

ANSI/CEA Standard

Versatile Home Network

ANSI/CEA-851-A

July 2006



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(Formulated under the cognizance of the CEA's **R7 Home Network Committee**.)

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FOREWORD

This standard was developed under the auspices of the R7 Home Network Committee.

It should be noted that this current version, CEA-851-A, supersedes CEA-851.

The Video Electronics Standards Association (VESA) established the VESA Home Network (VHN) Committee in 1995 to create the architecture for a digital, broadband home network. The VHN standard was initially developed by the VESA Home Network Committee. However, it was never ratified as a VESA standard.

In June 1999, the Consumer Electronics Association (CEA) established the R7 Committee to help harmonize the several efforts being undertaken to develop home networking standards. In January 2000, the Board of Directors of VESA and the Board of Directors of the Consumer Electronics Association agreed to merge the VESA Home Network and the CEA R7 Committee, by establishing the CEA R7.4 Committee.

CEA-851 was completed and approved in 2000. Work started on CEA-851-A in 2003. Subsequently, CEA-851-A was transferred to R7 WG3 as the R7 standards committee was reorganized by the CEA and R7.4 was dissolved. In 2004 CEA asked the 1394 Trade Association (1394TA) to help develop CEA-851-A. The 1394TA presented a proposal for CEA-851-A to CEA in January 2005.

This standard is to be forwarded to JTC1 SC25 WG1 for international adoption.

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Introduction

This standard defines an IP-enabled network for connecting cluster networks to a whole-home broadband distribution backbone in order to facilitate integrated operation of appliances and networked components. The distribution network in this standard is based on IEEE 1394. This network will accommodate Ethernet as an attached network via a bridge, and directly with the introduction of IEEE 1394c. The network defined in this standard is called the Versatile Home Network (VHN Home Network). The VHN Home Network provides a flexible and open network architecture and communications protocol specification for digital devices in the home.

Function and use of a VHN Home Network:

- Allows the transfer of information among all connected digital devices in the home, either as directly connected end devices or as part of a cluster network.
- Allows interoperability between devices on different cluster networks in the home, including low bandwidth networks and high bandwidth networks.
- Provides a common interface to Residential Gateways that connect devices in the home to access networks.
- Provides user-to-device control.
- Provides device-to-device control.
- Provides home network management for devices and applications.

NOTE: CEA-851-A defines a home intranet as a collection of networks that provides complete connectivity between end devices. This intranet uses the facilities of the TCP/IP protocol suite for asynchronous (and some isochronous) communications. Almost all of the underlying technologies, from media to applications, are defined elsewhere, as standards that were developed by national standards bodies, by international standards bodies, or by industry consortia. CEA-851-A is different from most other standards in that it places unusual emphasis on incorporation of these other technologies and protocols. In many cases, the entire technology or protocol is included by reference in CEA-851-A. Thus, a single sentence in this standard may imply hundreds of pages of definitions and requirements from other documents. It is important for the reader and user of CEA-851-A to understand that the underlying specifications must be respected, and carefully followed, for the VHN to be an effective integrating tool for the home network.

VHN (Versatile Home Network)

A Broadband Home Network

1 Scope and Purpose

1.1 Purpose

The VHN enables several important classes of applications for the home network:

- **Entertainment services** — which include the distribution of video, audio, and video games, and the control of audio/video (A/V) devices such as TVs, VCRs, and set-top boxes.
- **Communication services** — which include voice telephony (wired and wireless), video telephony, video conferencing, distance learning, and remote access to corporate networks.
- **Information services** — which include Internet access, on-line service access, PC file and printer sharing, news and information on demand, home shopping, and home banking.
- **Home automation services** — which include lighting, appliance control, energy management, comfort control, and premises security.

Figure 1 shows a VHN Home Network that supports these services.

