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[54] **SYSTEM FOR INTEGRATING SATELLITE BOARDBAND DATA DISTRIBUTED OVER A CABLE TV NETWORK WITH LEGACY CORPORATE LOCAL AREA NETWORKS**

[75] Inventor: **John C. Thacker**, Los Altos, Calif.

[73] Assignee: **CyberStar, L.P.**, Palo Alto, Calif.

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[52] **U.S. Cl.** **345/327**; 348/12; 348/13; 348/10; 455/3.2; 455/3.1; 455/5.1

[58] **Field of Search** 395/200.47; 345/327; 348/12, 13, 6, 10; 455/3.2, 3.1, 5.1, 6.1, 6.2, 6.3; H04N 7/10, 7/14; H04H 1/100

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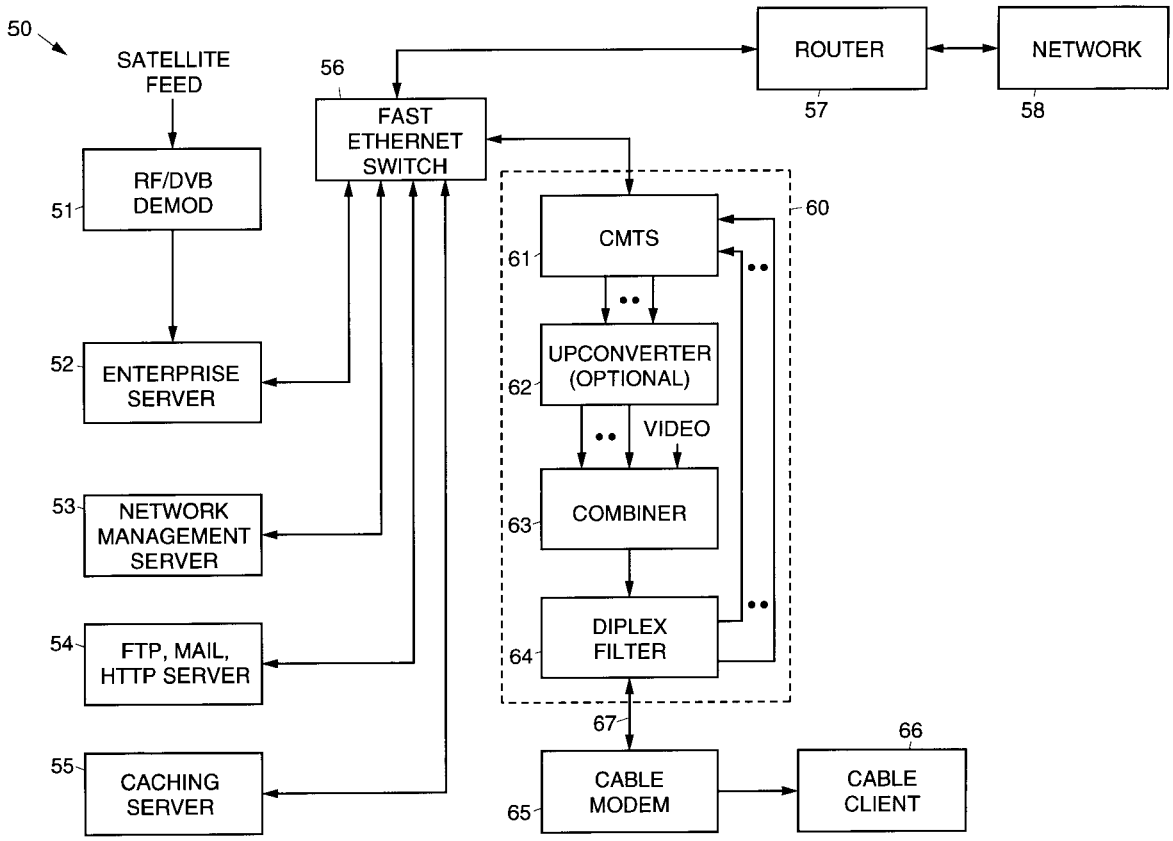
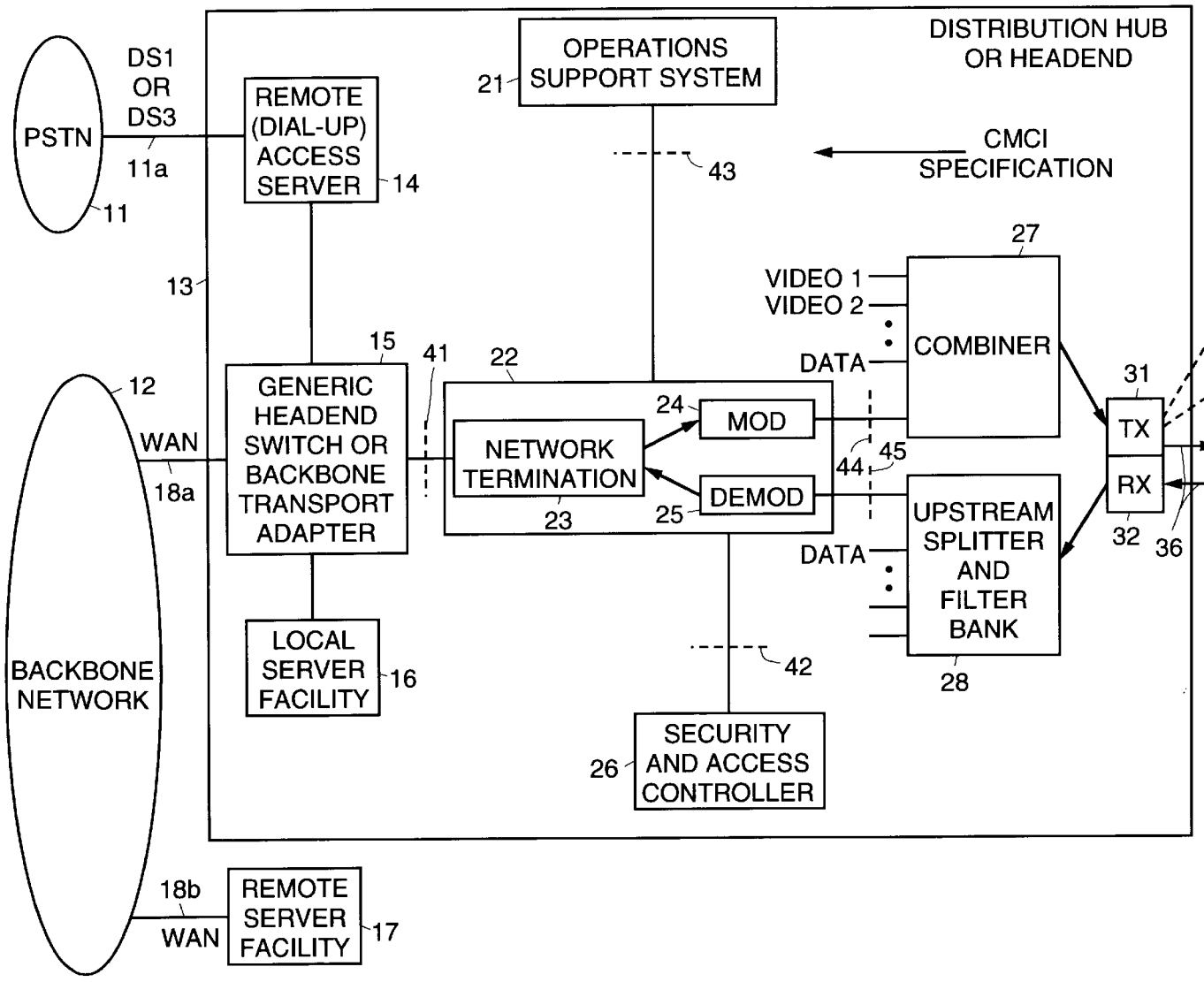
Primary Examiner—Nathan J. Flynn
Assistant Examiner—Vivek Srivastava
Attorney, Agent, or Firm—Kenneth W. Float

