US 20090313317A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2009/0313317 A1

(43) Pub. Date: Dec. 17, 2009

Srikant et al.

(54) WIDER DELIVERY OF MULTIMEDIA CONTENT

(75) Inventors: **Mosur Kumaraswamy Srikant**, Bangalore (IN); **Mahesh Kumar Jain**, Bangalore (IN); **Vadlamani Gopalakrishna**, Bangalore (IN)

Correspondence Address:
Ashok Tankha
36 Greenleigh Drive
Sewell, NJ 08080

(73) Assignee: **Integra Micro Systems (P) Ltd.**

(21) Appl. No.: **12/193,772**

(22) Filed: **Aug. 19, 2008**

(30) **Foreign Application Priority Data**

Jun. 12, 2008 (IN) 1429/CHE/2008

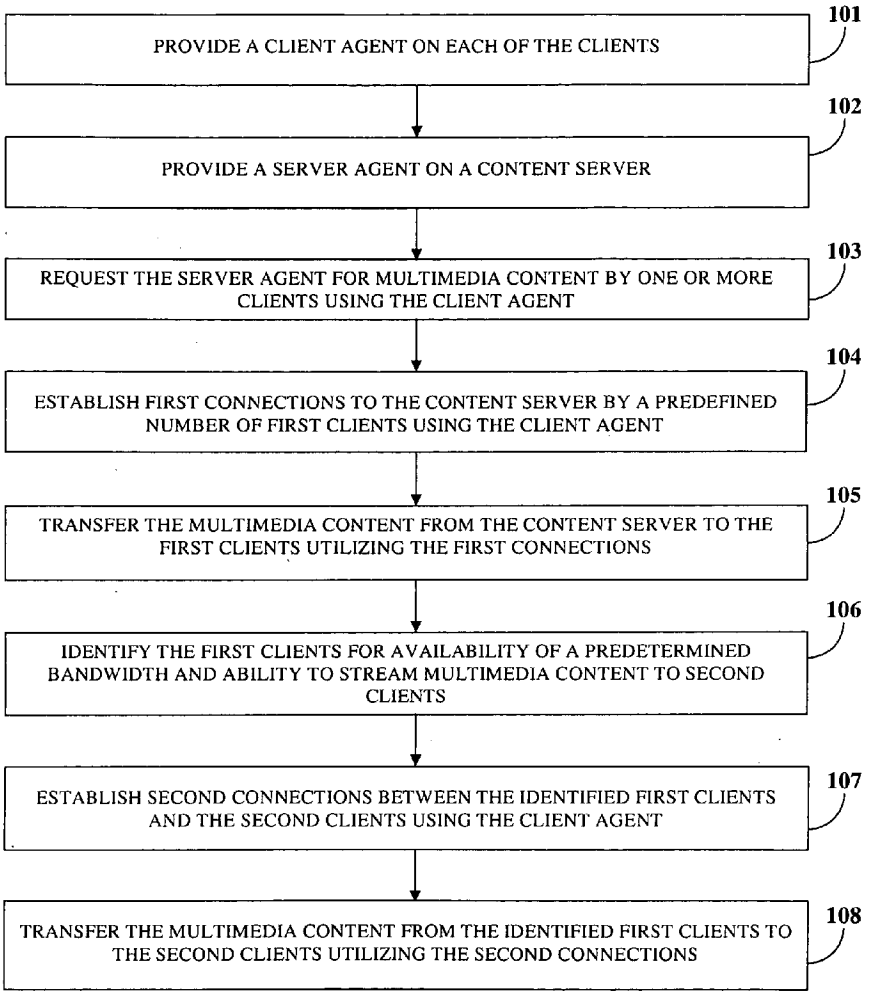
Publication Classification

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

(52) **U.S. Cl.** **709/202**

(57) **ABSTRACT**

Disclosed herein is a computer implemented method and system for streaming multimedia content available at a content server with a determinate bandwidth to multiple clients. A client agent provided on each of the clients requests a server agent on a content server for multimedia content. First connections are established to the content server by a predefined number of first clients from the requesting clients using the client agent. The predefined number is determined by the bandwidth available at the content server. The server agent then transfers the multimedia content to the first clients by utilizing the first connections. The server agent identifies the first clients for availability of a predetermined bandwidth for streaming multimedia content to second clients. Second connections are then established between the identified first clients and the second clients. The identified first clients then transfer the multimedia content to the second clients by utilizing the second connections.



