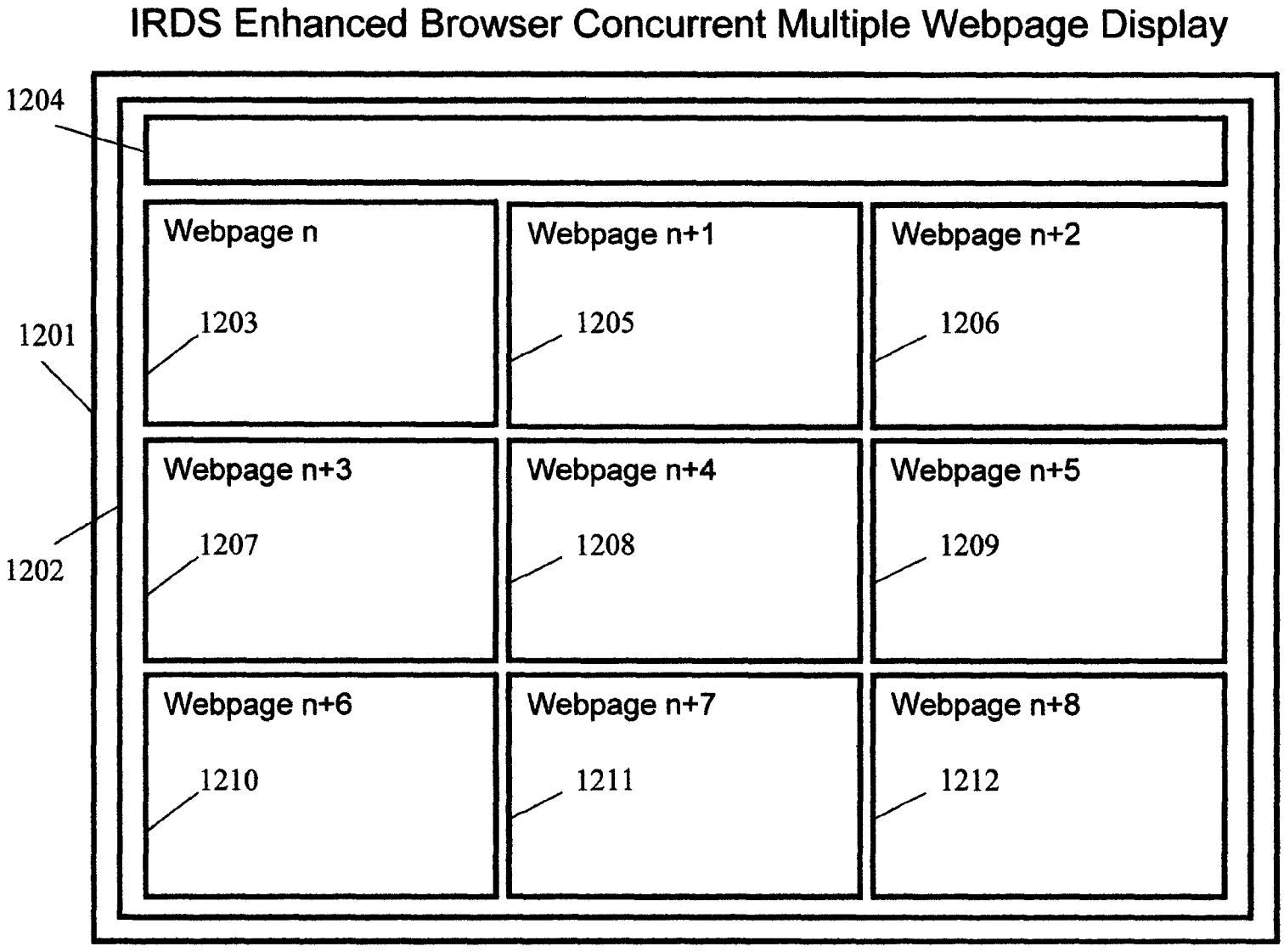

IRDS Enhanced Browser Concurrent Multiple Webpage Display
1204
1201
1202
Webpage n
1203
Webpage n+1
1205
Webpage n+2
1206
Webpage n+3
1207
Webpage n+4
1208
Webpage n+5
1209
Webpage n+6
1210
Webpage n+7
1211
Webpage n+8
1212

Figure 12

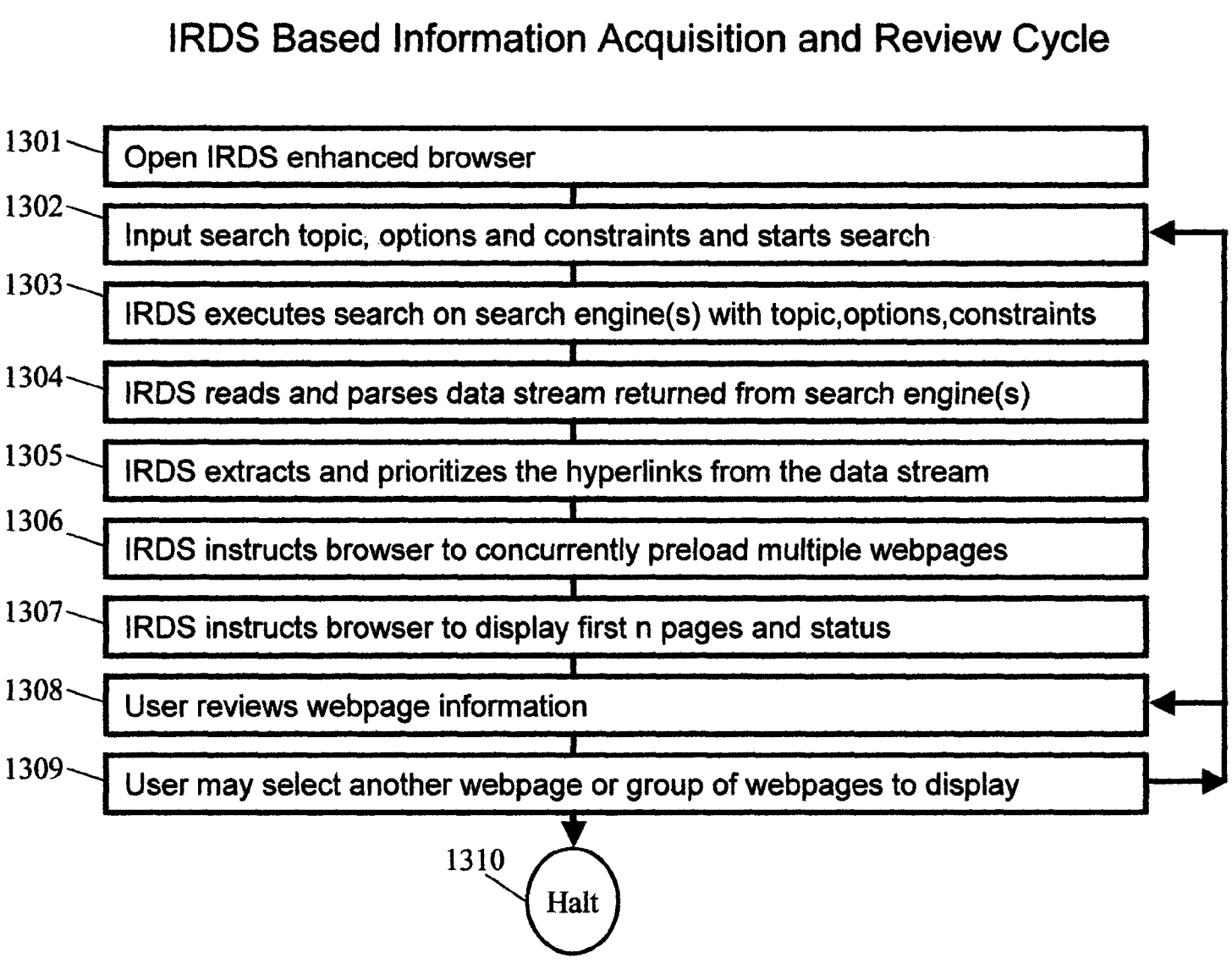

IRDS Based Information Acquisition and Review Cycle
1301
Open IRDS enhanced browser
1302
Input search topic, options and constraints and starts search
1303
IRDS executes search on search engine(s) with topic,options,constraints
1304
IRDS reads and parses data stream returned from search engine(s)
1305
IRDS extracts and prioritizes the hyperlinks from the data stream
1306
IRDS instructs browser to concurrently preload multiple webpages
1307
IRDS instructs browser to display first n pages and status
1308
User reviews webpage information
1309
User may select another webpage or group of webpages to display
1310
Halt

Figure 13

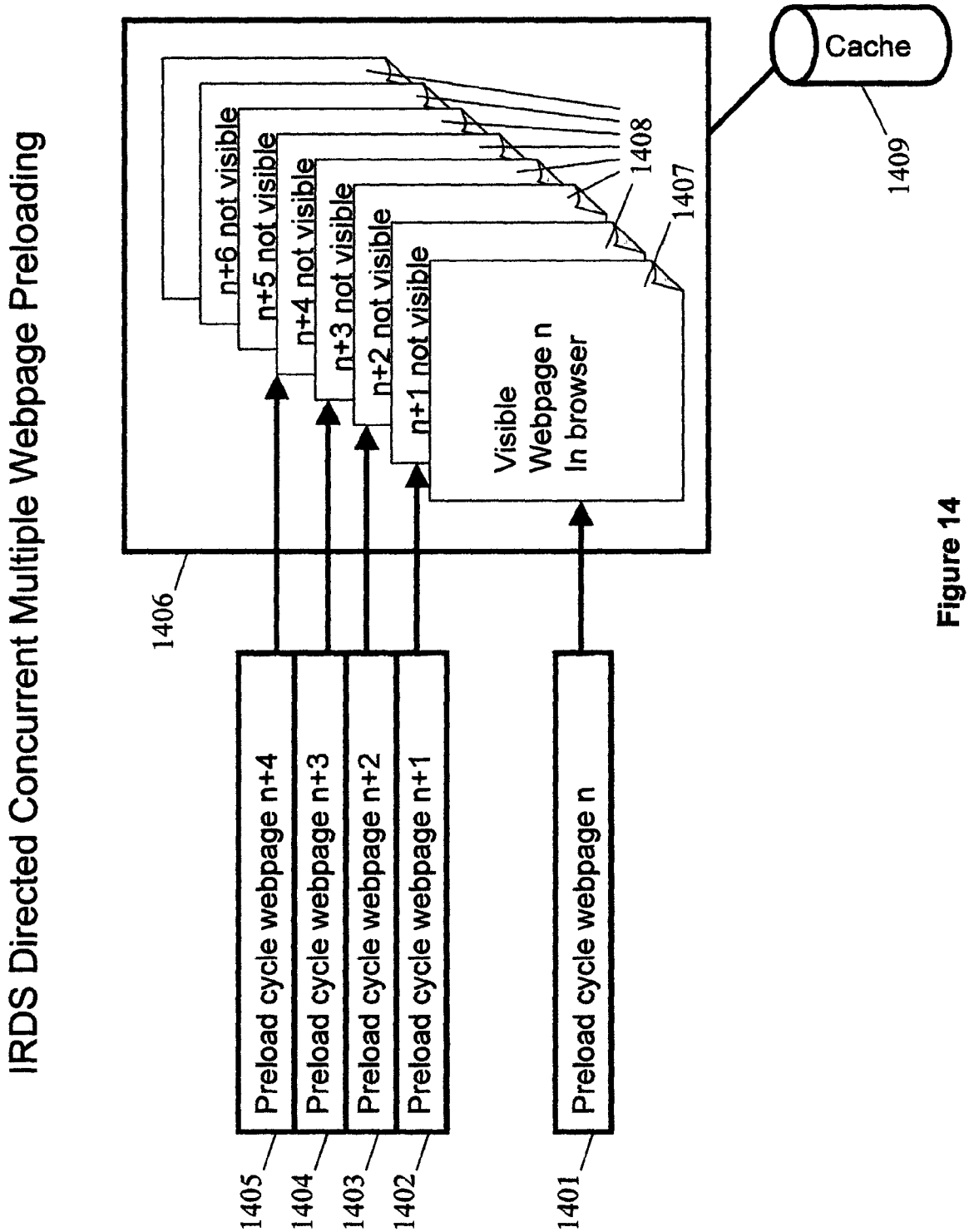

IRDS Directed Concurrent Multiple Webpage Preloading
Cache
1409
1408
1407
n+6 not visible
n+5 not visible
n+4 not visible
n+3 not visible
n+2 not visible
n+1 not visible
Visible
Webpage n
In browser
1406
Preload cycle webpage n+4
Preload cycle webpage n+3
Preload cycle webpage n+2
Preload cycle webpage n+1
Preload cycle webpage n
1405
1404
1403
1402
1401