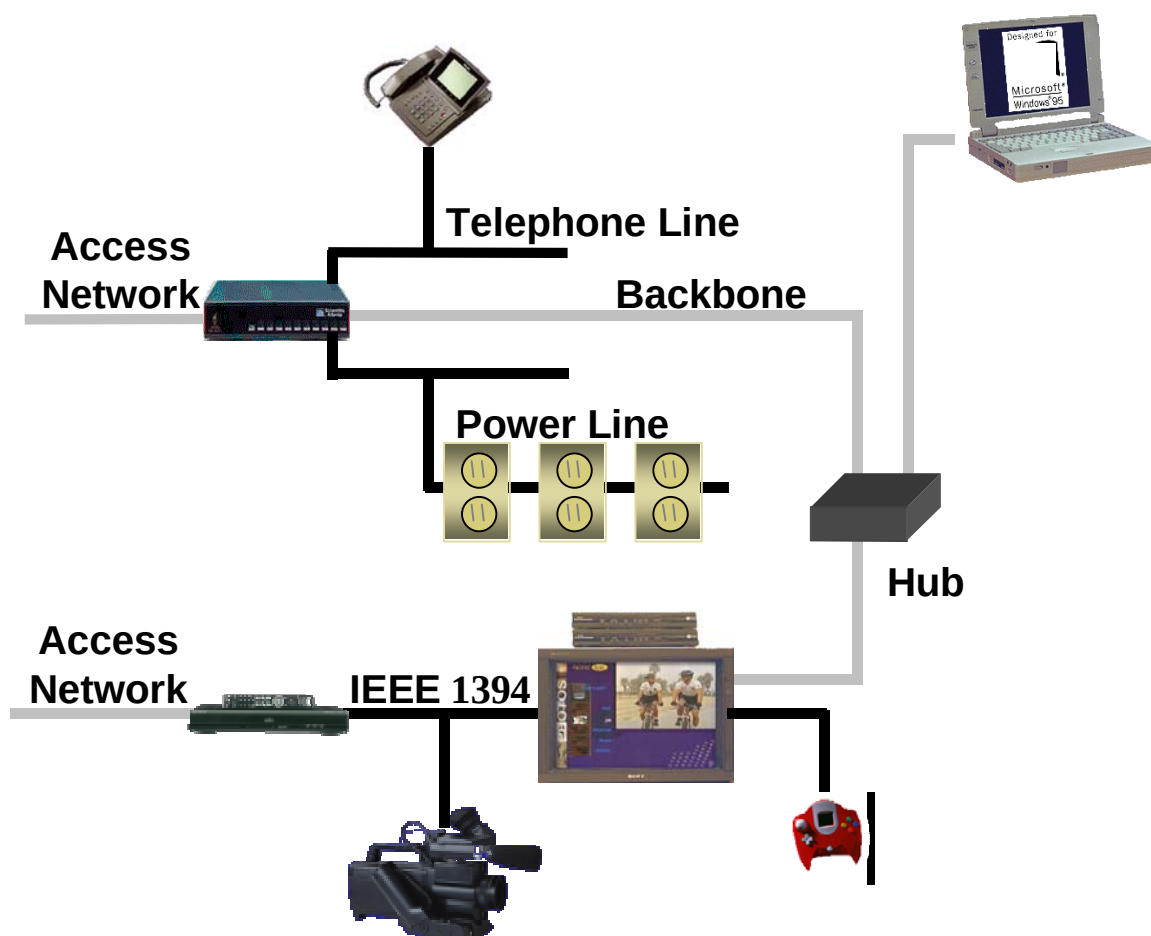


Figure 1 – A VHN Home Network

1.2 Scope

The VHN Home Network is defined by an abstract model (see Figure 2) that satisfies the needs of the classes of applications described in the Section 1.1. The model consists of:

- A backbone network.
- One or more component networks.
- A number of access devices that connect the home network to external access networks.
- A number of network devices that connect component networks to the home backbone network.
- End devices that provide various functional services to the home user.