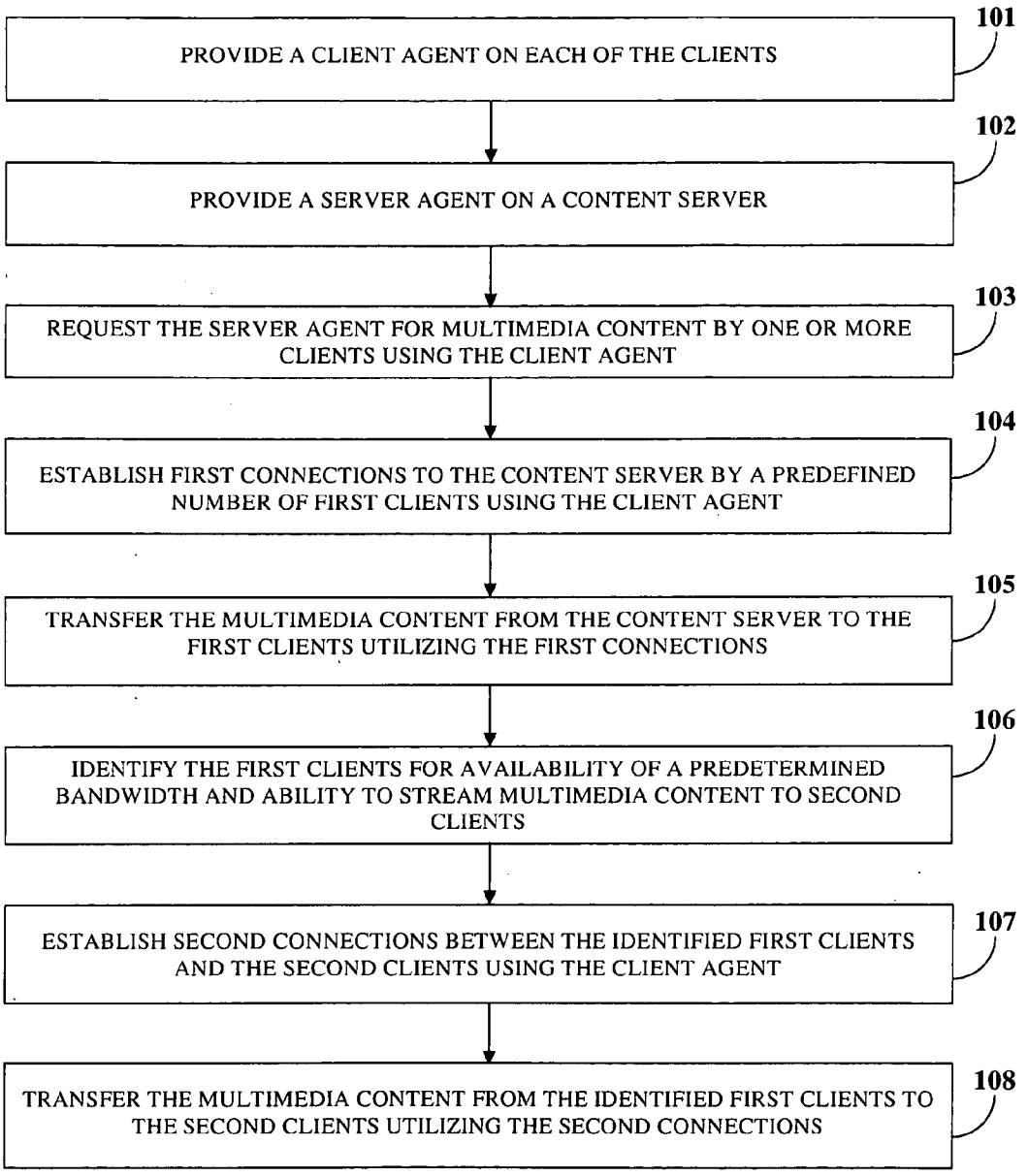

PROVIDE A CLIENT AGENT ON EACH OF THE CLIENTS
101
PROVIDE A SERVER AGENT ON A CONTENT SERVER
102
REQUEST THE SERVER AGENT FOR MULTIMEDIA CONTENT BY ONE OR MORE CLIENTS USING THE CLIENT AGENT
103
ESTABLISH FIRST CONNECTIONS TO THE CONTENT SERVER BY A PREDEFINED NUMBER OF FIRST CLIENTS USING THE CLIENT AGENT
104
TRANSFER THE MULTIMEDIA CONTENT FROM THE CONTENT SERVER TO THE FIRST CLIENTS UTILIZING THE FIRST CONNECTIONS
105
IDENTIFY THE FIRST CLIENTS FOR AVAILABILITY OF A PREDETERMINED BANDWIDTH AND ABILITY TO STREAM MULTIMEDIA CONTENT TO SECOND CLIENTS
106
ESTABLISH SECOND CONNECTIONS BETWEEN THE IDENTIFIED FIRST CLIENTS AND THE SECOND CLIENTS USING THE CLIENT AGENT
107
TRANSFER THE MULTIMEDIA CONTENT FROM THE IDENTIFIED FIRST CLIENTS TO THE SECOND CLIENTS UTILIZING THE SECOND CONNECTIONS
108

FIG. 1

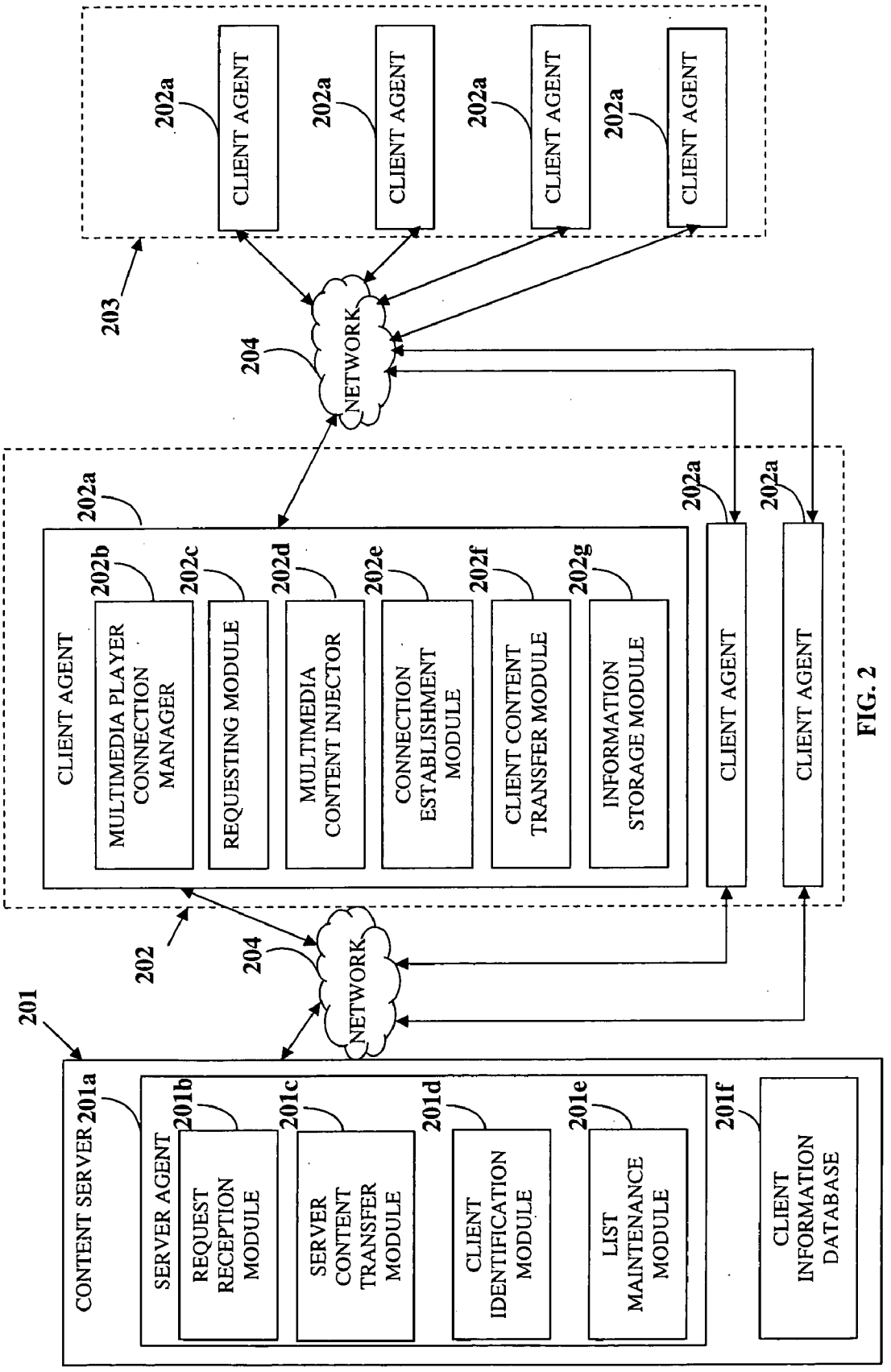

CONTENT SERVER 201a
SERVER AGENT
REQUEST RECEPTION MODULE
SERVER CONTENT TRANSFER MODULE
CLIENT IDENTIFICATION MODULE
LIST MAINTENANCE MODULE
CLIENT INFORMATION DATABASE
201
201b
201c
201d
201e
201f
NETWORK
204
202
CLIENT AGENT
MULTIMEDIA PLAYER CONNECTION MANAGER
REQUESTING MODULE
MULTIMEDIA CONTENT INJECTOR
CONNECTION ESTABLISHMENT MODULE
CLIENT CONTENT TRANSFER MODULE
INFORMATION STORAGE MODULE
202a
202b
202c
202d
202e
202f
202g
203