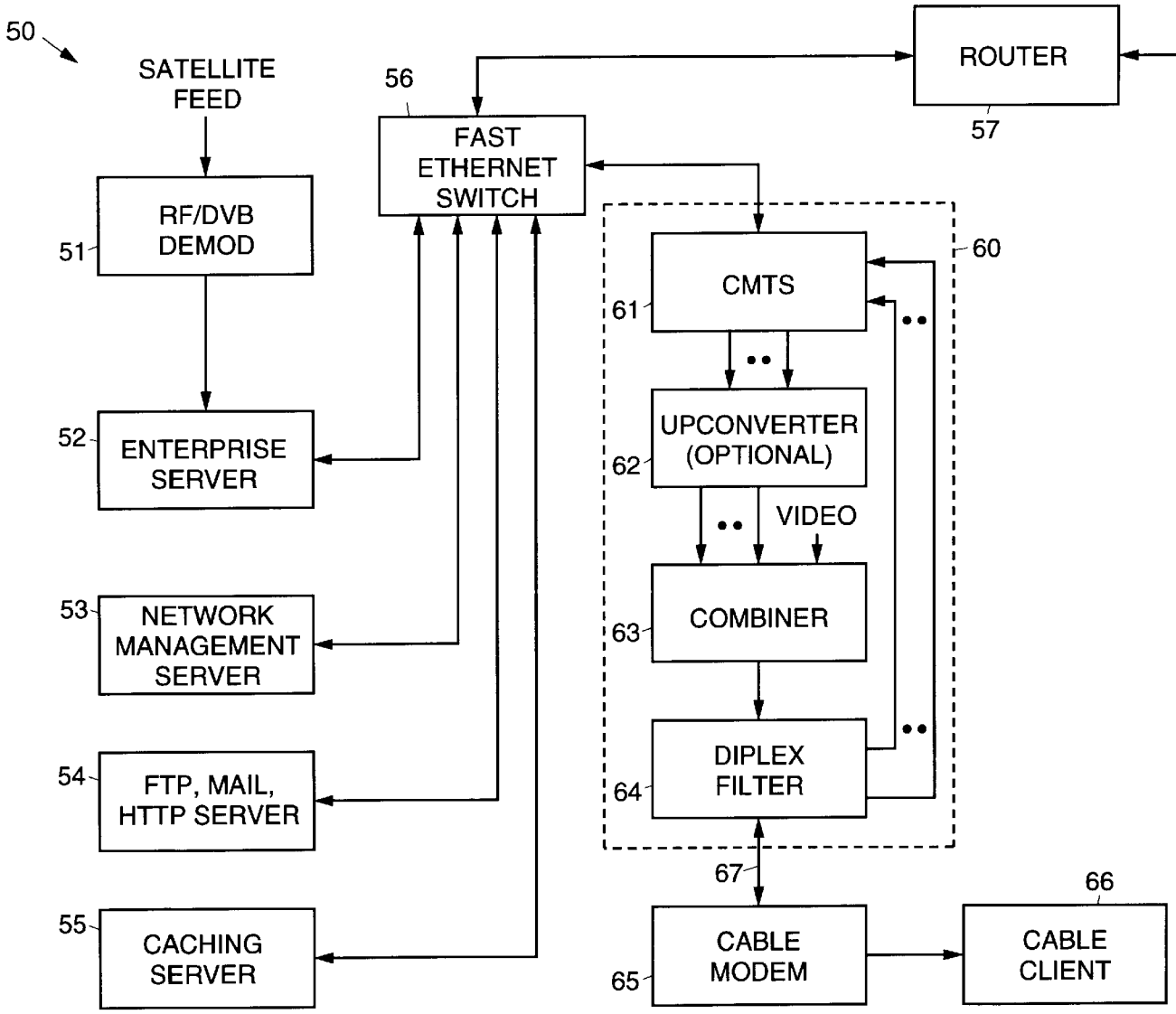
[57] **ABSTRACT**

A broadband multimedia data distribution system that integrates satellite broadband data derived from a satellite feed that is distributed over a cable TV network with a legacy corporate local area network. The system provides a broadband network overlay with satellite data delivery that integrates with currently available cable television transmission media. The system thus integrates broadband multimedia data distribution, cable TV network distribution, and the legacy network to expand corporate information services. The system thus expands existing network capabilities and avoids replacement or upgrade costs.