Figure 14

IRDS Directed Next-In-Queue Webpage Preloading

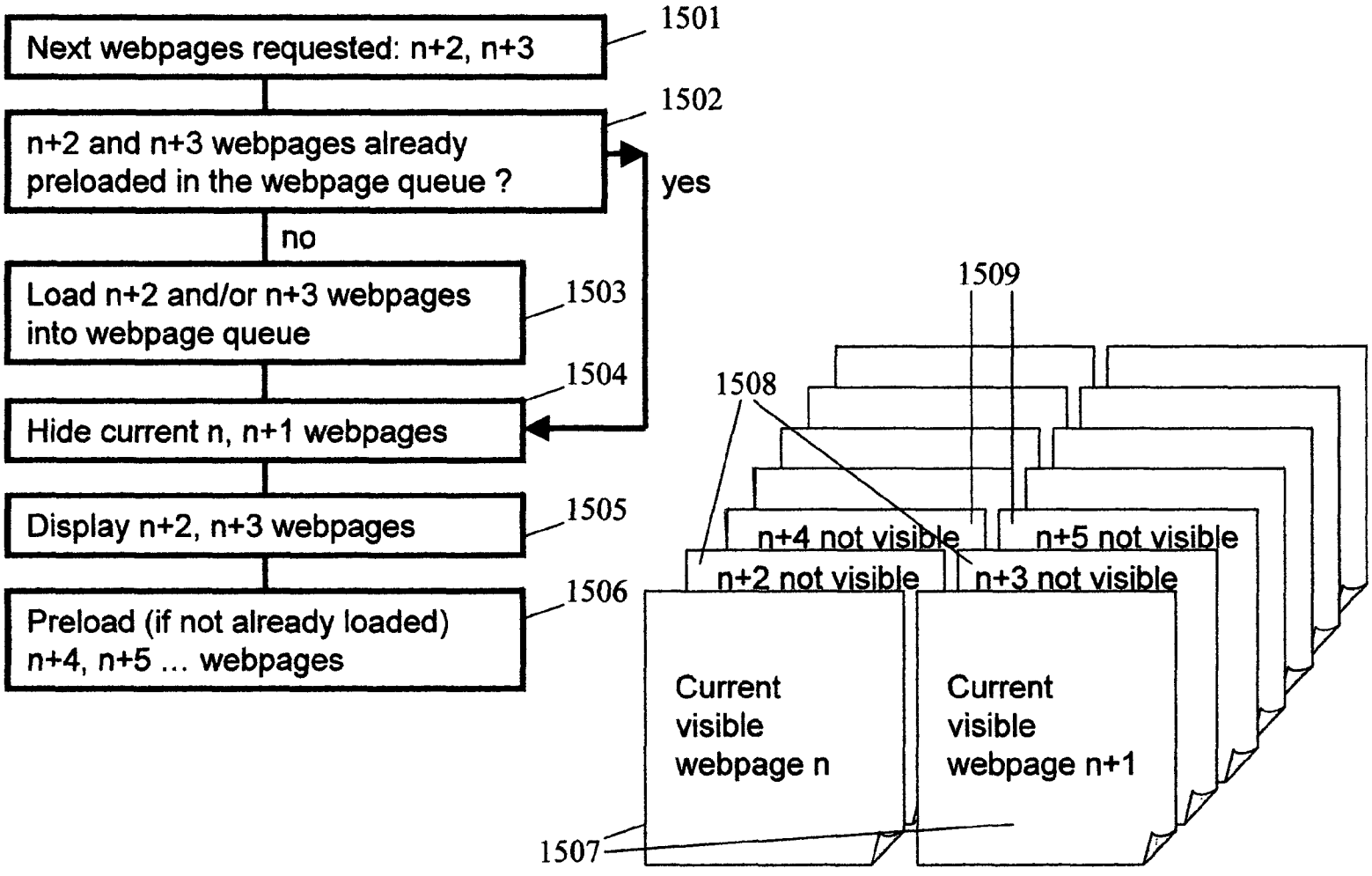


Figure 15

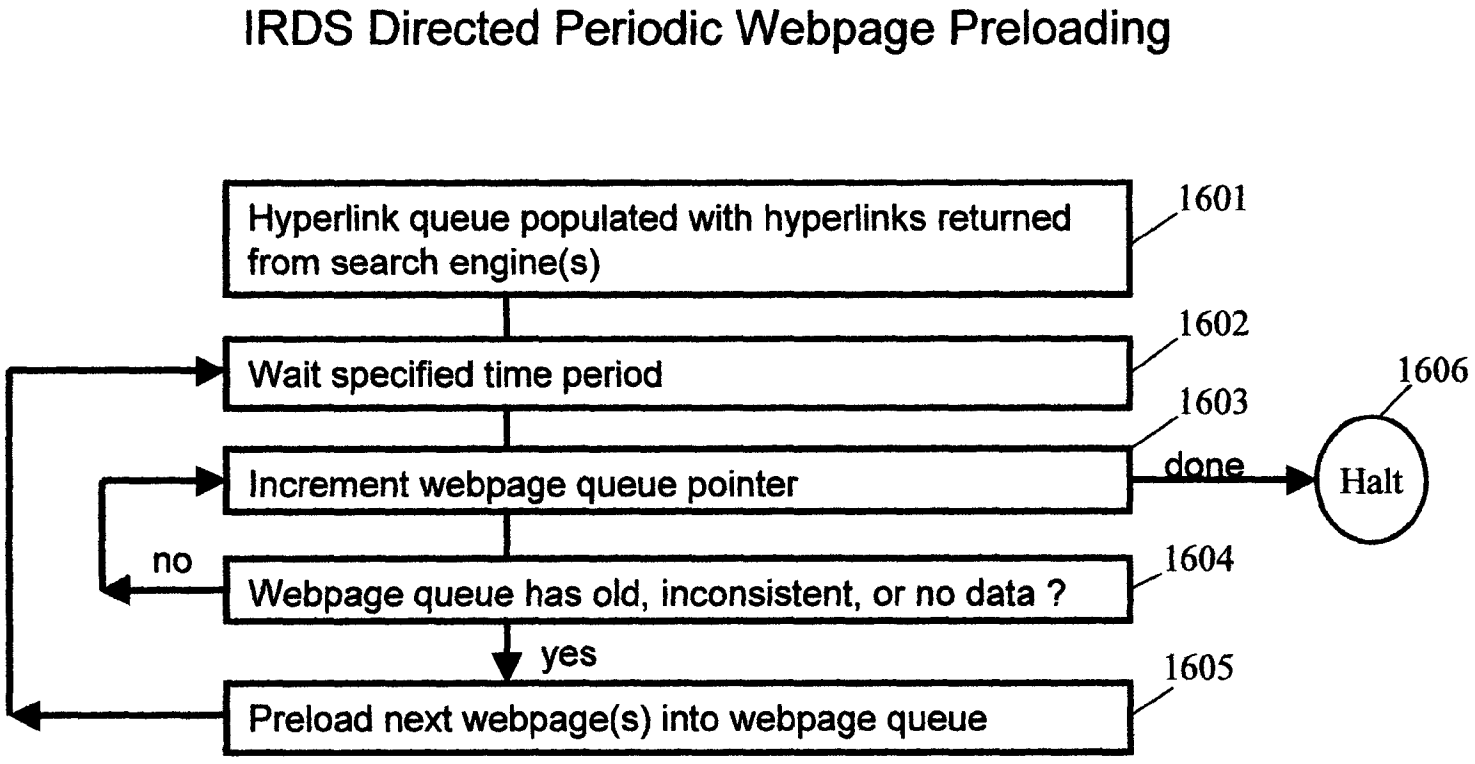

IRDS Directed Periodic Webpage Preloading
Hyperlink queue populated with hyperlinks returned from search engine(s)
1601
Wait specified time period
1602
Increment webpage queue pointer
1603
done
Halt
1606
no
Webpage queue has old, inconsistent, or no data ?
1604
yes
Preload next webpage(s) into webpage queue
1605

Figure 16

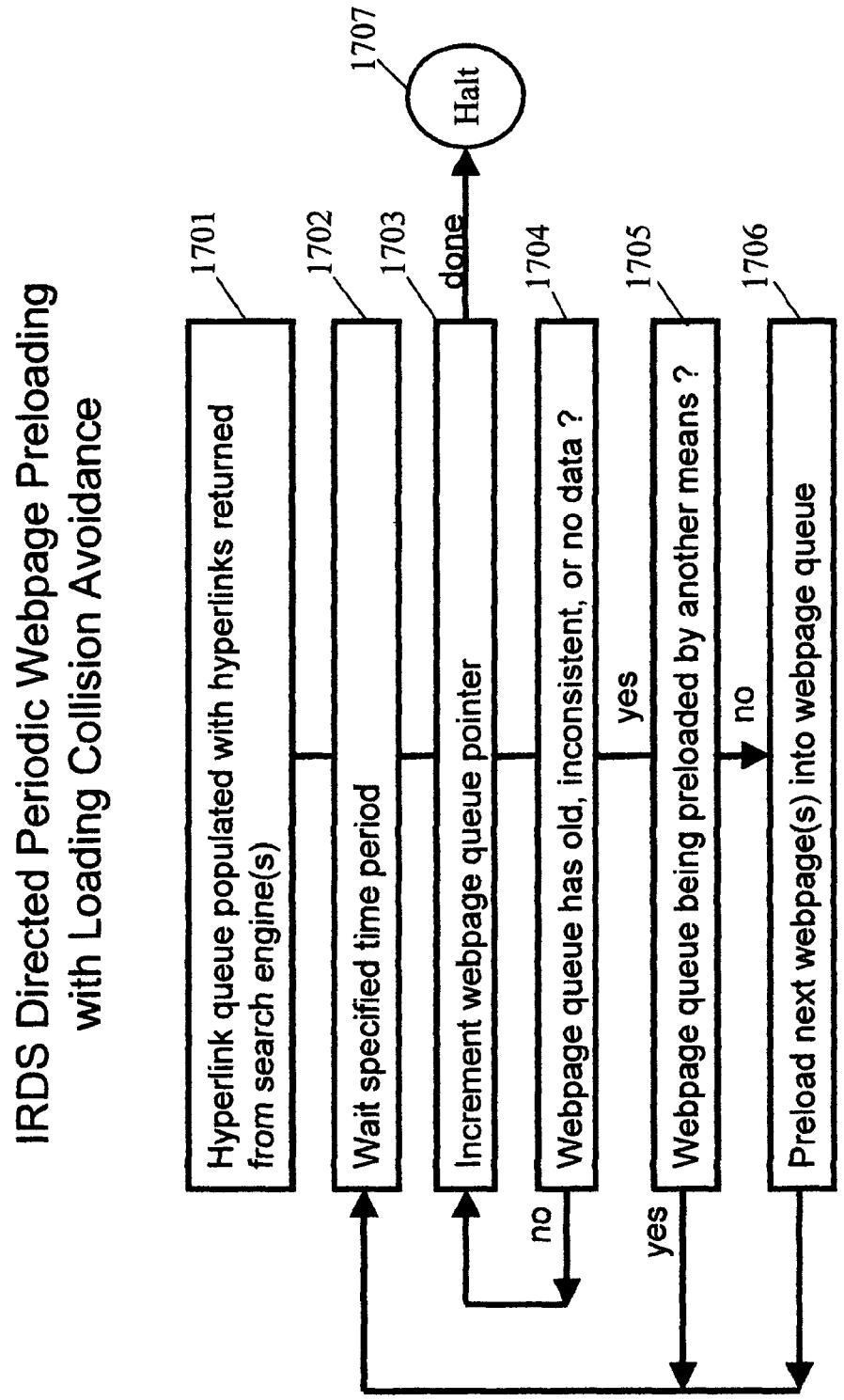

IRDS Directed Periodic Webpage Preloading with Loading Collision Avoidance
1701
Hyperlink queue populated with hyperlinks returned from search engine(s)
1702
Wait specified time period
1703
Increment webpage queue pointer
done
1707
Halt
1704
Webpage queue has old, inconsistent, or no data ?
yes
no
1705
Webpage queue being preloaded by another means ?
no
yes
1706
Preload next webpage(s) into webpage queue

Figure 17

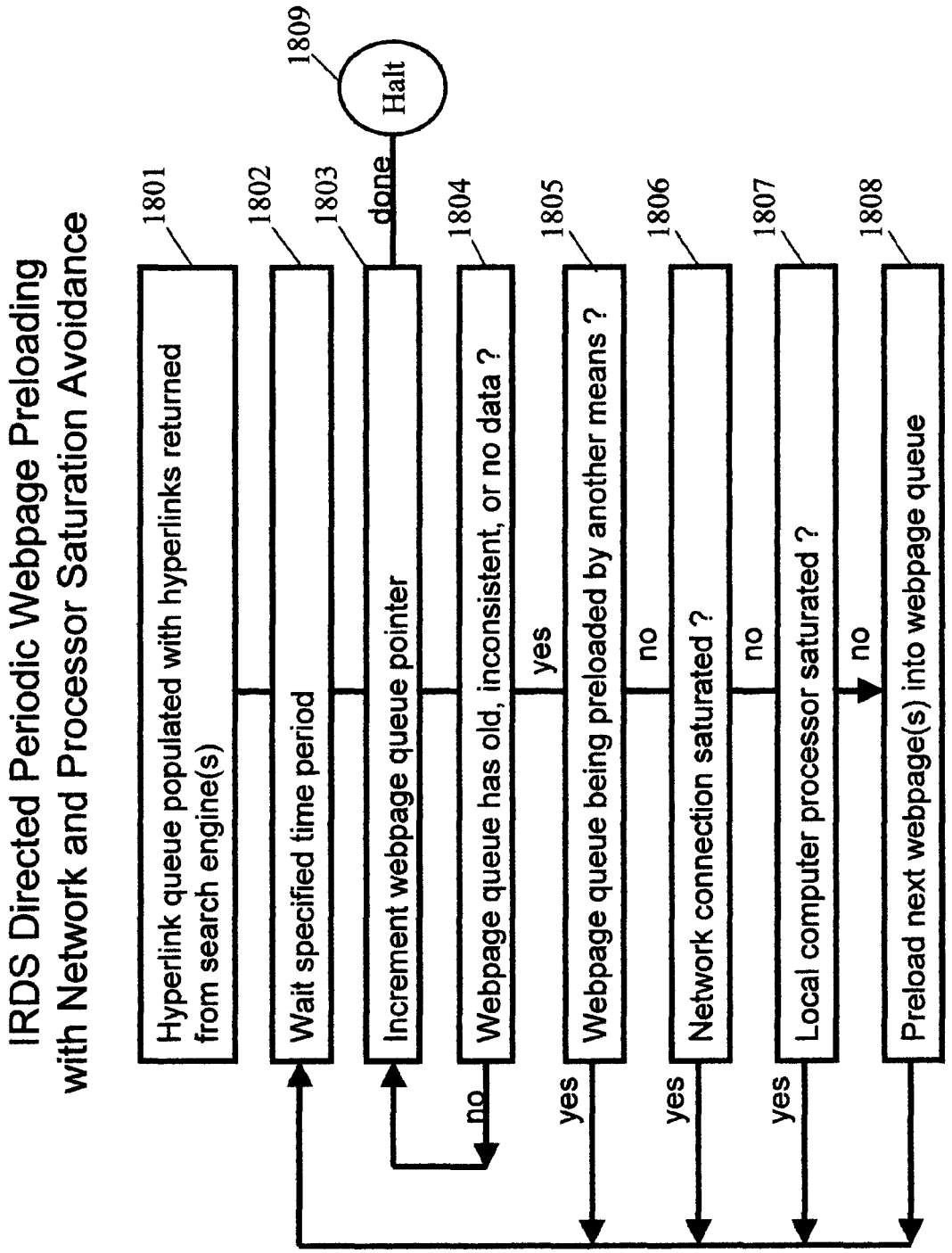

IRDS Directed Periodic Webpage Preloading
with Network and Processor Saturation Avoidance
1801
Hyperlink queue populated with hyperlinks returned from search engine(s)
1802
Wait specified time period
1803
Increment webpage queue pointer
done
1809
Halt
1804
Webpage queue has old, inconsistent, or no data ?
no
yes
1805
Webpage queue being preloaded by another means ?
yes
no
1806
Network connection saturated ?
yes
no
1807
Local computer processor saturated ?
yes
no
1808
Preload next webpage(s) into webpage queue