FIG. 2

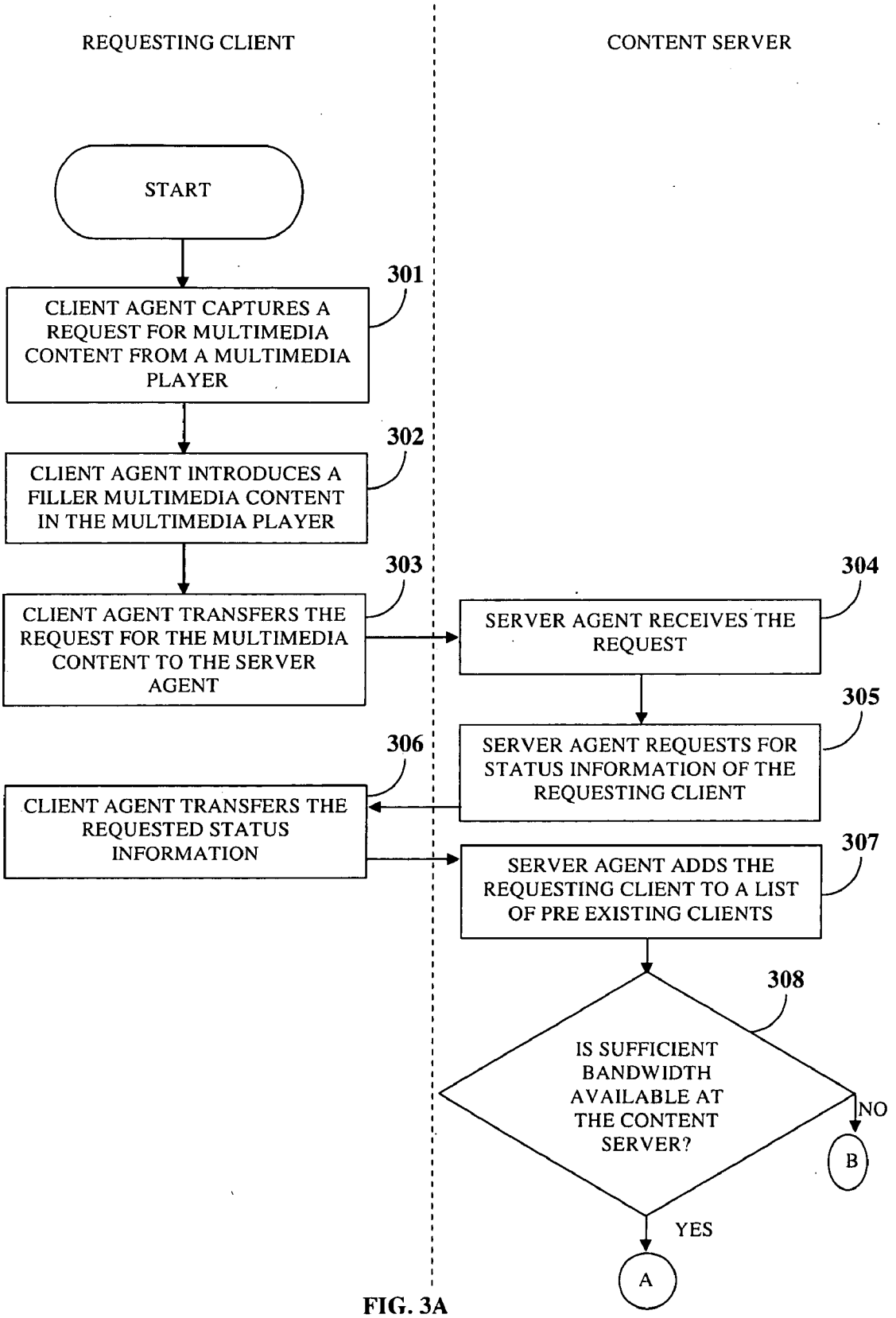

REQUESTING CLIENT
CONTENT SERVER
START
301
CLIENT AGENT CAPTURES A REQUEST FOR MULTIMEDIA CONTENT FROM A MULTIMEDIA PLAYER
302
CLIENT AGENT INTRODUCES A FILLER MULTIMEDIA CONTENT IN THE MULTIMEDIA PLAYER
303
CLIENT AGENT TRANSFERS THE REQUEST FOR THE MULTIMEDIA CONTENT TO THE SERVER AGENT
304
SERVER AGENT RECEIVES THE REQUEST
305
SERVER AGENT REQUESTS FOR STATUS INFORMATION OF THE REQUESTING CLIENT
306
CLIENT AGENT TRANSFERS THE REQUESTED STATUS INFORMATION
307
SERVER AGENT ADDS THE REQUESTING CLIENT TO A LIST OF PRE EXISTING CLIENTS
308
IS SUFFICIENT BANDWIDTH AVAILABLE AT THE CONTENT SERVER?
NO
B
YES
A