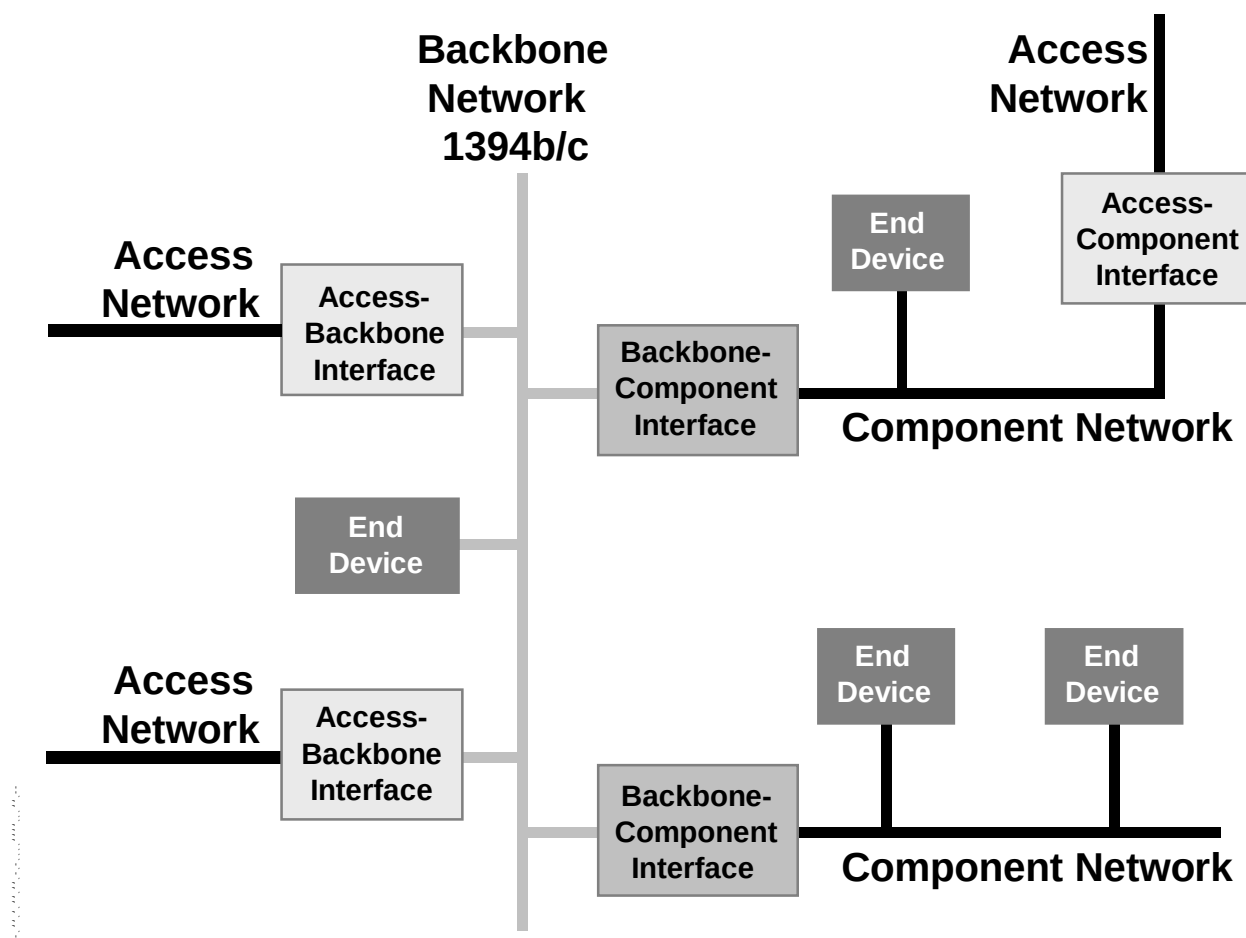


Figure 2 – An Abstract VHN Home Network

The key components of the VHN network architecture are:

- **End Device** — An end device is a digital device connected to the home network that provides some utility (other than network service) to the end user. Examples of end devices are printers, televisions, audio speakers, security sensors, and HVAC (Heating, Ventilating, and Air-Conditioning) controllers.
- **Component Networks** — The component networks enable the several devices connected to them to communicate with each other. The component network is connected to the backbone through a backbone-component interface. The choice of a component network for a particular device is dictated by the communication needs and cost points of the device. Some examples of important component networks are IEEE 1394-1995, Ethernet, HomePNA, X-10™, Powerline CEBus™, Echonet™, and RF Wireless LAN.
- **Backbone-Component Interface** — In VHN Home Network terminology, a network interconnection or backbone-component interface device is an element that provides network services to end devices. Examples of network devices include repeaters, bridges, routers, brouters, and network management stations, or any device that implements such a function (e.g., a personal computer).

- **Access-Backbone Interface and Access-Component Interface**—An access-backbone interface connects an external access network to the home network. Access-component interfaces connect to a component interface through which a connection is made to the home network backbone. Some examples of access interfaces are a POTS modem, an xDSL adapter, a cable modem, a DBS (satellite TV service) decoder, and a Residential Gateway. ISO/IEC 15045, “Residential Gateway,” defines a standard residential gateway that is referenced in this standard (see Section 8.1).

The VHN Home Network architecture is extremely flexible, allowing it to be adapted to meet the needs of many living styles. Annex A contains illustrations of three VHN Home Network implementations as examples of how the abstract architecture of Figure 2 may be translated into an actual VHN Home Network.

2 Normative References

2.1 Normative Reference List

The following standards contain provisions that, through reference in this text, constitute normative provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed in this section.

1. ANSI/CEA-2027-A, A User Interface for Home Networks Using Web-based Protocols, March 2005.
2. AV/C Digital Interface Command Set General Specification Version 4.2, <http://www.1394ta.org>.
3. Enhancements to the AV/C General Specification 3.0 Version 1.1, <http://www.1394ta.org>.
4. CEA-851.1, IP-Based Digital Telephony for the Versatile Home Network
5. CEA-851.2, Security Services for the Versatile Home Network
6. CEA-2007, QoS Priority Groupings for 802.1Q
7. IEEE 1394-1995 – Standard for a High Performance Serial Bus – Firewire, <http://www.ieee.org>
8. IEEE 1394.1-2004 – High Performance Serial Bus Bridges, <http://www.ieee.org>
9. IEEE 1394a-2000 – IEEE Standard for a High Performance Serial Bus- Amendment 1, <http://www.ieee.org>
10. IEEE 1394b-2002 – IEEE Standard for a Higher Performance Serial Bus-Amendment 2, <http://www.ieee.org>

11. IEEE p1394c-200x – IEEE Standard for a Higher Performance Serial Bus-Amendment 3, draft 0.3, April 27, 2004, <http://grouper.ieee.org/groups/1394/c/1394c.pdf>
12. IEC 61883-1 – Consumer Audio/Video Equipment – Digital Interface, 1998.
13. IP1394, IPv4 over IEEE 1394, P. Johansson, September 1998, <ftp://ftp.ietf.org/internet-drafts/draft-ietf-ip1394-ipv4-11.txt>.
14. ISO 639, ISO-639: Code for the representation of names of languages, 1988 et seq. <http://www.iso.ch>. (ISO is the International Organization for Standardization.)
15. IEEE 802.1d, Annex H (formerly 802.1p), ISO/IEC 15802-3:1998, *IEEE Standard for Information technology--Telecommunications and information exchange between systems--IEEE standard for local and metropolitan area networks--Common specifications--Media access control (MAC) Bridges*, IEEE 802.1D, 1998 Edition.
16. IEEE 802.1q, IEEE Standard for Local and Metropolitan area networks: Virtual Bridged Local Area Networks, IEEE, December 1998.
17. ISO 8601, ISO, ISO 8601:1988 (E), Data elements and interchange formats - Information interchange - Representation of dates and times, 1998. <http://www.iso.ch>
18. ISO/IEC 10646, ISO/IEC 10646-1993 (E). Information technology – Universal Multiple-Octet Coded Character Set (UCS) -- Part 1: Architecture and Basic Multilingual Plane. [Geneva]: International Organization for Standardization, 1993 (plus amendments AM 1 through AM 7). <http://global.ihs.com> or <http://www.iso.ch>
19. ISO/IEC 15018 Information technology — Interconnection of information technology equipment — Generic cabling for homes. <http://www.iso.ch>
20. ISO/IEC 15045-1 Information technology — Interconnection of information technology equipment — Home Electronic System [HES] — Part1: A Residential gateway model for HES. <http://www.iso.ch>
21. OG-UUID, The Open Group, Universal Unique Identifier Format
22. OTP, The Open Trading Protocol Consortium. Internet Open Trading Protocol Part 2: Specification. Version 0.9, 12 January 1998., <http://www.otp.org>
23. RFC 1945, T. Berners-Lee, R. Fielding, H. Frystyk, Hypertext Transfer Protocol - HTTP/1.0
24. RFC1738, "Uniform Resource Locators", T. Berners-Lee, L. Masinter, and M. McCahill, December 1994. Available at <ftp://ftp.isi.edu/in-notes/rfc1738.txt>.
25. RFC-1766, H. Alvestrand. March 1995, Tags for the Identification of Languages