Figure 18

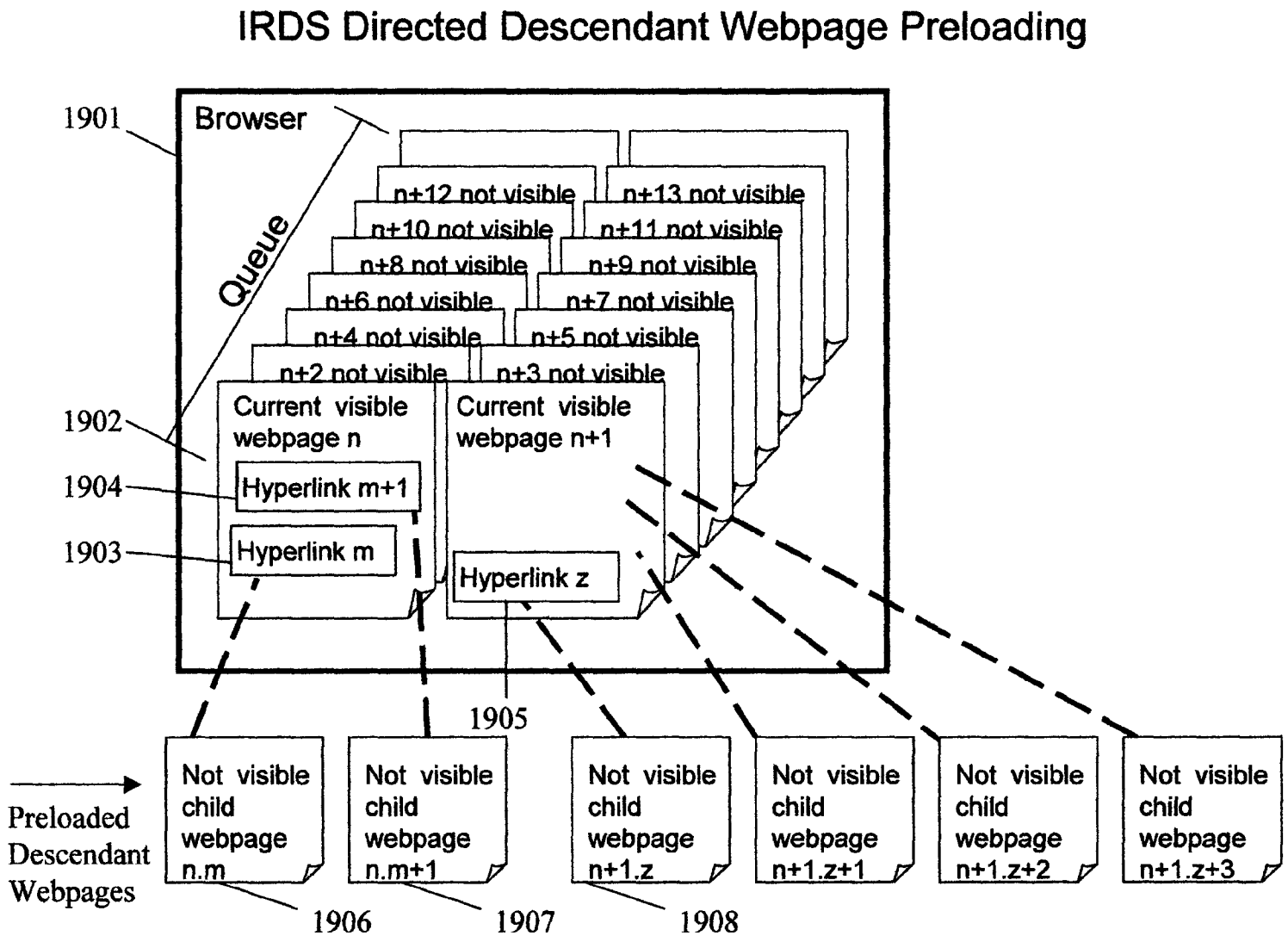

IRDS Directed Descendant Webpage Preloading
1901
Browser
Queue
n+12 not visible
n+13 not visible
n+10 not visible
n+11 not visible
n+8 not visible
n+9 not visible
n+6 not visible
n+7 not visible
n+4 not visible
n+5 not visible
n+2 not visible
n+3 not visible
1902
Current visible webpage n
Current visible webpage n+1
1904
Hyperlink m+1
1903
Hyperlink m
Hyperlink z
1905
Preloaded Descendant Webpages
Not visible child webpage n.m
Not visible child webpage n.m+1
Not visible child webpage n+1.z
Not visible child webpage n+1.z+1
Not visible child webpage n+1.z+2
Not visible child webpage n+1.z+3
1906
1907
1908

Figure 19

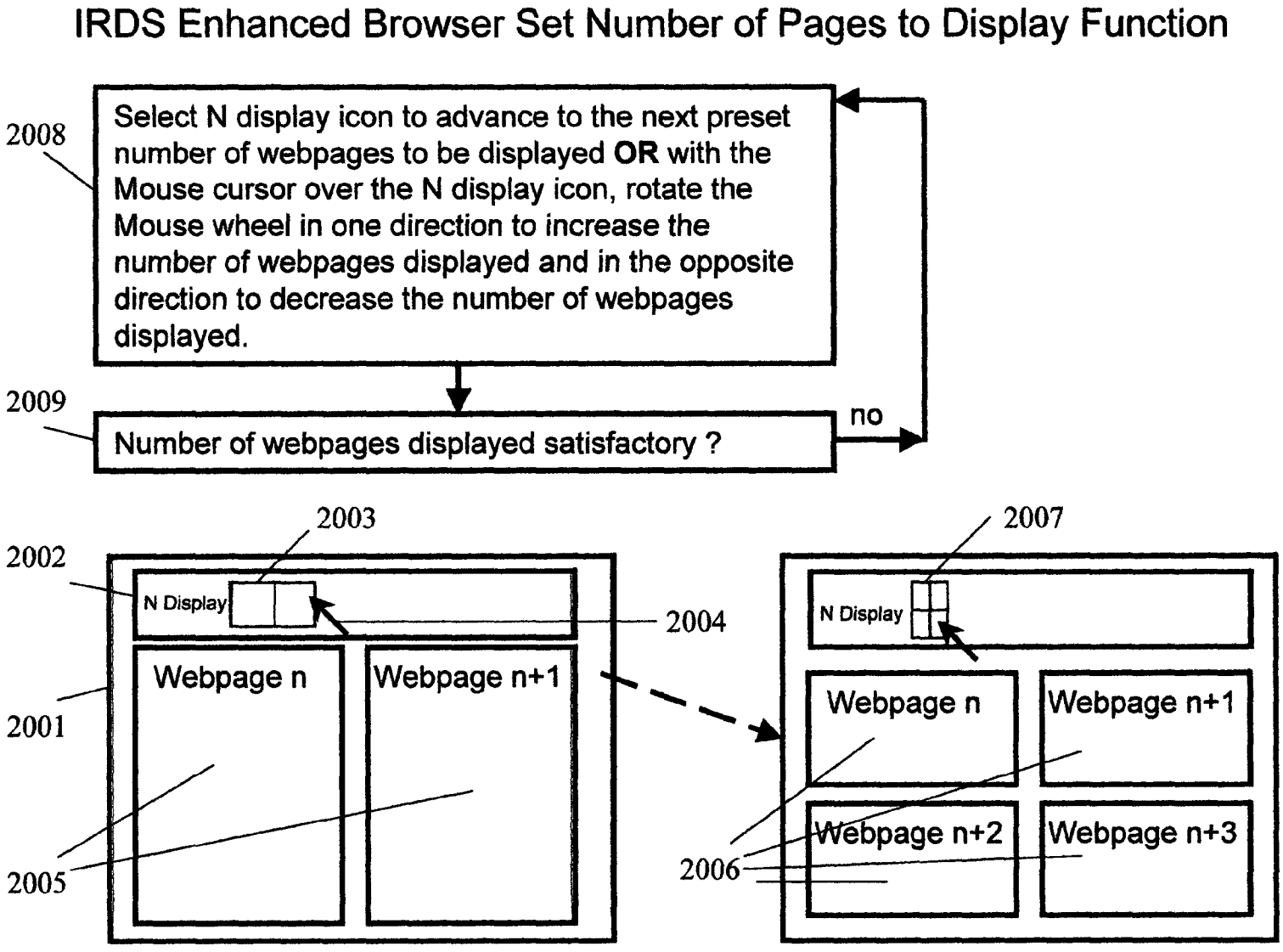

IRDS Enhanced Browser Set Number of Pages to Display Function
2008
Select N display icon to advance to the next preset number of webpages to be displayed OR with the Mouse cursor over the N display icon, rotate the Mouse wheel in one direction to increase the number of webpages displayed and in the opposite direction to decrease the number of webpages displayed.
2009
Number of webpages displayed satisfactory ?
no
2003
2002
N Display
2004
Webpage n
Webpage n+1
2001
2005
2007
N Display
Webpage n
Webpage n+1
Webpage n+2
Webpage n+3
2006

Figure 20

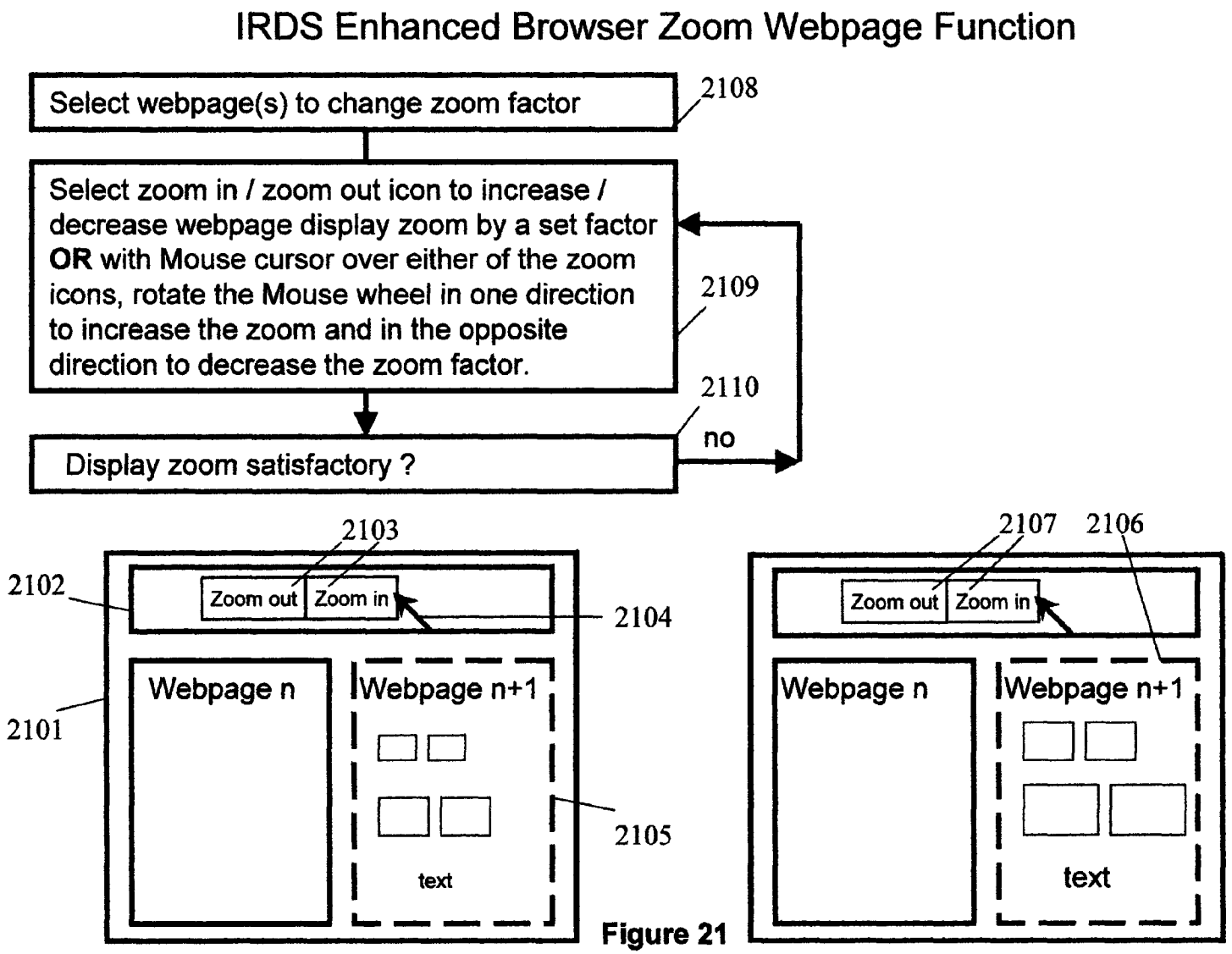

IRDS Enhanced Browser Zoom Webpage Function
Select webpage(s) to change zoom factor
2108
Select zoom in / zoom out icon to increase / decrease webpage display zoom by a set factor OR with Mouse cursor over either of the zoom icons, rotate the Mouse wheel in one direction to increase the zoom and in the opposite direction to decrease the zoom factor.
2109
2110
Display zoom satisfactory ?
no
2103
2102
Zoom out
Zoom in
2104
Webpage n
Webpage n+1
2101
2105
text
2107
2106
Zoom out
Zoom in
Webpage n
Webpage n+1
text

Figure 21

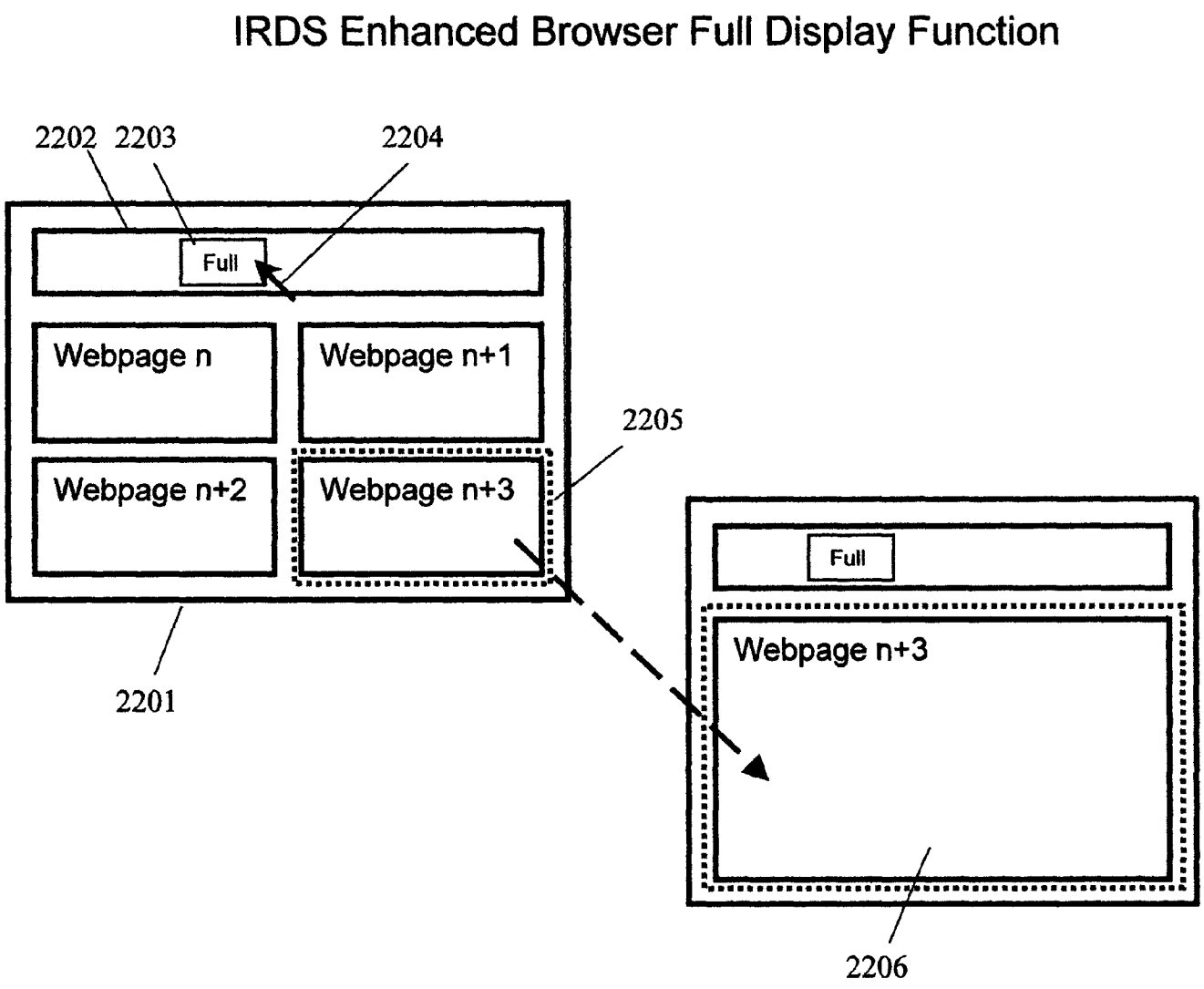

IRDS Enhanced Browser Full Display Function
2202
2203
2204
Full
Webpage n
Webpage n+1
Webpage n+2
Webpage n+3
2205
2201
Full
Webpage n+3
2206