FIG. 3A

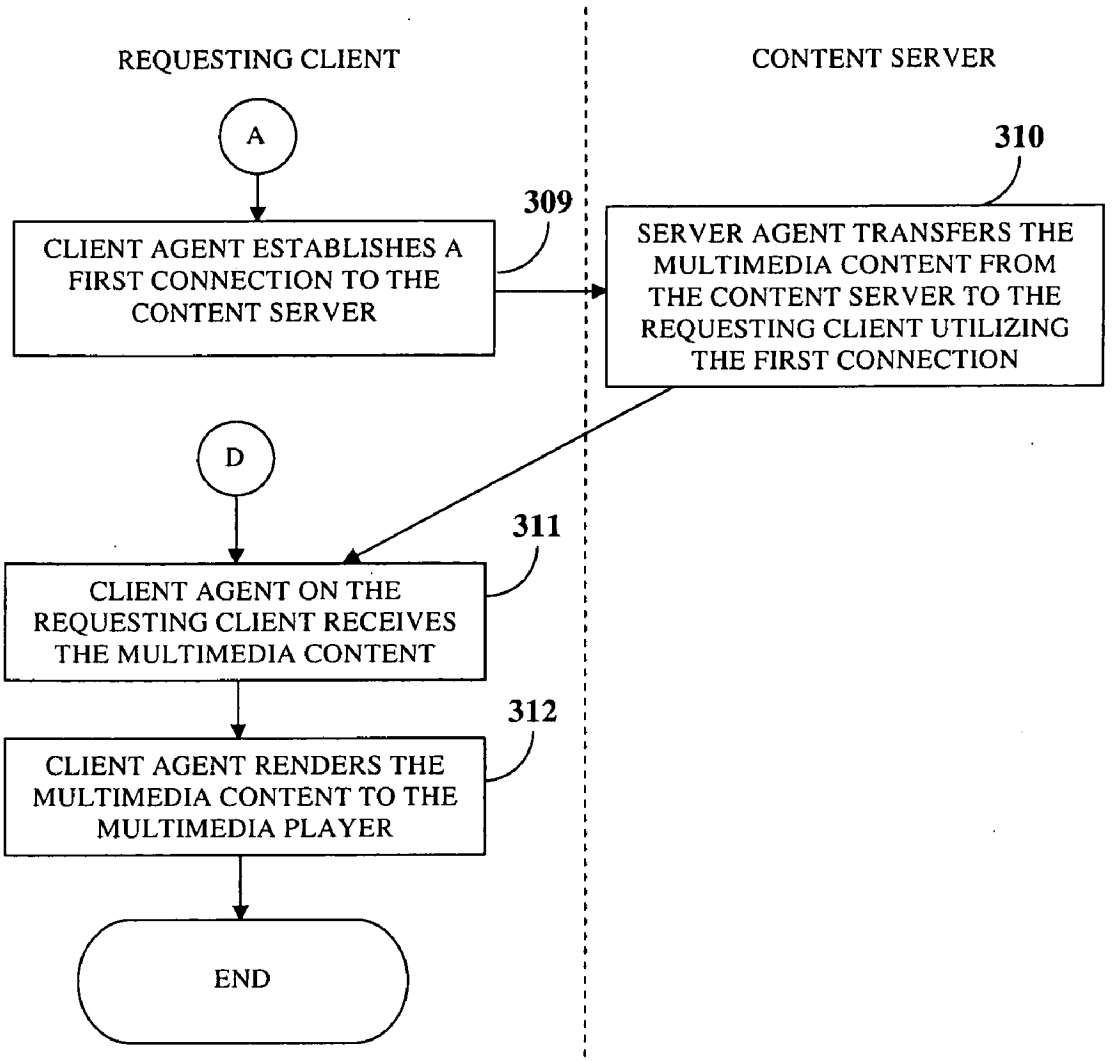

REQUESTING CLIENT
CONTENT SERVER
A
309
310
CLIENT AGENT ESTABLISHES A FIRST CONNECTION TO THE CONTENT SERVER
SERVER AGENT TRANSFERS THE MULTIMEDIA CONTENT FROM THE CONTENT SERVER TO THE REQUESTING CLIENT UTILIZING THE FIRST CONNECTION
D
311
CLIENT AGENT ON THE REQUESTING CLIENT RECEIVES THE MULTIMEDIA CONTENT
312
CLIENT AGENT RENDERS THE MULTIMEDIA CONTENT TO THE MULTIMEDIA PLAYER
END

FIG. 3B

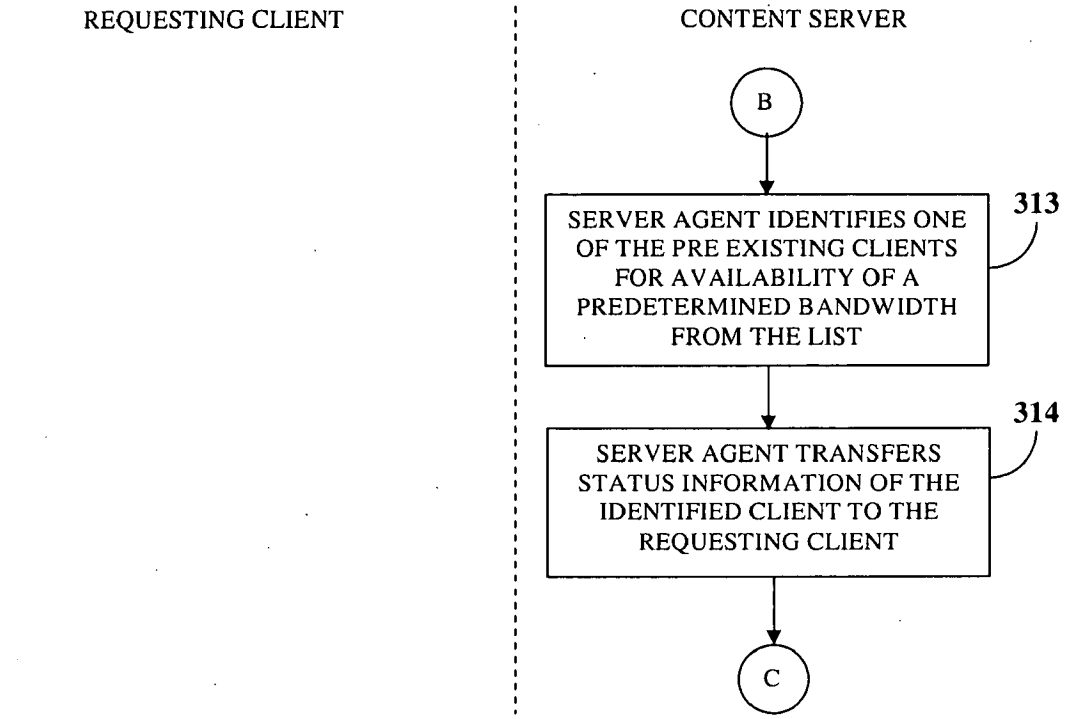

REQUESTING CLIENT
CONTENT SERVER
B
SERVER AGENT IDENTIFIES ONE OF THE PRE EXISTING CLIENTS FOR AVAILABILITY OF A PREDETERMINED BANDWIDTH FROM THE LIST
313
SERVER AGENT TRANSFERS STATUS INFORMATION OF THE IDENTIFIED CLIENT TO THE REQUESTING CLIENT
314
C