9 Claims, 2 Drawing Sheets







SYSTEM FOR INTEGRATING SATELLITE BOARDBAND DATA DISTRIBUTED OVER A CABLE TV NETWORK WITH LEGACY CORPORATE LOCAL AREA NETWORKS

BACKGROUND

The present invention relates generally to broadband multimedia data distribution systems, and more particularly, to apparatus for integrating satellite broadband data distributed over a cable TV network with legacy corporate local area networks.

Legacy corporate local area networks (LANs) can become congested under user demand for broadband multimedia data and other data services. These legacy networks are costly to replace or upgrade to meet the increasing demand for multimedia data. It would be desirable to have the ability to expand existing legacy network capabilities and avoid replacement or upgrade costs.

Currently available technology relating to the present invention includes a Multimedia Cable Networking Standards (MCNS) compliant "data over cable TV" architecture. By way of background, the Institute of Electronic and Electrical Engineering's (IEEE) 802.14 Cable TV Media Access Control and Physical Protocol Working Group was formed in 1994 to develop international standards for data communications over cable. The goal was to submit a cable modem Media Access Control and Physical Protocol standard to the IEEE in December 1995, but the delivery date slipped to late 1997.

Because of the delay in finalizing the IEEE 802.14 standard, certain cable operators, operating under a limited partnership dubbed Multimedia Cable Network System Partners Ltd. (MCNS), proceeded to research and publish their own set of interface specifications for high-speed cable data services. MCNS released its Data Over Cable System Interface Specification (DOCSIS) for cable modem products to vendors in March 1997. Many vendors have announced plans to build products based on the MCNS DOCSIS standard.

The differing cable modem specifications advocated by IEEE 802.14 and MCNS reflect the priorities of each organization. The 802.14 group focused on creating a future-proof standard based on industrial-strength technology. The members of MCNS, on the other hand, were concerned with mnimizing product costs and time to market. To achieve its objectives, MCNS sought to minimize technical complexity and develop a technology solution that was adequate for its members' needs.

At the physical layer, which defines modulation formats for digital signals, the IEEE and MCNS specifications are similar. The 802.14 specification supports the International Telecommunications Union's (ITU) J.83 Annex A, B and C standards for 64/256 QAM modulation, providing a maximum 36 Mbps of downstream throughput per 6 MHz television channel. The Annex A implementation of 64/256 QAM is the European DVB/DAVIC standard, Annex B is the North American standard supported by MCNS, while Annex C is the Japanese specification. The proposed 802.14 upstream modulation standard is based on QPSK (quadrature phase shift keying) and 16QAM, virtually the same as MCNS.

As for media access control, which sets the rules for network access by users, 802.14 specified Asynchronous Transfer Mode (ATM) as its default solution from the headend to the cable modem. MCNS uses a scheme based on variable-length packets that favors delivery of Internet Protocol (IP) data. Although the MCNS media access control is based on packets and the IEEE specifies fixed ATM cells, both cable modem solutions specify a 10 Base-T Ethernet connection from the cable modem to the PC.

It would be desirable to have a multimedia data distribution system and method that overcomes limitations of the Multimedia Cable Networking Standards architecture. Accordingly, it is an objective of the present invention to provide for broadband multimedia data distribution system apparatus for integrating satellite broadband data distributed over a cable TV network with legacy corporate local area networks.

SUMMARY OF THE INVENTION

To meet the above and other objectives, the present invention provides for a broadband multimedia data distribution system that integrates satellite broadband data distributed over a cable TV network with a legacy corporate local area network (LAN). The present invention provides a broadband network overlay with satellite data delivery that integrates with currently available cable television transmission media The present invention thus integrates broadband multimedia data distribution, cable TV network distribution, and the legacy network to expand corporate information services. The present invention thus expands existing network capabilities and avoids replacement or upgrade costs.