Figure 22

IRDS Enhanced Browser to Conventional Browser Mode Function

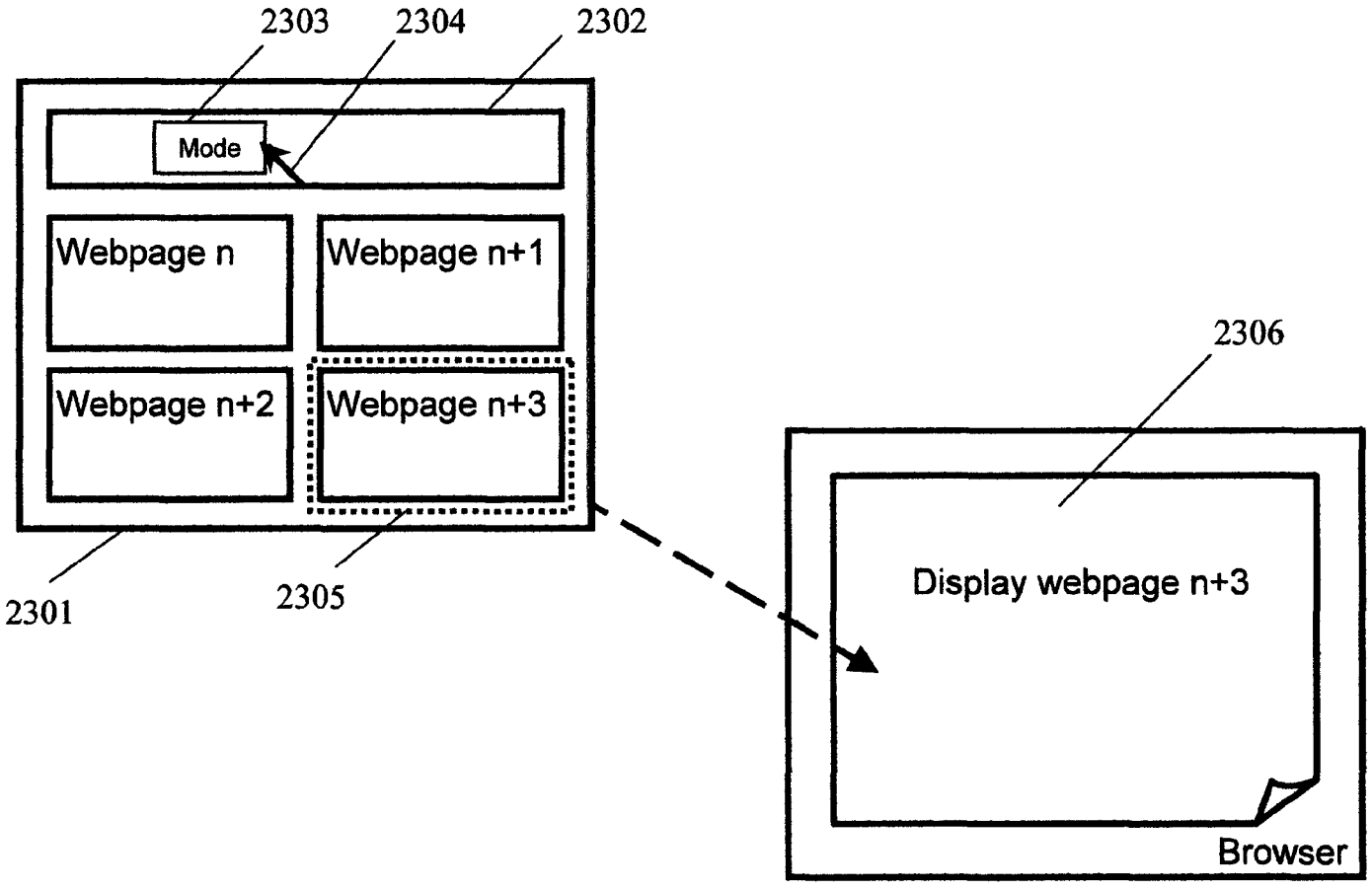


Figure 23

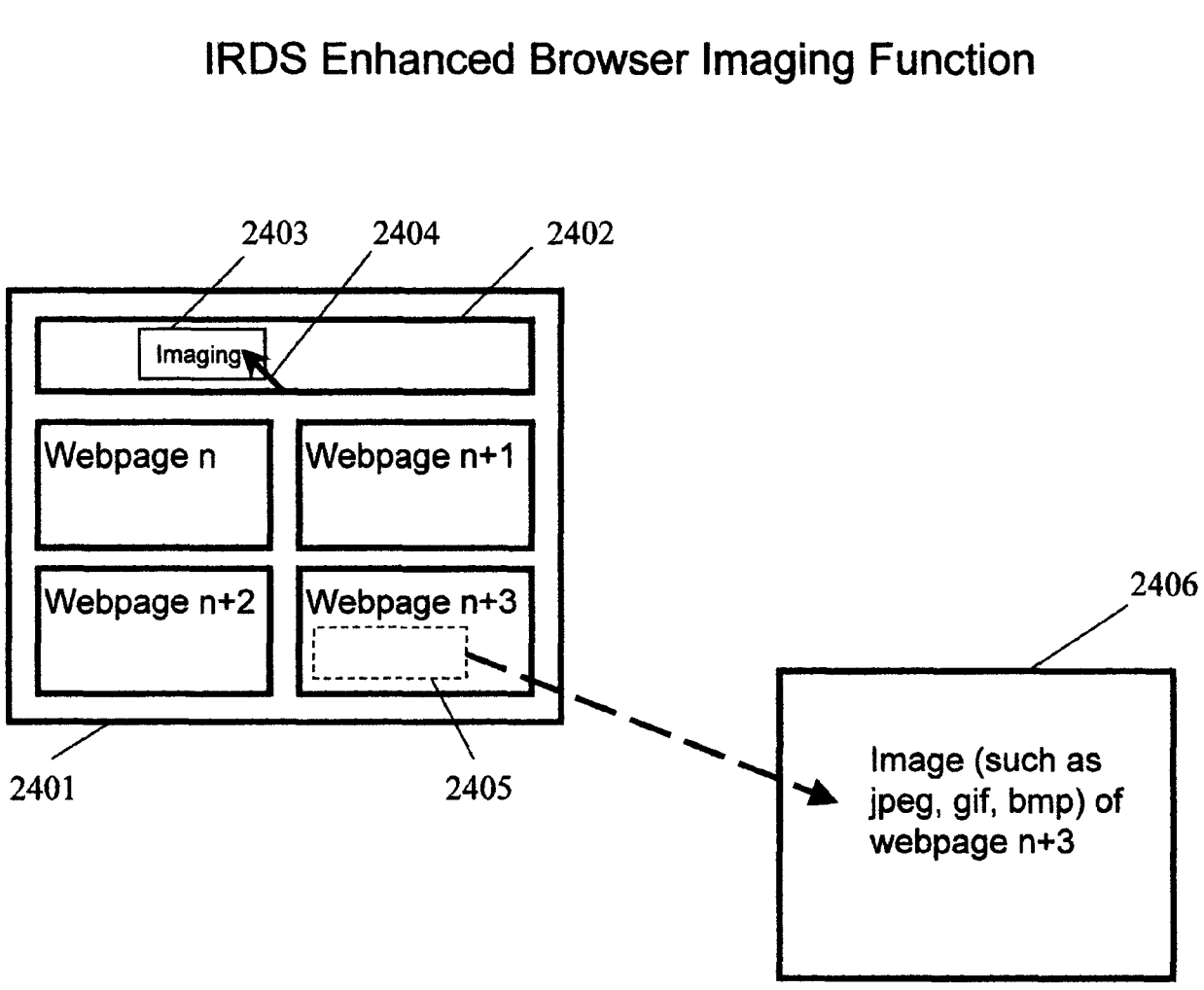

IRDS Enhanced Browser Imaging Function
2403
2404
2402
Imaging
Webpage n
Webpage n+1
Webpage n+2
Webpage n+3
2406
2401
2405
Image (such as jpeg, gif, bmp) of webpage n+3

Figure 24

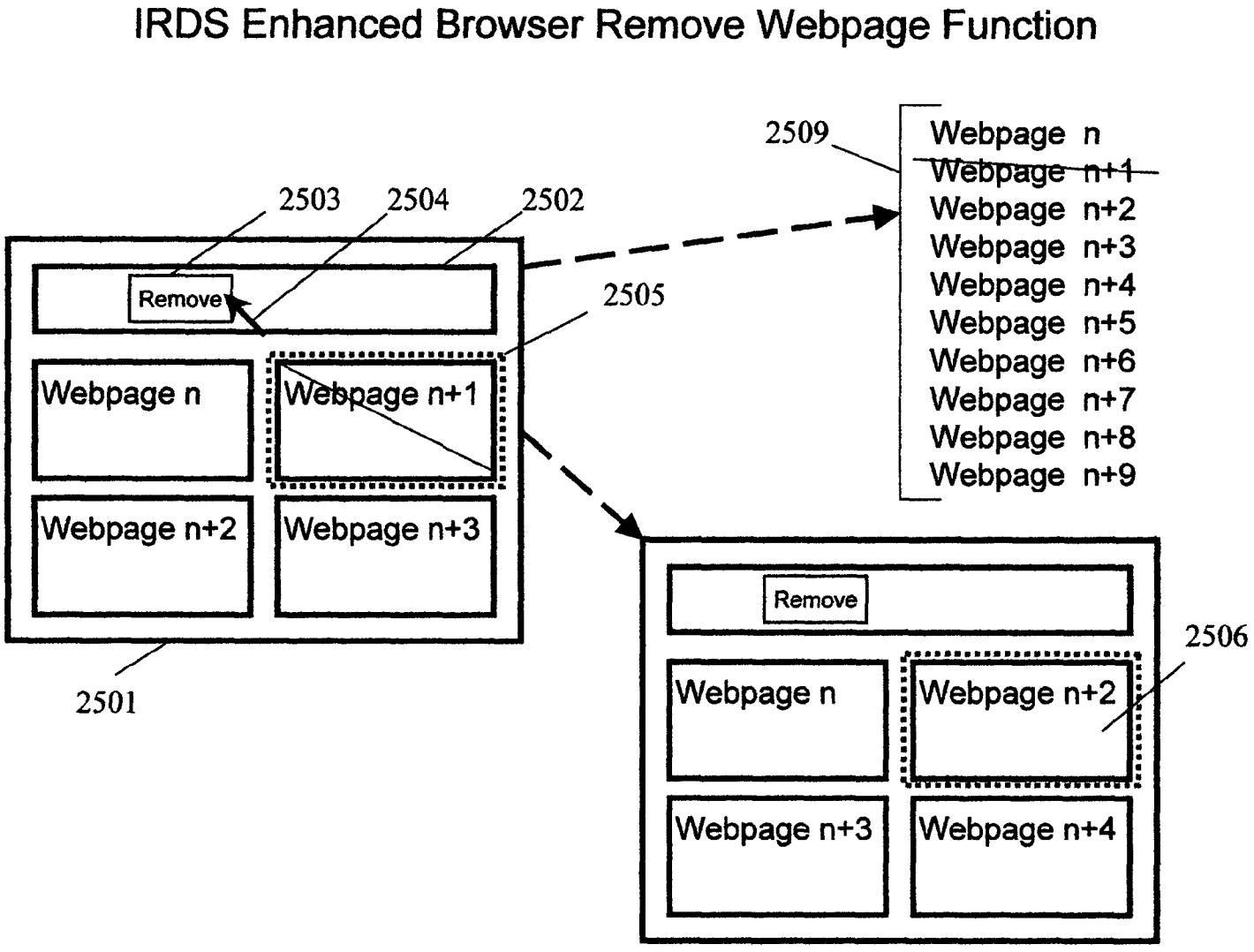

IRDS Enhanced Browser Remove Webpage Function
2509
Webpage n
Webpage n+1
Webpage n+2
Webpage n+3
Webpage n+4
Webpage n+5
Webpage n+6
Webpage n+7
Webpage n+8
Webpage n+9
2503
2504
2502
2505
Remove
Webpage n
Webpage n+1
Webpage n+2
Webpage n+3
2501
Remove
2506
Webpage n
Webpage n+2
Webpage n+3
Webpage n+4

Figure 25

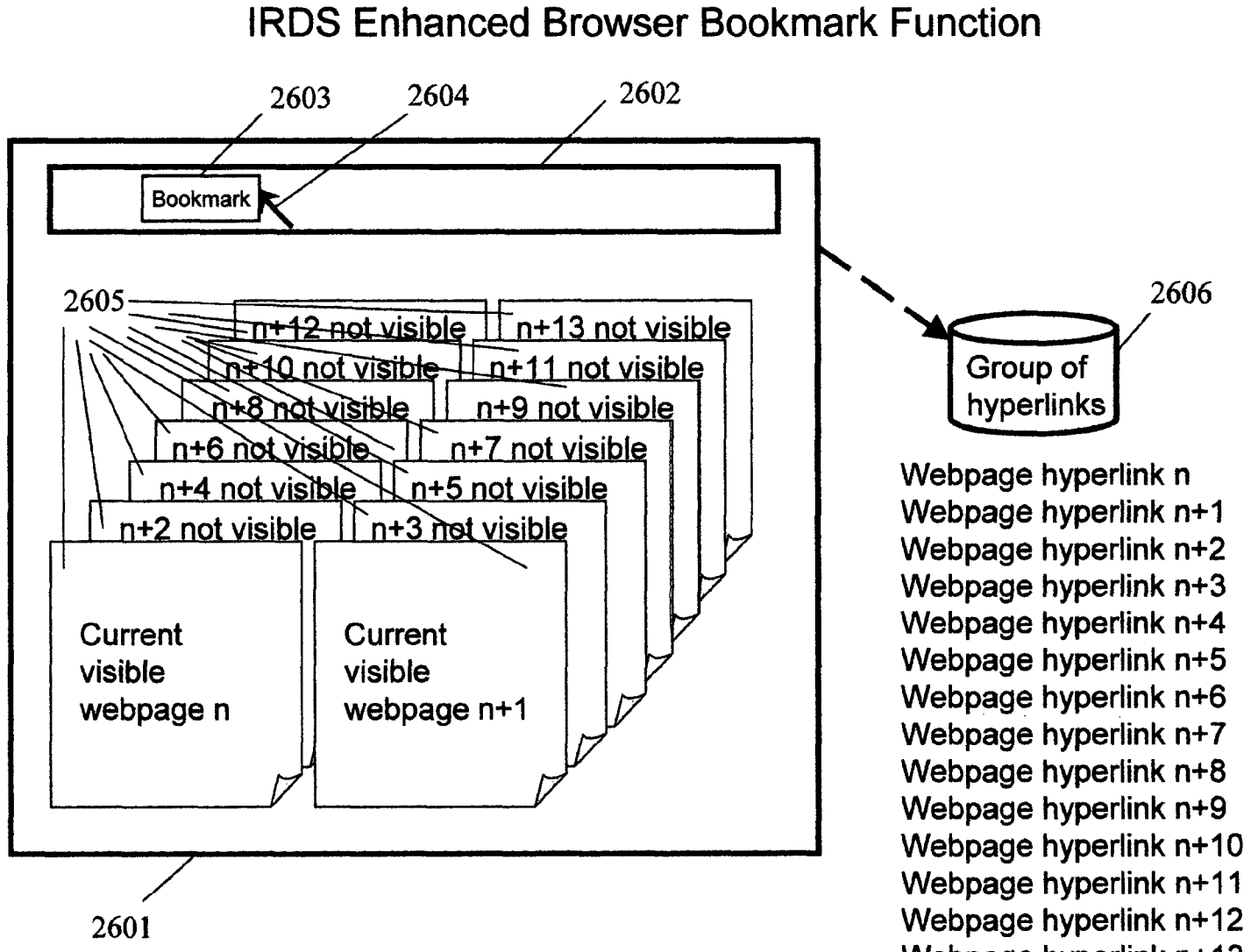

IRDS Enhanced Browser Bookmark Function
2603
2604
2602
Bookmark
2605
n+12 not visible
n+13 not visible
n+10 not visible
n+11 not visible
n+8 not visible
n+9 not visible
n+6 not visible
n+7 not visible
n+4 not visible
n+5 not visible
n+2 not visible
n+3 not visible
Current visible webpage n
Current visible webpage n+1
2601
2606
Group of hyperlinks
Webpage hyperlink n
Webpage hyperlink n+1
Webpage hyperlink n+2
Webpage hyperlink n+3
Webpage hyperlink n+4
Webpage hyperlink n+5
Webpage hyperlink n+6
Webpage hyperlink n+7
Webpage hyperlink n+8
Webpage hyperlink n+9
Webpage hyperlink n+10
Webpage hyperlink n+11
Webpage hyperlink n+12
Webpage hyperlink n+13