FIG. 3C

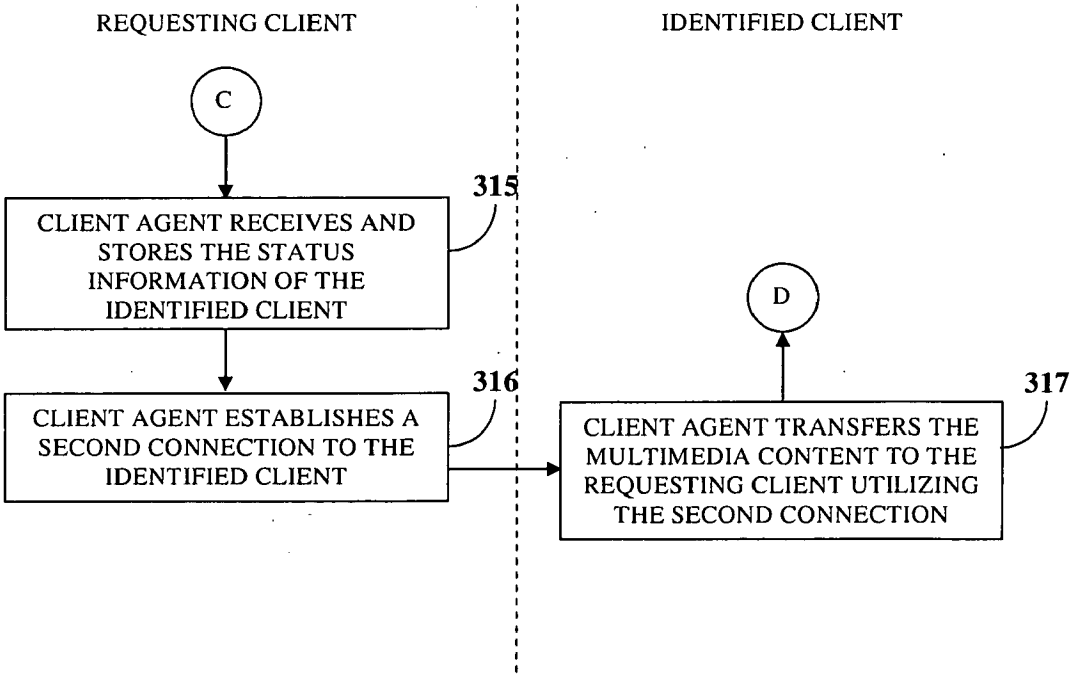

REQUESTING CLIENT
IDENTIFIED CLIENT
C
CLIENT AGENT RECEIVES AND STORES THE STATUS INFORMATION OF THE IDENTIFIED CLIENT
315
CLIENT AGENT ESTABLISHES A SECOND CONNECTION TO THE IDENTIFIED CLIENT
316
D
CLIENT AGENT TRANSFERS THE MULTIMEDIA CONTENT TO THE REQUESTING CLIENT UTILIZING THE SECOND CONNECTION
317

FIG. 3D

WIDER DELIVERY OF MULTIMEDIA CONTENT

CROSS REFERENCE TO THE RELATED APPLICATION

[0001] This application claims the benefit of the non provisional patent application number 1429/CHE/2008 titled "Wider Delivery Of Multimedia Content", filed on 12 Jun. 2008 in the Indian Patent Office.

BACKGROUND

[0002] This invention, in general, relates to digital content communication and more specifically relates to streaming digital content to multiple clients from a transmitting station with a limited bandwidth.

[0003] The widespread use of the internet in the present day has given rise to situations where a large amount of digital content may have to be simultaneously transmitted from a source to a number of destinations. Typically a number of lossy or lossless compression algorithms may be used to cope with the stringent bandwidth usage policies set down by service providers. However, regardless of the advances in audio and video compression, transmitting an audio or video stream still takes a finite amount of bandwidth that increases with the desired quality of the transmission.

[0004] In a typical internet based multimedia stream, the requirements of bandwidth and processing power of the originating station increase in direct proportion to the number of clients receiving the stream. In order to receive an acceptable quality of audio or video stream, both sending and receiving stations require at least 256 kilobytes per second (KBps) bandwidth. However, for each additional receiving station, the sending station needs to have an additional 256 KBps bandwidth. Therefore, for four simultaneous connections, the sending station requires 1 megabyte per second (Mbps) available bandwidth. For applications such as remote education, where the intention is to reach out to many more than four locations at a time, the bandwidth requirement becomes prohibitively expensive and infeasible.

[0005] Hence, there is a need for a method and system that streams digital content to an almost unlimited number of clients without increasing the bandwidth available at the transmitting station, and also without customizing any of the available multimedia stream decoders or multimedia players.

SUMMARY OF THE INVENTION

[0006] This summary is provided to introduce a selection of concepts in a simplified form that are further described in the detailed description of the invention. This summary is not intended to identify key or essential inventive concepts of the claimed subject matter, nor is it intended for determining the scope of the claimed subject matter.

[0007] Disclosed herein is a method and system for streaming multimedia content available at a content server with a determinate bandwidth to multiple clients. A client agent is provided on each of the clients and a server agent is provided on a content server. When one or more of the clients require multimedia content, the client agent provided on each of the clients requests the server agent on the content server for the multimedia content. The requests may be synchronous requests or asynchronous requests for audio content, video content, textual content, animation, still images, etc. If the requests for the multimedia content are granted by the server agent, first connections are established to the content server by a predefined number of first clients from the requesting clients using the client agent. The client agent on each of the first clients establishes the first connections to the content server. The predefined number of the first clients is determined by the bandwidth available at the content server. The server agent then transfers the multimedia content to the first clients by utilizing the first connections.

[0008] The server agent identifies the first clients for availability of a predetermined bandwidth and ability of the first clients to stream the multimedia content to one or more of second clients. The predetermined bandwidth available at the first clients is utilized to stream the multimedia content to the second clients. When the second clients request for the multimedia content, second connections are established to the identified first clients by the second clients. The client agent on each of the second clients establishes the second connections to the identified first clients. The client agent on each of the identified first clients then transfers the multimedia content to the second clients by utilizing the second connections.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The foregoing summary, as well as the following detailed description of the invention, is better understood when read in conjunction with the appended drawings. For the purpose of illustrating the invention, exemplary constructions of the invention are shown in the drawings. However, the invention is not limited to the specific methods and instrumentalities disclosed herein.

[0010] FIG. **1** illustrates a computer implemented method of streaming multimedia content available at a content server with a determinate bandwidth to multiple clients.

[0011] FIG. **2** illustrates a computer implemented system for streaming multimedia content available at a content server with a determinate bandwidth to multiple clients.

[0012] FIGS. **3**A-**3**D exemplarily illustrate a flowchart of the steps involved in streaming multimedia content available at a content server with a determinate bandwidth to a requesting client.

DETAILED DESCRIPTION OF THE INVENTION

[0013] FIG. **1** illustrates a computer implemented method of streaming multimedia content available at a content server **201** with a determinate bandwidth to multiple clients **202** and **203**. A client agent **202***a* is provided **101** on each of the clients **202** and **203**. A server agent **201***a* is provided **102** on the content server **201**. When one or more of the clients **202** and **203** require multimedia content, the client agent **202***a* provided on each of the clients **202** and **203** captures a request for the multimedia content from a multimedia player. The multimedia content may comprise audio content, a video content, textual content, animation, still images, and a combination thereof. The multimedia player may be any application capable of playing audio content, video content, textual content, animations, still images, etc. For example, the multimedia player may be a Windows media player of Microsoft® Corporation, a QuickTime player of Apple Inc., an Mplayer, etc.