More particularly, the broadband multimedia data distribution system comprises a satellite receiver that receives a satellite feed whose output is coupled to an enterprise server for distributing broadband data content derived from the satellite feed. Network switching equipment is coupled to the enterprise server whose output is coupled by way of a router to a local area network. Headend equipment is coupled to the network switching equipment that comprises a cable modem terminating system, one or more upconverters, a combiner, and a diplexer. A bidirectional cable transmission system interconnects the diplex filter and a cable modem, and a personal computer is coupled to the cable modem.

Client and server software provided on the enterprise server and on the personal computer provides for access to broadband content, broadband network services provided by the satellite receiver and enterprise server, and network services provided by the local area network.

Unique aspects of the present invention include the provision for satellite broadband data delivery and the interconnection of a "data over cable TV" network with an existing corporate LAN using router (layer **3**) networking equipment and server software and client/server software used to integrate the services of the broadband receiver and server and the existing corporate LAN.

BRIEF DESCRIPTION OF THE DRAWINGS

The various features and advantages of the present invention may be more readily understood with reference to the following detailed description taken in conjunction with the accompanying drawings, wherein like reference numerals represent like structural elements, and in which

FIG. **1** is a block diagram that illustrates the architecture of a Multimedia Cable Networking Standards system; and

FIG. **2** is a block diagram that illustrates a broadband multimedia data distribution system in accordance with the principles of the present invention.

DETAILED DESCRIPTION

Referring to the drawing figures, FIG. **1** is a block diagram that illustrates the architecture of a Multimedia

Cable Networking Standards (MCNS) system **10**. As is shown in FIG. **1**, the MCNS system **10** includes a public service telephone network (PSTN) **11** that is connected to a distribution hub **13** or headend equipment **13** by way of a local exchange carrier digital subscriber service **11***a* (DS 1 at 1.544 Mbps or DS3at 44.736 Mbps). The public service telephone network **11** is connected to a remote access server **14** or dial-up server **14** that is part of the distribution hub **13**.

The distribution hub **13** also includes a headend switch **15** or backbone transport adapter **15** that is coupled to the remote access server **14**. The headend switch **15** or backbone transport adapter **15** is coupled to a backbone network **12** by way of a wide area network **18***a*. The headend switch **15** or backbone transport adapter **15** is also coupled to a local sever facility **16**. A remote sever facility **17** is also coupled to the backbone network **12** by way of a wide area network **18***b*.

The headend switch **15** or backbone transport adapter **15** is connected by way of a cable modem termination system network side interface **41** to a network termination **23** of a cable modem termination system **22**. The network termination **23** is coupled to a modulator (MOD) **24** and to a demodulator (DEMOD) **25**. The output of the modulator **24** is coupled by way of a cable modem termination system downstream RF side interface **44** to a data input of a combiner **27**. The combiner **27** also receives video inputs for distribution. The combiner **27** is coupled to a transmitter (TX) **31** which communicates over a fiber link **36** to a plurality of O:E nodes (optical/electrical node) **33**.

Each node **33** is coupled, through a coaxial cable plant, by way of a cable modem to RF interface **46** to an input of a cable modem **34**. The cable plant may have a spectrum of from about 50 MHz to about 750 MHz. The cable modem **34** is coupled by way of a cable modem to customer equipment interface **48** to customer equipment **35**, such as a personal computer **35**. A telephone company return (Telco return) is provided from the cable modem **34** to the telephone company by way of a cable modem to telephone company interface **47**.

Each node **33** is also coupled by way of a fiber link **36** to a receiver (RX) **32**. The receiver **3** is coupled to an upstream splitter and filter bank **28**. Data outputs of the upstream splitter and filter bank **28** are coupled by way of a cable modem termination system upstream RF side interface **45** to the demodulator (DEMOD) **25**. The demodulator (DEMOD) **25** is coupled to the network termination **23**.