Figure 26

Populating Alternate Set or Queue for Selected Webpages

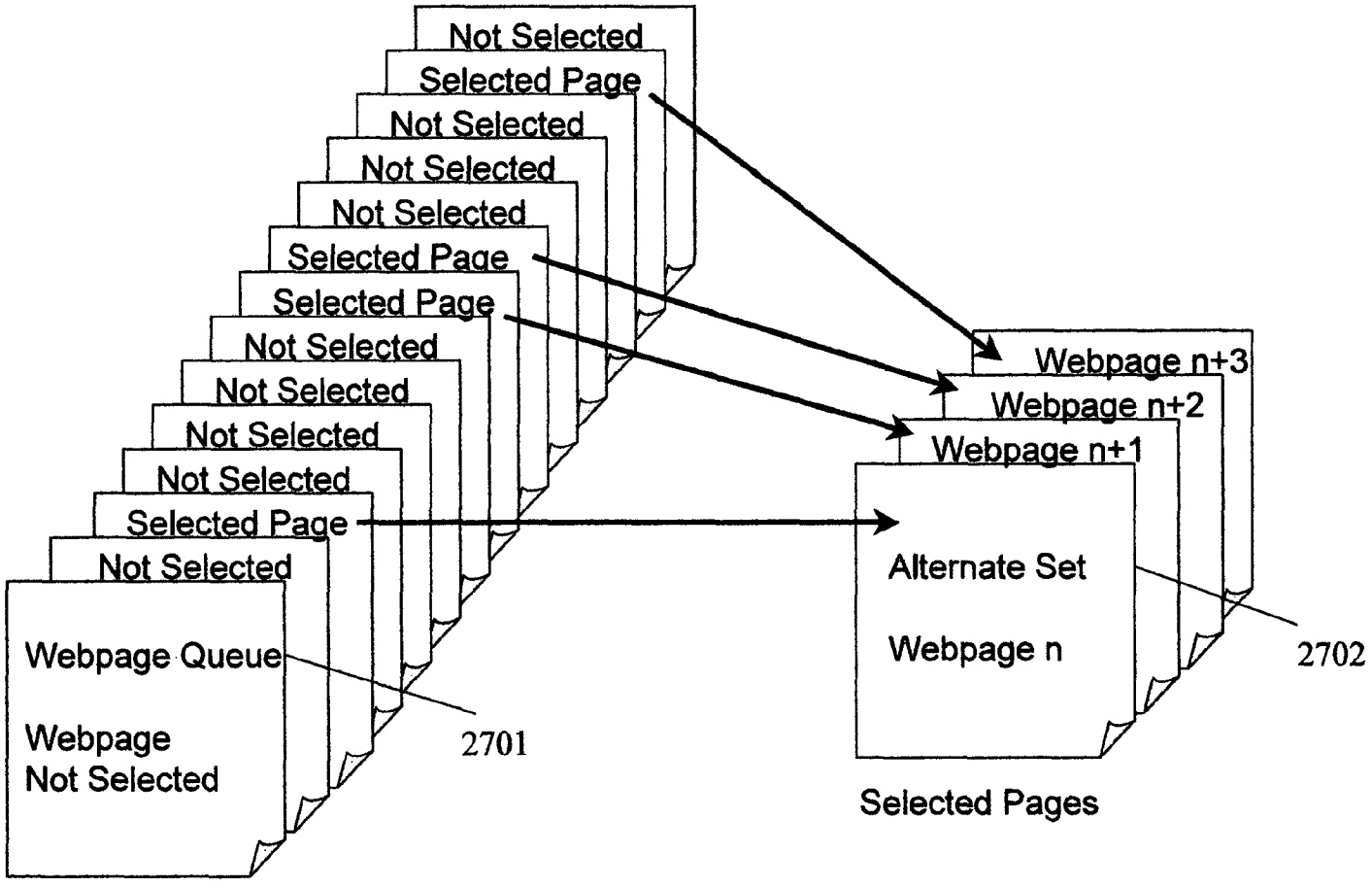


Figure 27

MULTI-WINDOW INTERNET SEARCH WITH WEBPAGE PRELOAD

CROSS REFERENCE TO RELATED APPLICATIONS AND DISCLOSURES

This application claims the benefit of U.S. Provisional Application, Application No. 60/409,456, filed on Sep. 10, 2002, and entitled "Information retrieval and display system", commonly assigned with the present invention and incorporated herein by reference.

FIELD OF THE INVENTION

This invention, hereinafter referred to as "IRDS" relates to
(i) Information Retrieval and Display Systems in a networked communications environment;
(ii) the operation of web browsers; and
(iii) the operation of search engines.

The networked communications environment ("Network") may include Wide Area Networks (WANs), Metropolitan Area Networks (MANs), Local Area Networks (LANs), wired and wireless systems that permit multiple computers to communicate utilizing a set of protocols, such as Transmission Control Protocol/Internet Protocol (TCP/IP) and Hypertext Transfer Protocol (HTTP), in an Internet, Intranet, or Extranet environment.

BACKGROUND

Web browsers include but are not limited to Internet Explorer, Netscape Navigator, Mozilla, Opera, Konqueror, and Galeon. Web browsers are the standard for viewing website information. Web browsers have differentiated themselves by computer operating system support (such as Apple, Microsoft Windows, and Unix), webpage download speed, computer memory usage, and compliance to standards. Most web browsers are also capable of uploading and downloading files, but this competes with well-established file transfer protocol (FTP) programs in this particular arena. Some web browsers have the capability to call other programs depending on context, such as opening a media player to play a music file, after downloading the music file from a Network. Called programs may permanently reside on a local computer's physical media, but may sometimes be (i) loaded across a Network and executed locally or (ii) executed on a different computer.

Some web browsers have a loosely integrated search capability, such as Microsoft's Internet Explorer. The user may enter the search topic and constraints into the web browser display and subsequently execute a search. The web browser calls a search engine across a Network to execute a search on a different computer and displays the resulting hyperlinks to webpages in a prioritized order on the local computer. A list of text hyperlinks, that may have an associated description in the vicinity of the hyperlink, is usually displayed in one panel of the web browser. A second panel sometimes holds static images with hyperlinks that may have
(i) an associated text hyperlink repeated in the vicinity of each image; and/or
(ii) an associated description in the vicinity of each image.

These images, when present, are simple thumbnail images with hyperlinks to an associated webpage. The thumbnail images are very small and tiled in the panel. Their small size makes it difficult to obtain much useful information from the picture alone. U.S. Pat. No. 6,271,840 B1 dated Aug. 7, 2001 to inventors James Lee Finseth and Jerry Hermel and Bryan F. Pelz entitled "Graphical Search Engine Visual Index" describes a visual index method that provides graphical output from search engine results or other URL lists. The graphical information and other media information is rendered into a reduced graphical form for review by a user. The reduced graphical form is sometimes useful for discerning graphical and/or textual information when not much detail is required, but it is difficult to use a reduced graphical form when detailed graphical and/or textual information is required, similar to the thumbnail images described in the foregoing.

Web browsers that don't have a loosely integrated search function, rely on search engine websites to provide the user interface to perform a search. Search engine websites generally display their results in one main viewing area of a web browser, and optionally display a list of
(i) text hyperlinks; or
(ii) static images with hyperlinks that may have the associated text hyperlink repeated in the vicinity of each image and an associated description in the vicinity of each image.

Again, these images, when present, are simple thumbnail images with hyperlinks to an associated website. As this method is web browser independent and has been available for many years, it is the most widely used search technique.

Web browsers have the ability to display a webpage that contains information from multiple sources on a Network. A webpage points to such information through hyperlinks, designated Uniform Resource Identifiers (URIs) or informally as Uniform Resource Locators (URLs). URIs are short strings that identify resources on a Network, including but not limited to documents, images, services, downloadable files, webpages, and electronic mailboxes. When loading a webpage, a web browser uses the URIs to locate, load and display information residing on a Network. In some cases, the web browser may take additional actions, such as asking for a username/password or loading another program(s) to interpret the information.

The information from these multiple Network sources can be divided up into independent web browser viewing areas, called Frames. Frames are usually used to manage complexity and information from a particular website. A common use for Frames is to divide the web browser viewing area into categories of information, such as keeping the menu system in one area, advertisements in a second area, and main website content in a third area. Not all websites use Frames and not all web browsers support Frames. It is possible to subjugate multiple websites and their respective webpages within a website's webpage(s). Such subjugation is usually done when the information is closely related between such websites and/or a relationship exists between the website owners.

Even though a website may subjugate another related website's webpages through mechanisms such as Frames discussed in the foregoing, web browsers do not generally display and operate on multiple independent websites at one time. Information related to a particular search topic, may be scattered on multiple independent websites. Web browsers and search engines, do not coalesce pertinent webpages, as opposed to hyperlinks, and simultaneously display multiple webpages. This inability greatly impedes information search, retrieval, and viewing processes given current levels of processor power and Internet connection bandwidth. To display and/or operate on more than one webpage at a time and have the search capabilities that users have become accustomed to would require enhancements to the web browser and tight integration of the web browser and search engine control functions—something that has not been done to date.

Every website has its own latency in responding to a web browser, such that the web browser can download the webpage and render the webpage in the display. Hence the time to review multiple website webpages includes each website's response time, the Network latency at a given time, and the time to select the next hyperlink (collectively "Latency"). Web browsers are currently limited to downloading only one webpage at a time. Even with simultaneous multiple Network connections to such a webpage, the Latency to review multiple webpages or websites is additive and arbitrarily limited by the webpages that, for whatever reason, are slow to retrieve. U.S. Pat. No. 6,067,565 dated May 23, 2000 to inventor Eric Horvitz entitled "Technique For Prefetching A Web Page Of Potential Future Interest In Lieu Of Continuing A Current Information Download" describes prefetching webpages or pre-selected portions thereof, into a local cache of a client computer. This prefetching technique uses a probabilistic user model, which specifies, at any one time, those pages or portions of pages that are likely to be prefetched given, e.g., a webpage currently being rendered to a user; these pages being those which promise to provide the largest benefit (expected utility) to the user. This approach has little utility when used in conjunction with a conventional search engine, where a user gives search criteria to a search engine and such search engine returns a ranked ordered hyperlink list corresponding to webpages based on the user's criteria. The search engine has already calculated the rank order for the hyperlinks before returning said hyperlink list to the user's web browser. It is unnecessary to further apply a probabilistic or statistical user model to said web page containing said hyperlink list, as the hyperlink list is already ranked ordered. A preloading scheme that preloaded the ranked ordered hyperlinks directly into a web browser for later display would have much greater utility to lower the latency to review such webpages and more efficiently use the associated network and computer resources. Similarly, U.S. Pat. No. 6,085,226 dated Jul. 4, 2000 to inventor Eric Horvitz entitled "Method And Apparatus For Utility-Directed Prefetching Of Web Pages Into A Local Cache Using Continual Computation And User Models" describes prefetching webpages or pre-selected portions thereof, into a local cache of a client computer. This prefetching technique uses a probabilistic user model to specify, at any one time, those pages or portions of pages, that are likely to be prefetched given, e.g., a webpage currently being rendered to a user, which promises to provide the largest benefit (expected utility) to the user. Again, this approach has little utility when used in conjunction with a conventional search engine, where a user gives search criteria to a search engine and such search engine returns a ranked ordered hyperlink list corresponding to webpages based on the user's criteria. The search engine has already calculated the rank order for the hyperlinks before returning said hyperlink list to the user's web browser. It is unnecessary to further apply a probabilistic or statistical user model to said web page containing said hyperlink list, as the hyperlink list is already ranked ordered. A preloading scheme that preloaded the ranked ordered hyperlinks directly into a web browser for later display would have much greater utility to lower the latency to review such webpages and more efficiently use the associated network and computer resources. Similarly, U.S. Pat. No. 6,182,133 B1 dated Jan. 30, 2001 to inventor Eric Horvitz entitled "Method And Apparatus For Display Of Information Prefetching And Cache Status Having Variable Visual Indication Based On A Period Of Time Since Prefetching" describes prefetching webpages or portions thereof and subsequently making a visual indication to a user that such pages or portions have been prefetched. This prefetching technique uses a probabilistic or statistical user model to specify, at any one time, those pages that are to be prefetched given information, e.g., a webpage currently being rendered to a user, content and structure of that particular page, a history of webpages visited by the user, user background, and user actions. Again, this approach has little utility when used in conjunction with a conventional search engine, where a user gives search criteria to a search engine and such search engine returns a ranked ordered hyperlink list corresponding to webpages based on the user's criteria. The search engine has already calculated the rank order for the hyperlinks before returning said hyperlink list to the user's web browser. It is unnecessary to further apply a probabilistic or statistical user model to said web page containing said hyperlink list, as the hyperlink list is already ranked ordered. A preloading scheme that preloaded the ranked ordered hyperlinks directly into a web browser for later display would have much greater utility to lower the latency to review such webpages and more efficiently use the associated network and computer resources.

In reviewing webpage information, it is often difficult to copy and paste information accurately into other applications or even print such information. The capability to select any portion of the web browser display and generate an image in a selected format that can be saved to a physical media such as hard drive, floppy drive, compact disk or computer memory—such as the Microsoft Windows clipboard, is not incorporated in web browsers today.

Websites frequently have webpages that include fonts and images that are small and difficult to read. Web browsers don't have a zoom capability to enlarge a viewing area or make it smaller, thereby rendering such information that may be too small or too large useless, if it can't be dynamically enlarged or made smaller respectively.

Web browsers have very limited functionality to enhance the viewing and processing of information, but do usually include the capability to

(i) list and select hyperlinks to webpages associated with the history of the websites previously visited; and

(ii) select and save favorite hyperlinks to website webpages, one at a time. Web browsers don't have the capability to remove or prune one or more hyperlinks from a hyperlink list returned by a search engine(s) or save, for future retrieval, a complete hyperlink list or pruned hyperlink list returned by a search engine(s).

There also isn't a capability to save a hyperlink list or pruned hyperlink list to an alternate list or queue for later review or saving, while possibly continuing on with a new search that may entail different subject matter, options, constraints, or search engine(s).