[0014] Filler multimedia content may be introduced to occupy the period between the request being made by the multimedia player and transfer of the multimedia content to the requesting clients **202** and **203**. The filler multimedia content may comprise one or more of a message such as

"waiting to connect", a short advertisement, a music video selected by a user of the multimedia player, a preview of the requested multimedia content, an available multimedia program guide, information on the current status of the network **204**, etc. On capture of the request from the multimedia player, the clients **202** and **203** request **103** the server agent **201***a* provided on the content server **201** for multimedia content using the client agent **202***a*. The requests may be synchronous requests or asynchronous requests.

[0015] The server agent **201***a* determines whether the content server **201** is capable of handling the requests based on the total bandwidth available at the content server **201**, processing power of the content server **201**, and the number of clients **202** and **203** already being serviced by the content server **201**. The content server **201** may be allocated a predetermined bandwidth by a service provider. The number of requesting clients **202** and **203** to be accommodated for streaming of the multimedia content is determined by the bandwidth allocated to the content server **201**. The content server **201** requires additional bandwidth for every additional connection being established at the content server **201**. Based on the determinate bandwidth available at the content server **201**, the content server **201** may be able to transfer the multimedia content to a predefined number of the requesting clients **202** and **203**. The predefined number of the requesting clients **202** and **203** are herein referred to as "first clients". The remaining requesting clients are herein referred to as "second clients". For purposes of illustration, the detailed description refers to multiple first clients **202** and multiple second clients **203**; however the scope of the method and system disclosed herein is not limited to the first clients **202** and the second clients **203** but may be extended to include an almost unlimited number of clients and multiple levels of clients.

[0016] If the requests for the multimedia content are granted by the server agent **201***a*, the first clients **202** establish **104** first connections to the content server **201** using the client agent **202***a*. Once the first connections are established, the server agent **201***a* transfers **105** the multimedia content to the first clients **202** by utilizing the first connections. The client agent **202***a* on each of the first clients **202** then renders the transferred multimedia content to the multimedia player on each of the first clients **202**.

[0017] The server agent **201***a* identifies **106** the first clients **202** for availability of a predetermined bandwidth and ability of the first clients **202** to stream the multimedia content to one or more of the second clients **203**. The server agent **201***a* maintains a list of the requesting clients **202** and **203**. The list comprises status information of the requesting clients **202** and **203**. The status information may comprise information on bandwidth available at the requesting clients **202** and **203** and ability of the requesting clients **202** and **203** to stream the multimedia content to one or more of the second clients **203**. The status information may further comprise information on network latency between the first clients **202** and the second clients **203**, network latency between the clients **202** and **203** and the content server **201**, network accessibility information, etc. The status information may be used by the server agent **201***a* to identify appropriate first clients **202** to stream the multimedia content to the second clients **203** such that the routing path distance between the first clients **202** and the second clients **203** is short. By choosing the shortest routing path, the server agent **201***a* may transfer the multimedia content in the least possible time.

[0018] The server agent **201***a* utilizes the status information to reroute the requests for the multimedia content made by the second clients **203** to the identified first clients **202** due to insufficient bandwidth available at the content server **201** to directly stream the multimedia content to the second clients **203**. For example, when a new client requests for multimedia content, the server agent **201***a* may request the client agent **202***a* of the new client to check the latency between the new client and each of the already connected clients to determine if the content server **201** or one of the identified first clients **202** is suited to stream the multimedia content to the new client. The status information of the identified first clients **202** is made available to the second clients **203** by the server agent **201***a*. The client agent **202***a* on each of the second clients **203** receives and stores the status information of the identified first clients **202**. The client agent **202***a* on each of the second clients **203** then establishes **107** second connections to the identified first clients **202**. The identified first clients **202** now behave as the content server **201** and transfer **108** the multimedia content to the second clients **203** by utilizing the second connections.

[0019] When the multimedia player on each of the clients **202** and **203** makes a request for the multimedia content to the content server **201**, the client agent **202***a* traps the requests, simulates the destination host internet protocol (IP), and establishes a connection with the multimedia player as if the client agent **202***a* was the original host that the multimedia player was trying to connect to. The multimedia player continues to act as if the multimedia player was connected to the original host.

[0020] The client agent **202***a* may also provide an interface where the user can provide the uniform resource locator (URL) that the multimedia player should connect to in order to receive the multimedia content. The client agent **202***a* establishes a connection with the host specified in the URL to receive the multimedia content. Simultaneously, the client agent **202***a* launches the multimedia player, but forces the multimedia player to connect to the client agent **202***a*. The client agent **202***a* then provides a dummy stream to connect to. The client agent **202***a* thus acts as a pipe, receiving the multimedia content from the server agent **201***a*, and forwarding the multimedia content to the multimedia player. In case of any interruption of the multimedia content, the client agent **202***a* introduces filler multimedia content in the multimedia player.

[0021] FIG. **2** illustrates a computer implemented system for streaming multimedia content available at a content server **201** with a determinate bandwidth to multiple clients **202** and **203**. The system disclosed herein comprises a client agent **202***a* provided on each of the clients **202** and **203** and a server agent **201***a* provided on the content server **201**. The content server **201**, the first clients **202**, and the second clients **203** are connected via a network **204**. The client agent **202***a* comprises a multimedia player connection manager **202***b*, a requesting module **202***c*, a multimedia content injector **202***d*, a connection establishment module **202***e*, a client content transfer module **202***f*, and an information storage module **202***g*. The server agent **201***a* comprises a request reception module **201***b*, a server content transfer module **201***c*, a client identification module **201***d*, and a list maintenance module **201***e*. The content server **201** further comprises a client information database **201***f*.

[0022] The multimedia player connection manager **202***b* captures a request for the multimedia content from a multi-

media player on each of the clients **202** and **203**. The multimedia content injector **202***d* introduces filler multimedia content in the multimedia player to occupy a period between the request being made by the multimedia player and transfer of the multimedia content to the clients **202** and **203**.

[0023] On capture of the request from the multimedia player, one or more of the clients **202** and **203** request the server agent **201***a* for multimedia content using the requesting module **202***c* of the client agent **202***a*. The request reception module **201***b* of the server agent **201***a* receives the requests for the multimedia content from the clients **202** and **203**. Based on the determinate bandwidth available at the content server **201**, the content server **201** may be able to transfer the multimedia content to a predefined number of first clients **202** from the requesting clients **202** and **203**. The predefined number is determined by the bandwidth available at the content server **201**. If the requests for the multimedia content are granted by the server agent **201***a*, the connection establishment module **202***e* of the client agent **202***a* on each of the first clients **202** establishes first connections to the content server **201**. Once the first connections are established, the server content transfer module **201***c* transfers the multimedia content to the first clients **202** by utilizing the first connections. The client agent **202***a* on each of the first clients **202** then renders the transferred multimedia content to the multimedia player on each of the first clients **202** via the multimedia player connection manager **202***b* and the multimedia content injector **202***d*.