An operations support system **21** is coupled by way of a data over cable system OSS interface **43** to the cable modem termination system **22**. The data over cable system OSS interface **43** meets a CMCI (cable modem computer interface) specification. A security and access controller **26** is coupled to the cable modem termination system **22** by way of a security management interface **42**.

Referring now to FIG. **2**, it is a block diagram that illustrates a broadband multimedia data distribution system **50** in accordance with the principles of the present invention. The broadband multimedia data distribution system **50** requires installation of cable media, RF headend (primary sending and receiving transmission equipment), cable modem terminating equipment, and cable modems, similar to equipment that is used in the MCNS system **10**.

The broadband multimedia data distribution system **50** comprises a satellite receiver **51** for receiving a satellite feed. The satellite receiver **51** includes a receive antenna, a low noise block down converter and RF and digital video broadcast (DVB) demodulators. The satellite receiver **51** is coupled to an enterprise server **52** that provides for distribution of broadband data content. The satellite receiver **51** and enterprise server **52** form a broadband subnetwork **50***a* of the system **10**. The enterprise server **52** is coupled to a first input of a network switching equipment **56**, such as a fast Ethernet switch **56**, that is used to interconnect the various network elements of the system **10**.

A plurality of additional network servers may be coupled to the fast Ethernet switch **56** that provide for any number of standard services. For example, FIG. **1** illustrates the use of a network management server **53** that is coupled to a second input of the fast Ethernet switch **56**. Also shown is an ftp, mail and http server **54** that is coupled to a third input of the fast Ethernet switch **56**. A caching server **55** may also be coupled to a fourth input of the fast Ethernet switch **56**.

The fast Ethernet switch **56** is coupled by way of a router **57** (layer **3** data distribution equipment) to an existing (legacy) local area network (LAN) **58**. The fast Ethernet switch **56** is also coupled to headend equipment **60**. The headend equipment **60** comprises a cable modem terminating system (CMTS) **61**, appropriate upconverters **62**, a combiner **63**, and a diplexer **64**.

The cable modem terminating system **61** is capable of providing one or more 6 Mz data channels over the same cable plant. Each 6 MHz data channel provides a data rate of approximately 30 Mbps depending on the modulation that is used (64/256 QAM). Given that the cable plant has a spectrum of from 50 MHz to 750 MHz, the present system provides for transmission of a large amount of broadband data

The cable modem terminating system **61** is coupled to one or more upconverters (optional), one for each 6 MHz data channel. Outputs of the upconverters **62** are coupled to inputs of a combiner **63**. The output of the combiner **63** is coupled to the diplexer **64**, or diplex filter **64**. The diplex filter **64** is coupled by way of a cable system **67** to a cable modem **65**. The cable system **67** is capable of providing two-way transmission. Each cable modem is capable of transmitting data originating at the user computer to the head end, on frequencies consistent with a two-way cable system. The diplexer **64** or diplex filter **64** is also coupled to the cable modem terminating system **61**, terminating one or more cable modem transmission channels. The cable modem **65** is coupled to a personal computer **66** of a cable client.

To integrate the various components of the system **10**, client and server software is provided on the various servers **52**, **53**, **54**, **55** and on the personal computer **66** of the cable client to access the broadband content, network services provided on the broadband subnetwork **51***a*, and network services provided by the existing local area network (LAN) **58**.

The enterprise server acts as the primary manager of the services provided over the network. Enterprise channel/server software acts as a proxy for the servers **53**, **54**, **55** directly attached to the network and for services existing on the local area network (LAN) **58**. The enterprise client/server thus directs requests for services which it cannot provide otherwise. The enterprise client/server software provides the only means of accessing broadband information transferred via satellite. The servers **53**, **54**, **55** are used for illustrative purposes only to demonstrate the alternatives available in providing integrated broadband services. The enterprise client/server software is readily constructed using http server, proxy server, and browser technologies.

Thus, apparatus for integrating satellite broadband data distributed over a cable TV network with legacy corporate

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