Common search engines include, but are not limited to Google, Yahoo!, AltaVista, Lycos, Webcrawler, Excite, Northern Light, MSN Search, iWon, HotBot, AlltheWeb, Teoma, DMOZ, DOGPILE, WizeNut, Overture, AOL, Ask Jeeves, Inktomi, LookSmart, and Netscape. Search engines differentiate themselves mainly on content and features. The size of the search engine database is one of the content metrics. Search engines may return lists of hyperlinks that specialize in a content area such as: news, music files, auctions, employment, insurance, loans, yellow pages, white pages, email addresses, sports, shopping, movies, classifieds, health, images, movies, home life, finance, stocks, and travel. Search features may include: language selection, word exclusion, exact phrases to be returned, number of pages to be returned, file format, returning results from a specific website domain, and content blocks. Some search engines are website domain specific such as Dell, GM, and Sears and are accessed from their respective websites. Conventional search engines return

one or more lists of text hyperlinks and/or images with hyperlinks, not the fully active webpages associated with the hyperlinks.

Utilizing a search engine website is a serial process of browsing to such website; entering the search topic, options and constraints; executing the search; a list of hyperlinks (usually a set of ten (10) at one time) is returned by the search engine and displayed by the web browser; selecting a single hyperlink from the list; being vectored to the associated website; reviewing the webpage information that resides on the website in the web browser; and returning to the search engine website to select another hyperlink. This process is repeated for each such successive hyperlink. To view the next set (usually ten) of hyperlinks requires selecting yet a different hyperlink to render the next set of hyperlinks in the web browser. This laborious ping-pong process between websites and the search engine hyperlink list is continued until the sought after information is found or the search is terminated.

There are multiple inherent problems in using a prior art web browser-search engine paradigm for information retrieval and display, stemming from an age where Network and Internet bandwidth was limited and costly. Better solutions are needed that remove the foregoing web browser and search engine deficiencies, given the greater processor power measured in millions of instructions per second (MIPS) and Internet access bandwidth measured in millions of bits per second (Mbits/sec.) available today, while providing a tighter integration between the web browser and search engine(s).

SUMMARY

IRDS enhancements are described that enable search, display, and review of Network based information to become a fast efficient process. An IRDS based solution includes web browser enhancements and enhancements only achieved in combination with a search engine and web browser.

An embodiment of IRDS may include, but is not limited to: a stand-alone computer application program; integration into a web browser; or an add-on to a conventional web browser such as, Microsoft's Internet Explorer and Netscape's Navigator. An add-on may take the form of

(i) an applet;

(ii) a web browser plugin; or

(iii) a computer program that interfaces to a web browser through an application-programming interface (API) or proprietary interface.

IRDS enhancements to a web browser in combination with one or more search engines permits the search topic, options and constraints to be sent to one or more search engines without browsing to the search engine website(s). Each search engine has its own limited grammar that controls each search, which can be sent to a search engine across a Network. For example, searching for classic cars with webpages in German or Polish and requesting fifty (50) pages to be returned, starting with the twenty-first webpage utilizing the Google search engine, would entail sending the search engine a string of information in a grammar that it recognizes such as:

"http://www.google.com/search?q=classic+cars&num=50&hl=en&lr=lang_de|lan g_pl&ie=UTF-8&oe=UTF-8&start20&sa=N".

Here the "q=classic+cars" represents the search topic "classic cars", with the languages German or Polish specified by "lr=lang_de|lang_pl", and the starting webpage of twenty-one is specified by "start=20" and fifty pages to be returned are specified by "num=50".

This string could be typed into a web browser with the resulting hyperlink list directly displayed in a web browser without browsing to the search engine website first. This string of information could also be sent from an IRDS enhanced web browser, where search topic, options and constraints are entered and/or selected by the user. Such an enhanced web browser dynamically builds the string in the correct grammar for one or more search engines and passes the string to each selected search engine through the Network. Each search engine processes the request and returns a webpage that contains a list of hyperlinks and/or images with hyperlinks. These webpages when communicated back to the enhanced web browser are in a binary format representing text. This format can be used to reconstruct a list of hyperlinks. The lists of hyperlinks returned from one or more search engines can be aggregated and/or prioritized by such web browser. The enhanced web browser may then use the hyperlinks to preload a number of the associated webpages concurrently ("Concurrent Webpage Preloading") and display a selected number for review. The webpages may be from the same website domain and/or differing website domains. The selectable number of webpages to load concurrently will depend on the Network bandwidth, how much computer memory is available, and to a smaller degree, computer-processing power.

Other fields could also use the concept of Concurrent Webpage Preloading to enhance performance, such as web robots. Computer programs called by various names including web robots and spiders, capture data that database centric programs like search engines and bulk email programs utilize. These robots scour the web for data by contacting website webpages and cataloging information such as a website description, title, email addresses, and/or keywords. By using Concurrent Webpage Preloading these robots would be able to contact and catalog many website webpages at the same time. This would enable better use of available Network bandwidth and reduce the time to visit target websites and update an ongoing catalog.

In addition to Concurrent Webpage Preloading, one or more look-ahead webpage preloading mechanisms can be provided for the remaining unloaded webpages, to ensure a near instantaneous webpage review experience. Such mechanisms can include a look-ahead

(i) next-in-queue webpage preloading method ("Next-In-Queue Webpage Preloading");

(ii) periodic webpage preloading method ("Periodic Webpage Preloading"); and/or

(iii) descendant webpage preloading method ("Descendant Webpage Preloading").

Next-In-Queue Webpage Preloading refers to a method that preloads a selectable number of webpages pointed to by hyperlinks in a hyperlink queue that haven't been previously preloaded by other methods including Concurrent Webpage Preloading, Periodic Webpage Preloading, and Descendant Webpage Preloading. While one or more webpages are being displayed in a web browser, these webpages can be preloaded and subsequently displayed in a web browser on demand.

Periodic Webpage Preloading refers to a method whereby the webpage queue is scanned periodically for unloaded webpages. Upon finding empty locations, one or more webpages are preloaded into a webpage queue, which may then be subsequently displayed in a web browser on demand. Unloaded webpages may be selectively preloaded depending on which webpages are currently displayed, user preferences and/or other criteria, hence the preloading order is not required to be sequential.

Parent webpages referred to by a list or set of hyperlinks may contain hyperlinks that point to other children webpages, which in turn may contain hyperlinks that point to other webpages (grandchildren of the parent webpages), in perpetuity, collectively referred to as "Descendants". Descendant Webpage Preloading refers to a method that preloads selected Descendants. Any such Descendants would be visible in a web browser on demand. A selectable limit on the number of Descendants or generation of Descendants to preload may be provided, as the number of possible webpages to preload rises quickly with each additional parent webpage.

Other IRDS enhancements that improve a web browser in a search and multiple webpage display context include

(i) finding and highlighting the search topic within one or more displayed webpages;

(ii) bookmarking selected webpages or all the webpages as a list of hyperlinks that can be later recalled and used to preload the associated webpages into a webpage queue for web browser display on demand;

(iii) deleting selected webpages in a list, queue, or web browser history thereby pruning the list or set of webpages;

(iv) saving any or all of the webpages in a webpage queue to an alternate webpage set or queue for recall at a later time, while allowing a new search to commence that may entail different subject matter, constraints, or search engines; and

(v) displaying search statistics, the webpage index being viewed, highest webpage index preloaded, Network bandwidth, memory usage, and/or processor usage statistics.

IRDS enhancements to a web browser enable

(i) a web browser to display one or more fully active webpages simultaneously;

(ii) a web browser individual operation on any webpage or simultaneous operation on multiple webpages;

(iii) zoom in or out on any displayed webpage or webpages;

(iv) changing the number of webpages displayed;

(v) displaying the next webpage or next set of webpages depending on the number of webpages being displayed at a given time;

(vi) displaying any selected webpage or any set of webpages depending on the number of pages displayed at a given time; and

(vii) creating an image of any portion of the web browser display screen on demand and saving it to selected media or computer memory.

IRDS enhancements capitalize on the availability of

(i) high bandwidth networks, such as broadband cable networks rated at up to 1.5 Mbits/sec. and Digital Subscriber Line (DSL) networks rated at up to 1.5 Mbits/sec.;

(ii) multithreaded computer architectures;

(iii) large inexpensive computer memory storage; and

(iv) fast computer instruction processing, such as the Intel Pentium 4 rated at ~1700 MIPS for a clock speed of 1.5 GHz.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is described with respect to particular exemplary embodiments thereof and reference is accordingly made to the drawings in which:

FIG. **1** shows a distributed Network environment for a conventional information search, utilizing a web browser on a computer and a search engine.

FIG. **2** shows a conventional search engine display in a web browser with command and control, a list of text hyperlinks returned from a search and optional value-add information.

FIG. **3** shows a conventional search engine display in a web browser with command and control, a list of thumbnail images with hyperlinks returned from a search and optional value-add information.

FIG. **4** shows a flowchart of a conventional information acquisition and review cycle for a search performed with a web browser and search engine.

FIG. **5** shows a conventional web browser incorporating a loosely integrated search function with command and control, a list of text hyperlinks, a list of images with hyperlinks returned from a search, and optional value-add information.

FIG. **6** shows a flowchart of a conventional information acquisition and review cycle for a search performed with a web browser incorporating a loosely integrated search function.

FIG. **7** shows a flowchart of a conventional web browser serial webpage loading cycle, after a web browser has requested a new webpage from a website or other Network resource.

FIG. **8** shows possible levels of IRDS integration with a conventional web browser in a Networked environment.

FIG. **9** shows an IRDS command, control, status panel and a single (1) fully active webpage displayed.

FIG. **10** shows an IRDS command, control, status panel, and two (2) fully active webpages displayed.

FIG. **11** shows an IRDS command, control, status panel, and four (4) fully active webpages displayed.

FIG. **12** shows the IRDS command, control, status panel and nine (9) fully active webpages displayed.

FIG. **13** shows a flowchart of an IRDS based information acquisition and review cycle.

FIG. **14** shows an IRDS directed, web browser concurrent multiple webpage preloading from one or more websites, after a search has been initiated.

FIG. **15** shows a flowchart that describes an IRDS directed, web browser look-ahead Next-In-Queue Webpage Preloading function, where when a request is made to view the next group of webpages, the group of webpages immediately following this next group of webpages pointed to by the associated hyperlinks in the hyperlink queue are preloaded into a webpage queue. These webpages are not visible, but are immediately available to become visible and viewed upon demand.

FIG. **16** shows a flowchart that describes an IRDS directed, web browser look-ahead Periodic Webpage Preloading function. After a webpage is loaded into the web browser display, the associated hyperlink in the hyperlink queue is marked as loaded. The Periodic Webpage Preloading function scans the hyperlink queue for hyperlinks not marked as loaded and directs the web browser to preload one or more webpages into a webpage queue pointed to by such unmarked hyperlinks. These webpages are not visible, but are immediately available to become visible and viewed upon demand. After directing the web browser to preload such webpages, the unmarked hyperlinks are marked as loaded and the function waits a specified period of time before rescanning the hyperlink queue and repeating the process.

FIG. **17** shows a flowchart that describes an IRDS directed, web browser look-ahead Periodic Webpage Preloading function with webpage loading collision avoidance. After a webpage is loaded into the web browser display, the associated hyperlink in the hyperlink queue is marked as loaded. The Periodic Webpage Preloading function scans the hyperlink queue for hyperlinks not marked as loaded and directs the

web browser to preload one or more webpages into a webpage queue pointed to by such unmarked hyperlinks, if such webpages are not already in the process of being loaded by a different type of look-ahead function, such as described in FIG. **15** and FIG. **19**. These webpages are not visible, but are immediately available to become visible and viewed upon demand. After directing the web browser to preload such webpages, the unmarked hyperlinks are marked as loaded and the function waits a specified period of time before rescanning the hyperlink queue and repeating the process.

FIG. **18** shows a flowchart that describes an IRDS directed, web browser look-ahead Periodic Webpage Preloading function with webpage loading collision avoidance and Network and processor saturation avoidance. After a webpage is loaded into the web browser display, the associated hyperlink in the hyperlink queue is marked as loaded. The Periodic Webpage Preloading function scans the hyperlink queue for hyperlinks not marked as loaded and directs the web browser to preload one or more webpages into a webpage queue pointed to by such unmarked hyperlinks, if

(i) such webpages are not already in the process of being loaded by a different type of look-ahead function, such as described in FIG. **15** and FIG. **19**;

(ii) the Network bandwidth has not become saturated; and

(iii) the computer processor has not become saturated. These webpages are not visible, but are immediately available to become visible and viewed upon demand.

After directing the web browser to preload such webpages, the unmarked hyperlinks are marked as loaded and the function waits a specified period of time before rescanning the hyperlink queue and repeating the process.

FIG. **19** depicts an IRDS directed, web browser look-ahead Descendant Webpage Preloading, where the descendant webpages pointed to by hyperlinks that reside on webpages that have already been preloaded into a webpage queue or computer memory, whether or not visible, are preloaded into a webpage queue, computer memory, or other web browser object. These descendant webpages are not visible until requested by the web browser to be displayed on demand. A user selecting a hyperlink on a visible webpage would immediately have the webpage associated with such hyperlink available on demand and made visible in the web browser display.

FIG. **20** shows a flowchart and diagram associated with selecting the number of webpages to display at a given time.

FIG. **21** shows a flowchart and diagram associated with selecting a webpage(s) in a multi-page web browser display and changing the zoom factor for a selected webpage(s).

FIG. **22** shows a diagram associated with selecting a webpage in a multi-page web browser display and making the selected webpage encompass the entire screen area allotted for the multi-page display, which is equivalent to setting the number of webpages to display to one.

FIG. **23** shows a diagram associated with changing from an IRDS enhanced web browser mode to a conventional web browser mode for a selected webpage.

FIG. **24** shows a diagram associated with selecting any portion of a web browser display and creating an image in a standard image format, such as Joint Photography Experts Group ("JPEG"), Graphics Interchange Format ("GIF"), or bitmapped ("BMP") that can be saved to physical media (hard drive, floppy drive, compact disk, etc) or computer memory or copied to another computer application, such as a word processor, spread sheet, or presentation program.

FIG. **25** shows a diagram associated with removing the selected webpages from the multi-page web browser display and/or webpage queue and/or the associated hyperlinks from the hyperlink queue.

FIG. **26** shows a diagram associated with group bookmarking a selected set of hyperlinks, where such set of hyperlinks can be recalled later and used to preload the webpages pointed to by such hyperlinks into a webpage queue and subsequently displayed by a web browser upon demand.

FIG. **27** shows a diagram associated with selecting any portion of a webpage queue, whether or not displayed by a web browser and saving such webpages to an alternate webpage set or queue. One or more such alternate sets could be made the active display set upon demand.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** shows a distributed Network environment for a conventional information search utilizing a search engine and web browser on a computer. Here, a computer **101** including a local web browser, is attached to the Internet **102** or possibly a more generalized Network through a physical link **105**. The physical link **105** may be wired, wireless, or an optical link. The search engine contacted by the web browser is usually on another computer **106** attached to the Internet **102**, but it is possible that the search engine could reside on the same computer **101** as the web browser. The search engine retrieves applicable information from one or more databases **104** connected to a database server computer **103** and returns a list of hyperlinks to the web browser. The database server computer **103** and its databases **104** are usually connected through a private LAN **107** to the search engine computer **106** to keep the databases themselves isolated from the Internet for security purposes. However, it is possible that the database server computer **103** and its databases **104** are connected to the Internet or more generalized Network. It is also possible that the databases **104** reside on or are directly connected to the search engine computer **106**. When computer and Network bandwidth were limited, databases tended to be local to a computer or on a mainframe computer accessed through terminals. With the advent of fast processing and high Network throughput, databases tend to be distributed on a Network to allow for the greatest access and flexibility.