[0024] In case of insufficient bandwidth available at the content server **201**, the client identification module **201***d* identifies the first clients **202** for availability of a predetermined bandwidth and ability of the first clients **202** to stream the multimedia content to one or more of the second clients **203**. The list maintenance module **201***e* maintains a list comprising status information of the requesting clients **202**. The status information comprising bandwidth available at each of the requesting clients **202** and ability of each of the requesting clients **202** to stream the multimedia content to one or more of the second clients **203** is stored in the client information database **201***f*.

[0025] On identifying availability of predetermined bandwidth at the first clients **202**, the status information of the identified first clients **202** is sent to the second clients **203**. The second clients **203** store the status information in the information storage module **202***g*. The connection establishment module **202***e* of the client agent **202***a* on each of the second clients **203** then establishes second connections to the identified first clients **202**. The client content transfer module **202***f* of the client agent **202***a* of each of the identified first clients **202** then transfers the multimedia content from the identified first clients **202** to the second clients **203** by utilizing the second connections. The identified first clients **202** therefore, behave as the content server **201** in terms of functionality and serve the multimedia content to the second clients **203**.

[0026] Similarly, multiple levels of the clients may be streamed with the multimedia content from clients previously connected to the content server **201**. Since the first connections and the second connections are established by the client agent **202***a* on each of the clients **202** and **203**, the transfer of the multimedia content is seamless without requiring intervention of the user requesting for the multimedia content. Furthermore, the multimedia content available at the content server **201** with the determinate bandwidth being streamed to multiple levels of the clients **202** and **203** enables wider delivery of the multimedia content.

[0027] FIGS. **3**A-**3**D exemplarily illustrate a flowchart of the steps involved in streaming multimedia content available at a content server **201** with a determinate bandwidth to a requesting client. Consider a client agent **202***a* provided on the requesting client and a server agent **201***a* provided on the content server **201**. The client agent **202***a* captures **301** a request for multimedia content from a multimedia player on the requesting client. The request may be a synchronous request or an asynchronous request for audio content, video content, textual content, animation, still images, etc. On capture of the request from the multimedia player, the client agent **202***a* introduces **302** filler multimedia content in the multimedia player until the requested multimedia content is rendered. The client agent **202***a* transfers **303** the request for the multimedia content to the server agent **201***a* on the content server **201**. The multimedia player starts playing immediately and keeps the user engaged. The server agent **201***a* receives **304** the request and requests **305** for status information of the requesting client. The client agent **202***a* transfers **306** the requested status information to the content server **201**.

[0028] The server agent **201***a* then adds **307** the requesting client to a list of pre existing clients. If sufficient bandwidth is available **308** at the content server **201**, the client agent **202***a* on the requesting client establishes **309** a first connection to the content server **201**. The server agent **201***a* then transfers **310** the multimedia content to the requesting client utilizing the first connection. The client agent **202***a* on the requesting client then receives **311** the multimedia content and renders **312** the multimedia content to the multimedia player.

[0029] If sufficient bandwidth is not available **308** at the content server **201**, the server agent **201***a* identifies **313** one of the pre existing clients from the list for availability of a predetermined bandwidth. The server agent **201***a* transfers **314** the status information of the identified client to the requesting client. By transferring the status information of identified client, the server agent **201***a* informs the requesting client of the rerouting of the client request to the identified client. The identified client will now behave as the content server **201** in order to stream the multimedia content to the requesting client. The client agent **202***a* receives **315** and stores the status information of the identified client. The client agent **202***a* on the requesting client establishes **316** a second connection to the identified client. The identified client transfers **317** the multimedia content to the requesting client utilizing the second connection. The client agent **202***a* on the requesting client then receives **311** the multimedia content and renders **312** the multimedia content to the multimedia player.

[0030] It will be readily apparent to those skilled in the art that the various methods and algorithms described herein may be implemented in a computer readable medium, e.g., appropriately programmed for general purpose computers and computing devices. Typically a processor, for e.g., one or more microprocessors will receive instructions from a memory or like device, and execute those instructions, thereby performing one or more processes defined by those instructions. Further, programs that implement such methods and algorithms may be stored and transmitted using a variety of media, for e.g., computer readable media in a number of manners. In one embodiment, hard-wired circuitry or custom hardware may be used in place of, or in combination with, software instructions for implementation of the processes of

various embodiments. Thus, embodiments are not limited to any specific combination of hardware and software. A processor means any one or more microprocessors, Central Processing Unit (CPU) devices, computing devices, microcontrollers, digital signal processors, or like devices. The term "computer-readable medium" refers to any medium that participates in providing data, for example instructions that may be read by a computer, a processor or a like device. Such a medium may take many forms, including but not limited to, non-volatile media, volatile media, and transmission media. Non-volatile media include, for example, optical or magnetic disks and other persistent memory volatile media include Dynamic Random Access Memory (DRAM), which typically constitutes the main memory. Transmission media include coaxial cables, copper wire and fiber optics, including the wires that comprise a system bus coupled to the processor. Transmission media may include or convey acoustic waves, light waves and electromagnetic emissions, such as those generated during Radio Frequency (RF) and Infrared (IR) data communications. Common forms of computer-readable media include, for example, a floppy disk, a flexible disk, hard disk, magnetic tape, any other magnetic medium, a Compact Disc-Read Only Memory (CD-ROM), Digital Versatile Disc (DVD), any other optical medium, punch cards, paper tape, any other physical medium with patterns of holes, a Random Access Memory (RAM), a Programmable Read Only Memory (PROM), an Erasable Programmable Read Only Memory (EPROM), an Electrically Erasable Programmable Read Only Memory (EEPROM), a flash memory, any other memory chip or cartridge, a carrier wave as described hereinafter, or any other medium from which a computer can read. In general, the computer-readable programs may be implemented in any programming language. Some examples of languages that can be used include C, C++, C#, or JAVA. The software programs may be stored on or in one or more mediums as an object code. A computer program product, comprising computer executable instructions embodied in a computer-readable medium, comprises computer parsable codes for the implementation of the processes of various embodiments.

[0031] Where databases are described, such as the client information database **201***f*, it will be understood by one of ordinary skill in the art that (i) alternative database structures to those described may be readily employed, and (ii) other memory structures besides databases may be readily employed. Any illustrations or descriptions of any sample databases presented herein are illustrative arrangements for stored representations of information. Any number of other arrangements may be employed besides those suggested by, e.g., tables illustrated in drawings or elsewhere. Similarly, any illustrated entries of the databases represent exemplary information only; one of ordinary skill in the art will understand that the number and content of the entries can be different from those described herein. Further, despite any depiction of the databases as tables, other formats including relational databases, object-based models and/or distributed databases could be used to store and manipulate the data types described herein. Likewise, object methods or behaviors of a database can be used to implement various processes, such as the described herein. In addition, the databases may, in a known manner, be stored locally or remotely from a device that accesses data in such a database.

[0032] The present invention can be configured to work in a network environment including a computer that is in communication, via a communications network, with one or more devices. The computer may communicate with the devices directly or indirectly, via a wired or wireless medium such as the Internet, Local Area Network (LAN), Wide Area Network (WAN) or Ethernet, Token Ring, or via any appropriate communications means or combination of communications means. Each of the devices may comprise computers, such as those based on the Intel® processors, AMD® processors, Sun® processors, IBM® processors etc., that are adapted to communicate with the computer. Any number and type of machines may be in communication with the computer.

[0033] The foregoing examples have been provided merely for the purpose of explanation and are in no way to be construed as limiting of the present method and system disclosed herein. While the invention has been described with reference to various embodiments, it is understood that the words, which have been used herein, are words of description and illustration, rather than words of limitations. Further, although the invention has been described herein with reference to particular means, materials and embodiments, the invention is not intended to be limited to the particulars disclosed herein; rather, the invention extends to all functionally equivalent structures, methods and uses, such as are within the scope of the appended claims. Those skilled in the art, having the benefit of the teachings of this specification, may effect numerous modifications thereto and changes may be made without departing from the scope and spirit of the invention in its aspects.

We claim:

1. A computer implemented method of streaming multimedia content available at a content server with a determinate bandwidth to a plurality of clients, comprising the steps of:

providing a client agent on each of said clients;

providing a server agent on said content server;

requesting said server agent for said multimedia content by one or more of the clients using said client agent, wherein said requests are one of synchronous requests and asynchronous requests;

establishing first connections to the content server by a predefined number of first clients from said requesting clients using the client agent, wherein said predefined number of said first clients is determined by said determinate bandwidth available at the content server;

transferring the multimedia content from the content server to the first clients utilizing said first connections;

identifying the first clients for availability of a predetermined bandwidth and ability of the first clients to stream the multimedia content to one or more of a plurality of second clients, wherein said predetermined bandwidth available at the first clients is utilized to stream the multimedia content to said second clients;

establishing second connections to said identified first clients by the second clients using the client agent; and

transferring the multimedia content from the identified first clients to the second clients utilizing said second connections;

whereby the multimedia content available at the content server with the determinate bandwidth is streamed to the first clients and the second clients, thereby enabling wider delivery of the multimedia content; and

whereby the client agent on each of the first clients and the second clients allows seamless streaming of the multimedia content available at the content server to the first clients and the second clients.

2. The computer implemented method of claim 1, wherein the multimedia content comprises audio content, a video content, a textual content, animation, still images, and a combination thereof.

3. The computer implemented method of claim 1, further comprising a step of maintaining a list of the requesting clients by the server agent on the content server, wherein said list comprises status information of each of the requesting clients, wherein said status information comprises bandwidth available at each of the requesting clients and ability of each of the requesting clients to stream the multimedia content to one or more of the second clients.

4. The computer implemented method of claim 3, wherein the status information of the first clients is sent to the second clients by the server agent, wherein the status information is used to reroute the requests for the multimedia content made by the second clients from the content server to the identified first clients due to insufficient bandwidth available at the content server.

5. The computer implemented method of claim 1, wherein the server agent transfers the multimedia content from the content server to the first clients by utilizing the first connections.

6. The computer implemented method of claim 1, wherein the client agent on each of the identified first clients transfers the multimedia content from the identified first clients to the second clients by utilizing the second connections.

7. The computer implemented method of claim 1, further comprising a step of capturing a request for the multimedia content from a multimedia player by the client agent, wherein filler multimedia content is introduced to occupy a period between said request being made by said multimedia player and transfer of the multimedia content to the clients.

8. The computer implemented method of claim 7, wherein the client agent renders the multimedia content to the multimedia player.

9. A computer implemented system for streaming multimedia content available at a content server with a determinate bandwidth to a plurality of clients, comprising:

a client agent on each of said clients, comprising:

a requesting module for requesting a server agent on said content server for said multimedia content by the clients;

a connection establishment module for establishing first connections to the content server from a predefined number of first clients of said requesting clients, wherein said connection establishment module further establishes second connections from second clients to said first clients identified by said server agent for availability of a predetermined bandwidth; and

a client content transfer module for transferring the multimedia content from said identified first clients to said second clients by utilizing said second connections;

the server agent on the content server, comprising:

a server content transfer module for transferring the multimedia content from the content server to the first clients utilizing said first connections; and

a client identification module for identifying the first clients for availability of a predetermined bandwidth and ability of the first clients to stream the multimedia content to one or more of the second clients.

10. The computer implemented system of claim 9, wherein the server agent further comprises a request reception module for receiving said requests for the multimedia content from the clients.

11. The computer implemented system of claim 9, wherein the server agent on the content server further comprises a list maintenance module for maintaining a list of the requesting clients, wherein said list comprises status information of each of the requesting clients, wherein said status information comprises bandwidth available at each of the requesting clients and ability of each of the requesting clients to stream the multimedia content to one or more of the second clients.

12. The computer implemented system of claim 11, wherein the content server comprises a client information database for storing the list comprising status information of the requesting clients.

13. The computer implemented system of claim 9, wherein said client agent further comprises an information storage module for storing status information of the first clients, wherein said status information of the first clients is sent to the second clients by the server agent.

14. The computer implemented system of claim 9, wherein said client agent further comprises a multimedia player connection manager for capturing a request for the multimedia content from a multimedia player on each of the clients.

15. The computer implemented system of claim 14, wherein the client agent further comprises a multimedia content injector for introducing filler multimedia content in said multimedia player to occupy a period between said request being made by the multimedia player and transfer of the multimedia content to the clients.

16. A computer program product comprising computer executable instructions embodied in a computer-readable medium, wherein said computer program product comprises:

a first computer parsable program code for requesting a server agent on a content server for multimedia content by one or more of a plurality of clients using a client agent on each of said clients;

a second computer parsable program code for establishing first connections to said content server from a predefined number of first clients of said requesting clients using said client agent;

a third computer parsable program code for transferring said multimedia content from the content server to said first clients utilizing said first connections;

a fourth computer parsable program code for identifying the first clients for availability of a predetermined bandwidth and ability of the first clients to stream the multimedia content to one or more of a plurality of second clients;

a fifth computer parsable program code for establishing second connections to said identified first clients from said second clients using the client agent; and

a sixth computer parsable program code for transferring the multimedia content from the identified first clients to the second clients utilizing said second connections.

17. The computer program product of claim 16, further comprising a seventh computer parsable program code for maintaining a list of the requesting clients by said server agent

on the content server, wherein said list comprises status information of each of the requesting clients.

18. The computer program product of claim **16**, further comprising an eighth computer parsable program code for capturing a request for the multimedia content from a multimedia player on each of the clients.

19. The computer program product of claim **18**, further comprising a ninth computer parsable program code for introducing filler multimedia content to occupy a period between said request being made by said multimedia player and transfer of the multimedia content to the clients.

20. The computer program product of claim **19**, further comprising a tenth computer parsable program code for rendering said transferred multimedia content to the multimedia player.

* * * * *