FIG. **2** shows a typical prior art search engine display in a web browser **201** after executing a web search, which may contain any portion or combination of the following: an input box **202** for the user's search topic; commands **203** and **207** to execute a search on the web, search for images **208**, search group listings **209**, search directory listings **210**, search and go directly **216** to the first website in the hyperlink list; hyperlinks to select the next hyperlink set **217**, the previous hyperlink set **218**, or a particular hyperlink set **219**; hyperlink to advanced search options **206**; hyperlink to user preferences **211**; hyperlinks **213** to related topics; hyperlinks **215** to unrelated topics; hyperlinks **204** to webpages that the search engine has returned for a particular topic; a text description **205** for each hyperlink **204**; statistics **212** for the results returned that may include the number of hyperlinks found for the associated search topic, the amount of time to execute the search, and which set of hyperlinks is currently displayed; and hyperlinks **214** to webpages related to advertisements. This conventional search paradigm returns lists of hyperlinks that are prioritized in relationship to the search topic. To view the actual webpage pointed to by the hyperlink, the hyperlink is selected and the web browser contacts the website that is

managing the webpage and the web browser subsequently downloads the webpage to the web browser, if the webpage is available.

FIG. **3** shows a typical prior art search engine display in a web browser **301** after executing a search for images, which may contain any portion or combination of the following: an input box **302** for the user's search topic; commands to execute a search **303**, **307** on the web, search for images **308**, search group listings **309**, search directory listings **310**, search and go **316** directly to the first website in the hyperlink list; hyperlinks to select the next hyperlink set **317**, the previous hyperlink set **318**, or a particular hyperlink set **319**; hyperlink to advanced search options **306**; hyperlink to user preferences **311**; hyperlinks **313** to related topics; hyperlinks **315** to unrelated topics; thumbnail images **304** with hyperlinks to webpages that were returned by a search engine(s) for a particular topic; a text description **305** for each thumbnail image **304**; statistics **312** for the results returned that may include the number of hyperlinks found for the associated search topic, the amount of time to execute the search, and which hyperlink set is currently displayed; and hyperlinks **314** to webpages related to advertisements. This conventional search paradigm returns lists of thumbnail images that are images that can themselves be selected, such as by clicking the image with a computer Mouse, to act as hyperlinks. These thumbnail image hyperlinks are prioritized in relationship to the search topic. To view the actual webpage pointed to by the thumbnail image hyperlink, the thumbnail image hyperlink is selected and the web browser contacts the website that is managing the webpage and the web browser subsequently downloads the webpage to the web browser, if the webpage is available.

FIG. **4** shows a flow chart for a possible sequence of events for a conventional information search utilizing a web browser on a computer and a search engine in a Networked environment. A web browser is opened **401** on a computer and the user browses **402** to a search engine website and inputs **403** the search topic and any options or constraints into the search engine webpage and executes **404** the search. The search engine returns **405** a limited list of hyperlinks, usually on the order of 10-20 hyperlinks. The user may review **406** the hyperlinks, descriptions, and any accompanying thumbnail images, then select **407** a desired hyperlink. The web browser downloads the webpage associated with the hyperlink, if the webpage is available. The user reviews **408** the webpage information and may

(i) return **409** to the search engine webpage to continue to review the list of hyperlinks **406** and select **407** another hyperlink from the hyperlink list to browse to another webpage; or

(ii) return **409** to the search engine webpage and input **403** a new search topic and any options or constraints into the search engine webpage and execute **404** a new search.

This ping-pong process between the search engine website and the websites associated with the hyperlinks returned from the search engine is continued until the user has found the sought after information or halts the search **410**.

FIG. **5** shows a prior art web browser display **501** incorporating a loosely integrated search capability, after a search has been executed. The web browser display may contain any portion or combination of the following: an input box **502** for the user's search topic; command **503** to execute a search; hyperlinks to select the next hyperlink set **506** or the previous hyperlink set **505**; hyperlink to advanced search options **508**; hyperlink to information regarding the results **509** of the search; hyperlink to help **510**; hyperlinks **504** to webpages that the search engine has returned for a particular topic; and a selection box **507** to select an alternate search engine. The user isn't required to browse to the search engine website to input criteria, execute a search, or review the resultant hyperlinks. The list of hyperlinks returned by the search engine, such as Internet Explorer, is capable of displaying both a text hyperlink list **504** in one panel of the web browser and thumbnail images **512** with hyperlinks and image locations **511** in a second panel. Selecting a text **504** hyperlink or a thumbnail image **512** representing a hyperlink, instructs the web browser to open the webpage associated with the hyperlink, if the webpage is available. The second panel is then replaced with such webpage. The text hyperlink list **504** remains in the left panel.

FIG. **6** shows a flow chart for a possible sequence of events for a conventional information search utilizing a web browser incorporating a loosely integrated search capability on a computer in a Networked environment. Specifically, a web browser is opened **601** on a computer and the user inputs **602** the search topic and any options or constraints and execute **603** a search. The search engine returns a limited list of hyperlinks to the web browser, usually on the order of 10-20 hyperlinks. The user reviews **604** the hyperlinks, descriptions, and any accompanying thumbnail images and selects **605** a desired hyperlink. The web browser opens the webpage associated with the hyperlink, if the webpage is available. The user reviews **606** the information on the webpage and may

(i) continue to review **604** the list of hyperlinks and select **605** another hyperlink from the hyperlink list to open another webpage; or

(ii) input **602** a new search topic and any options or constraints into the web browser and execute **603** a new search; or

(iii) terminate **607** the search.

FIG. **7** shows a flowchart for a possible sequence of events for loading a webpage into a conventional web browser **707**. Specifically, the web browser requests **701** a webpage. If the web browser has an active cache **709** memory, the cache **709** is checked **702** by the web browser for a valid webpage. If the webpage is valid, the web browser displays **708** the webpage. If the web browser's **707** cache **709** isn't active or a valid webpage isn't available in cache **709** memory, the web browser contacts **703** the website associated with the webpage and requests **704** the webpage. After a period of time **705**, which includes the website and Network latency, the webpage if available, is returned **706** to the web browser **707** for display **708**. Even though a web browser may have multiple concurrent connections to a particular webpage to load elements from such webpage, this aforementioned serial cycle is inherent for loading each successive webpage. Therefore, the latency **705** or wasted time is additive for each webpage loaded by the conventional web browser **707**.

FIG. **8** shows possible levels of IRDS integration, according to the present invention, with a conventional web browser including

(i) a fully integrated IRDS and web browser **806** that can be executed and displayed on a computer **807**;

(ii) an IRDS add-on **801** to a web browser **805**, where the IRDS program(s) **803** and any data **802** required, are separate from the web browser **805** and its data store. The IRDS add-on **801** communicates with the web browser **805** and any output is displayed on the local computer **804**. Both the IRDS add-on **801** and web browser **805** are executed on the local computer **804**; or

(iii) an IRDS add-on **801**, distributed on a Network **810** and residing on a different computer **804** than the web browser. The IRDS add-on **801** communicates with the

web browser **808** residing on computer **809**. Any output is displayed on the web browser computer **809**.

A client-server relationship is also possible, where a computer terminal **811** does not execute any programs, but displays and controls the execution of

(i) a web browser **805** or a web browser **808** working in conjunction with an IRDS add-on **801**; or

(ii) a fully integrated IRDS enhanced web browser **806**.

FIG. **9** shows an IRDS enhanced web browser **901** display **902** that contains function grouping **904** that includes command, control, and status. Features to be described enable search, display, and review of Network based information in a fast efficient manner. Inputs may be entered in the web browser display **902**, a web browser generated window, and/or a webpage loaded into the web browser. Inputs may include: a search topic **908**; search options or constraints **909**; search engine selection **922**; concurrent webpage loading (concurrent means performing multiple actions at nearly the same time without waiting for a prior action to complete) and look-ahead webpage preloading control **910**; initiate search execution **923**; select number of webpages to be display simultaneously **920**; change the multiple webpage display to the one webpage currently selected **906**; group bookmark options **907** for any portion of a hyperlink queue; setting the users homepage **918** to a selected webpage; removing **913** a webpage or multiple webpages from the web browser display and/or the webpage queue and/or the associated hyperlinks from the hyperlink queue; displaying the next set **917** of webpages; displaying the previous set **916** of webpages; displaying the first set **914** of webpages; displaying the last set **915** of webpages; zooming **911** in or out on a selected webpage(s) or any portion thereof; finding and highlighting **912** the search topic on the webpages currently displayed; creating an image **924** of a selected portion of a web browser display; switching **905** from IRDS enhanced mode to conventional web browser mode and browse to the selected webpage; and list **921** the current hyperlink queue and upon selection of one or more hyperlinks then display the associated webpages. Outputs may include the fully active webpage display **903** and status information **919** including but not limited to: number of webpages preloaded, total number of webpages that match the search topic criteria, processor utilization, network utilization, memory utilization, and current set of webpages displayed.

FIG. **10** shows an IRDS enhanced web browser **1001** including display **1002** containing function grouping **1004** that further includes command, control, and status for a web browser and features as enumerated in FIG. **9**. Also included are two (2) fully active webpages **1003** and **1005** that are displayed concurrently. No conventional web browser displays multiple webpages simultaneously from a list of hyperlinks returned by a search engine.

FIG. **11** shows an IRDS enhanced web browser **1101** including display **1102** containing function grouping **1104** that further includes command, control, and status for a web browser and features as enumerated in FIG. **9**. Also included are four (4) fully active webpages **1103**, **1105**, **1106**, and **1107** that are displayed concurrently. Again, no conventional web browser displays multiple webpages simultaneously from a list of hyperlinks returned by a search engine.

FIG. **12** shows an IRDS enhanced web browser **1201** including display **1202** containing function grouping **1204** that further includes command, control, and status for a web browser and features as enumerated in FIG. **9**. Also included are nine (9) fully active webpages **1203**, **1205**, **1206**, **1207**, **1208**, **1209**, **1210**, **1211**, and **1212** that are displayed concurrently. Depending on the display monitor screen size and resolution, various numbers and configurations of simultaneous webpage displays can be implemented with the IRDS paradigm described herein.

FIG. **13** shows a flowchart for a possible sequence of events for an information search in a Networked environment utilizing an IRDS enhanced web browser. Specifically, the IRDS enhanced web browser is opened **1301** on a computer and the user inputs **1302** the search topic and any options or constraints into the IRDS command and control center and starts a search. The IRDS contacts one or more selected search engines and executes **1303** searches on each search engine with the appropriate grammar for each search engine. The IRDS reads and parses **1304** each data stream returned from each search engine and extracts **1305** the lists of hyperlinks from the data streams and prioritizes the hyperlinks, and instructs the web browser to concurrently preload **1306** a number of the webpages pointed to by such hyperlinks. One or more webpages, depending on the display control, and status are displayed **1307** in the web browser simultaneously. The user may review **1308** any displayed webpage or select **1309** another webpage or group of webpages to display. After completing such review, the user can halt the search process **1310**, start a new search **1302**, or select other webpages **1309** to review.

FIG. **14** shows the IRDS directing a web browser **1406** to concurrently preload multiple webpages **1401**, **1402**, **1403**, **1404**, and **1405** into the web browser **1406**. If a valid webpage already exists in the web browser cache **1409**—if the cache is available—then the web browser loads the webpage from the cache; otherwise the web browser starts a preload cycle from the Network for each webpage. By concurrently preloading the webpages into the web browser, the Latency to preload multiple webpages is not additive, as in the conventional web browser serial loading case of FIG. **7**. Each preload cycle in FIG. **14** has its own independent thread and will not hold-up other threads while it completes. As many webpages can be preloaded at the same time and only a few are displayed **1407** simultaneously, most of the webpages **1408** are held in a webpage queue, waiting to be displayed. When the user selects another webpage that has been preloaded, it is immediately available for display in the web browser.

FIG. **15** shows a flowchart for a possible sequence of events for Next-In-Queue Webpage Preloading and a diagram depicting an IRDS enhanced web browser display of two (2) fully active and simultaneously displayed webpages **1507** and a webpage queue. Next-In-Queue Webpage Preloading refers to a method where IRDS directs a web browser to preload the next webpage or webpages into a webpage queue. The web browser loads such webpages from hyperlinks that point to these webpages. These hyperlinks are in their own queue. Specifically, an IRDS enhanced web browser requests **1501** the next webpages in the webpage queue for display. The number of webpages requested from the webpage queue depends on and is the same as the number of webpages currently displayed. In this example, two (2) webpages **1507** are currently displayed and the next two (2) webpages **1508** in the webpage queue are requested **1501**. If the webpages are not preloaded **1502** in the webpage queue, then the hyperlinks pointing to these webpages are utilized to load **1503** such webpages into the webpage queue. After the webpages are loaded **1503** into the webpage queue or if the webpages are already preloaded **1502** in the webpage queue, then the currently displayed webpages **1507** are made not visible **1504** and the next two (2) webpages **1508** in the webpage queue are made visible **1505**. The following two (2) webpages **1509** thereafter are then preloaded **1506** and not visible. The number of webpages **1509** to preload **1506** is governed by the

number of webpages to display on the lower bound, such that immediate display of such webpages by the web browser is possible upon demand, and available Network and processor bandwidth on the upper bound. Loaded and preloaded in the foregoing context can mean that the webpage and its constituent parts

(i) have been fully downloaded from a Network, computer storage or memory;

(ii) have been partially downloaded from a Network, computer storage or memory;

(iii) are in the process of being downloaded from a Network, computer storage or memory; and

(iv) any combination of (ii) and (iii).

FIG. **16** shows a flowchart for a possible sequence of events for Periodic Webpage Preloading. After a search on a Network has been initiated through an IRDS enhanced web browser, a list of hyperlinks to webpages may be returned from each search engine utilized and put into a hyperlink queue **1601**. These hyperlinks point to webpages that may be distributed on a Network and may be on multiple websites. Periodic Webpage Preloading refers to a method where IRDS periodically searches the webpage queue for locations that have old, inconsistent, or no data **1604**. Upon finding an unloaded position **1604** in the webpage queue, the web browser is directed to preload **1605** one or more webpages to take advantage of this available memory. Such webpages are not visible, until the web browser needs to display the webpages. Specifically, after the hyperlink queue has been populated **1601** with the hyperlinks returned from the search engine(s), a set period of time is waited **1602** and then a position pointer in the webpage queue is incremented **1603**. The new position **1604** in the webpage queue is checked for old webpage data, inconsistent webpage data, or no webpage data. If the webpage in the webpage queue has been preloaded and is the correct webpage pointed to by the associated hyperlink in the hyperlink queue, then the position pointer **1603** is incremented and the next position **1604** checked. If the webpage **1604** in the webpage queue hasn't been loaded or isn't the correct webpage pointed to by the associated hyperlink in the hyperlink queue, the web browser utilizes the hyperlink in the hyperlink queue to preload the webpage **1605** into the webpage queue. This process goes to sleep for a set period of time **1602** and then repeats. If at any time, the end of the webpage queue is reached, the process is temporarily halted **1606**. The waiting period and the number of webpages preloaded on each repetition can be adjusted according to available Network and processor bandwidth. The preloading process should not be detrimental to the user interacting with the currently displayed webpages.

FIG. **17** shows a flowchart for a possible sequence of events for Periodic Webpage Preloading with loading collision avoidance. After a search on a Network has been initiated through an IRDS enhanced web browser, a list of hyperlinks to webpages may be returned from each search engine utilized and put into a hyperlink queue **1701**. These hyperlinks point to webpages that may be distributed on a Network and may be on multiple websites. Periodic Webpage Preloading with loading collision avoidance refers to a method where IRDS periodically searches the webpage queue for locations that

(i) have old, inconsistent, or no data **1704**; and

(ii) are not being preloaded **1705** by another method.

Upon finding such an unloaded position in the webpage queue, the web browser is directed to preload **1706** one or more webpages. Such webpages are not visible, until the web browser needs to display the webpages. Specifically, after the hyperlink queue **1701** has been populated with the hyperlinks returned from the search engine(s), a set period of time is waited **1702** and then a position pointer in the webpage queue is incremented **1703**. The new position **1704** in the webpage queue is checked for old webpage data, inconsistent webpage data, or no webpage data. If the webpage in the webpage queue has been preloaded and is the correct webpage pointed to by the associated hyperlink in the hyperlink queue, then the position pointer **1703** is incremented and the next position **1704** checked. If the webpage **1704** in the webpage queue hasn't been loaded or isn't the correct webpage pointed to by the associated hyperlink in the hyperlink queue and isn't in the process of being preloaded **1705** by another method, the web browser utilizes the hyperlink in the hyperlink queue to preload **1706** the webpage into the webpage queue. The process then goes to sleep for a set period of time **1702** and then repeats. If there is a preloading **1705** conflict, the process goes to sleep for a set period of time **1702** and then repeats. If at any time, the end of the webpage queue is reached, the process is temporarily halted **1707**. The waiting period and the number of webpages preloaded on each repetition can be adjusted according to available Network and processor bandwidth. The preloading process should not be detrimental to the user interacting with the currently displayed webpages.

FIG. **18** shows a flowchart for a possible sequence of events for Periodic Webpage Preloading with network and processor saturation avoidance. After a search on a Network has been initiated through an IRDS enhanced web browser, a list of hyperlinks to webpages may be returned from each search engine utilized and put into a hyperlink queue **1801**. These hyperlinks point to webpages that may be distributed on a Network and may be on multiple websites. Periodic Webpage Preloading with network and processor saturation avoidance refers to a method where IRDS periodically searches the webpage queue for locations

(i) that have old, inconsistent data, or no data **1804**;

(ii) that are not being preloaded **1805** by another method;

(iii) when the network connection **1806** isn't saturated; and

(iv) when the computer processor **1807** local to the web browser isn't saturated.

Upon finding such an unloaded position in the webpage queue, the web browser is directed to preload **1808** one or more webpages. Such webpages are not visible, until the web browser needs to display the webpages. Specifically, after the hyperlink queue **1801** has been populated with the hyperlinks returned from the search engine(s), a set period of time is waited **1802** and then a position pointer in the webpage queue is incremented **1803**. The new position **1804** in the webpage queue is checked for old webpage data, inconsistent webpage data, or no webpage data. If the webpage in the webpage queue has been preloaded and is the correct webpage pointed to by the associated hyperlink in the hyperlink queue, then the position pointer **1803** is incremented and the next position **1804** checked. If a webpage **1804** in the webpage queue hasn't been preloaded or isn't the correct webpage pointed to by the associated hyperlink in the hyperlink queue and isn't in the process of being preloaded **1805** by another method and the network **1806** isn't saturated and computer processor **1807** local to the web browser isn't saturated, then the web browser utilizes the hyperlink in the hyperlink queue to preload **1808** the webpage into the webpage queue. The process then goes to sleep for a set period of time **1802** and then repeats. If there is a preloading **1805** conflict or the network connection **1806** is saturated or the processor **1807** is saturated, the process goes to sleep for a set period of time **1802** and then repeats. If at any time, the end of the webpage queue is reached, the process is temporarily halted **1809**. The waiting period and the number of webpages preloaded on each

repetition can be adjusted according to available Network and processor bandwidth. The preloading process should not be detrimental to the user interacting with the currently displayed webpages.

FIG. **19** depicts an IRDS directed web browser Descendant Webpage Preloading method. Descendant pages **1906**, **1907**, and **1908** are pointed to by hyperlinks **1903**, **1904**, and **1905** respectively that reside on webpages that have already been preloaded into a webpage queue **1902** or computer memory. Descendant pages are preloaded into computer memory, a queue, or web browser **1901** objects that are not visible until requested by the web browser **1901** to be displayed on demand. A user selecting hyperlink **1903**, **1904**, or **1905** on a visible webpage would immediately have the descendant webpage **1906**, **1907**, or **1908** associated with such hyperlink **1903**, **1904**, or **1905** available and displayed.

FIG. **20** shows a flowchart and diagram for an IRDS enhanced web browser **2001** display function that is able to change the number of webpages **2005** displayed at a given time. The web browser **2001** command and control function **2002** includes icon **2003** that is selected **2004**, or alternatively operated by rotating the computer Mouse wheel **2008** over icon **2003** to change the number of webpages **2005** displayed to a new preset number of webpages **2006**. The Mouse wheel may be continually rotated or the icon continually reselected until the number of webpages displayed is satisfactory **2009**, within the limitations of the number of display setting possibilities. In this example, the number of webpages displayed **2005** is changed from two (2) to four (4) webpages displayed **2006**. The webpages, two **2005** or four **2006**, are displayed simultaneously and are fully active webpages, that may be from different website domains. The icon **2003** may change appearance **2007** to indicate the current number of webpages displayed.

FIG. **21** shows a flowchart and diagram for an IRDS enhanced web browser **2101** including a zoom function to zoom in or out on any selected **2108** displayed webpage **2105** or group of webpages. The web browser **2101** command and control function **2102** includes zoom icon **2103** that is selected **2104**, or alternatively operated by rotating the computer Mouse wheel **2109** over such icon **2103** to change the zoom factor for selected **2108** webpages **2105** displayed to a new zoom factor. The Mouse wheel may be continually rotated **2109** or the icon **2103** continually reselected **2109** until the zoom factor for the webpages **2106** displayed is satisfactory **2110**, within the limitations of the number of display setting possibilities. In this example, the zoom factor for the selected webpage **2105** displayed is changed to zoom in and the resultant webpage **2106** displayed. The zoomed in webpage **2106** is displayed simultaneously with any non-zoomed webpages displayed and all displayed webpages are fully active webpages that may be from different website domains. The icon **2103** may change appearance **2107** to indicate the current zoom factor for the zoomed webpages **2106** displayed.

FIG. **22** shows a diagram for an IRDS enhanced multi-page web browser **2201** full display function **2203** to make the selected webpage **2205** encompass the entire screen area allotted for the multi-page display, which is equivalent to setting the number of website pages to display to one for such selected webpage **2205**. Specifically, a webpage **2205** is selected from the all the webpages displayed and then the web browser **2201** command and control **2202** full display function **2203** is selected with a computer Mouse **2204** or other input device. The resultant webpage **2206** is displayed in the entire screen area allotted for the multi-page display.

FIG. **23** shows a diagram for an IRDS enhanced multi-page web browser **2301** mode function **2303** to make the selected webpage **2305** encompass the entire screen area allotted for the multi-page display and switch from an IRDS enhanced mode to a conventional web browser mode that displays and operates on one (1) webpage at a time. The mode function will switch between conventional web browser mode and IRDS enhanced web browser mode on each reselection. Specifically, a webpage **2305** is selected from the all the webpages displayed and then the web browser **2301** command and control **2302** mode function **2303** is selected **2304** with a computer Mouse or other input device. The resultant webpage **2306** is displayed in the entire screen area allotted for the multi-page display and has switched to a conventional web browser mode. The web browser icons and command and control display will change appearance accordingly to show the current web browser mode and available features and functions in such mode.

FIG. **24** shows a diagram for an IRDS enhanced multi-page web browser **2401** imaging function **2403** that takes a selected portion **2405** of a web browser display and creates an image **2406** in a standard image format, such as Joint Photography Experts Group ("JPEG"), Graphics Interchange Format ("GIF"), or bitmapped ("BMP"). The selected portion of the web browser display can be any portion of the web browser display including, but not limited to, crossing multiple webpage display boundaries. Specifically, a portion **2405** of a web browser display is selected and then the web browser **2401** command and control **2402** imaging function **2403** is selected **2404** with a computer Mouse or other input device. The created image **2406** may be displayed and/or saved as a file to physical media (hard drive, floppy drive, compact disk, etc) or computer memory or copied to another computer application, such as a word processor, spreadsheet, or presentation program.

FIG. **25** shows a diagram for an IRDS enhanced multi-page web browser **2501** remove webpage function **2503** to remove selected **2505** webpages from the multi-page display and/or webpage queue **2509** and/or the associated hyperlinks from the hyperlink queue. Specifically, a webpage(s) **2505** is selected from the displayed webpages. The web browser **2501** command and control **2502** remove webpage function **2503** is selected with a computer Mouse **2504** or other input device. The resultant web browser display replaces the selected webpage **2505** with the webpage **2506** immediately following in the webpage queue. All webpages in the webpage queue following the removed webpage **2505** are decremented one position, such that webpage n+2 moves into webpage n+1 's display position and webpage n+3 moves into webpage n+2's display position and webpage n+4 moves into webpage n+3's display position. Any displayed webpages will immediately reflect the new webpage queue ordering. Alternately, a webpage from the webpage queue may replace the deleted page or the deleted page may be left blank, while the other webpages currently displayed may stay in their current positions.

FIG. **26** shows a diagram for an IRDS enhanced multi-page web browser **2601** group bookmarking function **2603** to bookmark selected hyperlinks **2605** or all the hyperlinks from the hyperlink queue. A conventional web browser allows a hyperlinked bookmark to be saved for one (1) webpage at a time. An IRDS enhancement would allow multiple hyperlinks **2605** associated with a hyperlink queue to be saved as a group bookmark **2606**. This group bookmark **2606** could be recalled later to reload the hyperlink queue and subsequently reload the associated webpages into the webpage queue. This would retrieve and display an updated state of a search with-

out performing a search. Hence, if the associated webpages had changed between an initial search and recalling the webpages with a group bookmark reload, the recalled version would reflect any updated webpage information. Specifically, hyperlinks **2605** from a hyperlink queue or portion thereof is selected and then the web browser **2601** command and control **2602** group bookmark function **2603** is selected with a computer Mouse **2604** or other input device. These selected hyperlinks **2605** are saved as a group bookmark **2606**. This group bookmark **2606** can be recalled later to reload the hyperlink queue and subsequently reload the associated webpages into the webpage queue for web browser display.

FIG. **27** shows a diagram associated with selecting any portion of a webpage queue **2701**, whether or not displayed by an IRDS enhanced web browser and saving such webpages to an alternate webpage set **2702** or queue. One or more such alternate sets **2702** could be made the active display set upon demand. During an information search and review process it would be advantageous to move selected pages to an alternate set for later review or group bookmarking. In this way, multiple searches could take place and only the useful webpages kept for review. Multiple alternate sets or queues would be available to enable grouping of selected webpages from multiple searches into like categories or by criteria set by the user. Group bookmarking would be available for each alternate set or queue.

Therefore, methods and apparatus for implementing an Information Retrieval and Display System, have been described.

It should be understood that the particular embodiments described above are only illustrative of the principles of the present invention, and various modifications could be made by those skilled in the art without departing from the scope and spirit of the invention. Thus, the scope of the present invention is limited only by the claims that follow.

What is claimed is:

1. A method for retrieving and viewing webpages in a single web browser instance operating on a user's computer, comprising the sequential steps of:

submitting, from said single web browser, a search request to an Internet search engine located on the Internet, wherein said search request is initiated by the user

receiving a hyperlink list from said Internet search engine, said hyperlink list having been automatically rank-ordered by said Internet search engine, and wherein said hyperlink list by default is not displayed;

automatically preloading a plurality of webpages referred to by said hyperlink list to form a rank-ordered queue of webpages stored on the user's computer;

viewing at least two webpages from said rank-ordered queue of webpages in separate windows within said single web browser instance such that all of said at least two webpages are fully active and simultaneously visible, and where any of said at least two webpages may be operated on without altering the state of another of said at least two webpages; and

wherein descendant webpages are preloaded for some, but not all, of said at least two webpages.

2. The method of claim **1** including changing the number of webpages that are simultaneously displayed according to an input from the user and when additional webpages are made visible, populating these additional webpages automatically with webpages corresponding to hyperlinks in said rank-ordered list of hyperlinks.

3. The method of claim **1** including selectively deleting webpages displayed or queued for display.

4. The method of claim **1** where said loading is accomplished by preloading a selectable number of webpages corresponding to a selectable number of hyperlinks in the queue of hyperlinks.

5. The method of claim **1** including changing the number of webpages that are simultaneously displayed according to an input from the user.

6. The method of claim **1** including selectively saving the queue of hyperlinks or a portion thereof as a group bookmark hyperlink list that may be loaded in a web browser at a later time.

7. The method of claim **1** where said loading is further accomplished by concurrently preloading a predetermined number of webpages pointed to by hyperlinks in the queue of hyperlinks.

8. The method of claim **1** where said loading is further accomplished by determining the available network download bandwidth and preloading a predetermined number of webpages based on such available network download bandwidth.

9. The method of claim **1** where said loading is further accomplished by:

determining that a processor within the user's computer isn't saturated; and

preloading a predetermined number of webpages based on the processor's non-saturation state.

10. The method of claim **1** including selectively deleting webpages displayed or queued for display.

11. A method for retrieving and viewing webpages in a single web browser instance operating on a user's computer, comprising the sequential steps of:

simultaneously submitting, from said web browser, a search request to multiple Internet search engines located on the Internet, and wherein said search request is initiated by the user

receiving a hyperlink list from each of said multiple Internet search engines, said hyperlink list having been automatically rank-ordered by the Internet search engine that supplied said hyperlink list;

automatically forming a single queue of hyperlinks from all hyperlink lists received by aggregating or prioritizing hyperlinks from said hyperlink lists;

automatically loading a plurality of webpages referred to by said single queue of hyperlinks to form a queue of webpages stored on the user's computer; and

viewing at least two webpages from said queue of webpages in separate windows within the single web browser instance such that all of said at least two webpages are fully active and simultaneously visible, and where any of said at least two webpages may be operated on without altering the state of another of said at least two webpages.

12. The method of claim **11** where said loading is accomplished by preloading a selectable number of webpages pointed to by a selectable number of hyperlinks in the list of hyperlinks, and wherein descendant are preloaded for some, but not all, of said selectable number of webpages.

13. The method of claim **11** where said loading is further accomplished by concurrently preloading a predetermined number of webpages pointed to by hyperlinks in the list of hyperlinks, and wherein descendant webpages are preloaded for some, but not all, of said predetermined number of webpages.

14. The method of claim **11** where said loading is accomplished by determining an available network download bandwidth and preloading a predetermined number of webpages based on such available network download bandwidth.

15. The method of claim 11 where said loading is further accomplished by:

determining that a processor within the user's computer isn't saturated; and

preloading a predetermined number of webpages based on the processor's non-saturation state.

16. The method of claim 11 including selectively saving the rank-ordered queue of hyperlinks or a portion thereof as a group bookmark hyperlink list that may be loaded in a web browser at a later time.

17. The method of claim 11 where viewing said webpages includes displaying at least two additional fully functional webpages in said single web browser instance at the same time such that all of said at least two additional fully functional webpages are simultaneously visible to the user and may be operated on simultaneously, and where any of said at least two additional fully functional webpages may be operated on without altering the state of another of said at least two additional fully functional webpages.

18. The method of claim 11 including selectively saving the queue of hyperlinks or a portion thereof as a group bookmark hyperlink list that may be loaded in a web browser at a later time.

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