26. RFC1808, "Relative Uniform Resource Locators", R. Fielding, June 1995. Available at <ftp://ftp.isi.edu/in-notes/rfc1808.txt>.
27. RFC-2045, N. Freed & N. Borenstein. November 1996, *Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies*.
28. RFC-2046, N. Freed & N. Borenstein. November 1996, *Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types*.
29. RFC-2311, Dusse, S., P. Hoffman, B. Ramsdell, L. Lundblade, and L. Repka. *S/MIME Version 2 Message Specification* [RFC 2311]. March 1998.
30. RFC-959, J. Postel, J. Reynolds, *File Transfer Protocol*
31. SSL, Freier, Alan O., Philip Karlton, and Paul C. Kocher. *The SSL Protocol Version 3.0* [<http://www.netscape.com/eng/ssl3/ssl-toc.html>]. Netscape Communications Corporation: March 1996. As amended by SSL 3.0 Errata of August 26, 1996 [<http://www.netscape.com/eng/ssl3/ssl-errata.html>].
32. TIA-570-B Residential Telecommunications Infrastructure Standard (ANSI/TIA-570-B-2004).
33. UPnP AV Architecture:0.83 for UPnP™ Version 1.0, Preliminary Design, June 12, 2002
34. UPnP AVTransport for UPnP™ Version 1.0, Preliminary Design, June 25, 2002
35. UPnP ConnectionManager:1 Service Template Version 1.01 for UPnP™ Version 1.0, June 25, 2002.
36. UPnP ContentDirectory:1 Service Template Version 1.01 for UPnP™ Version 1.0, June 25, 2002.
37. UPnP™ Device Architecture, Version 1.0, June 2000 <http://www.upnp.org>.
38. UPnP Device Architecture, Annex A–IPv6, August 8, 2002.
39. UPnP InternetGatewayDevice:1 Device Template Version 1.01 for UPnP™ Version 1.0, November 12, 2001.
40. UPnP MediaServer:1 Device Template Version 1.01 for UPnP™ Version 1.0, June 25, 2002.
41. UPnP MediaRenderer:1 Device Template Version 1.01 for UPnP™ Version 1.0, June 25, 2002.
42. W3C-NOTE-datetime, Misha Wolf, Charles Wicksteed, Date and Time Formats <http://www.w3c.org>

43. XML-NS, "Namespaces in XML", 27th March 1998, W3C Working Draft
(<http://www.w3.org/TR/WD-xml-names>)

2.2 Request For Comments (RFCs)

The following Requests For Comment filings are referenced in this standard:

RFC 879	The TCP Maximum Segment Size and Related Topics
RFC 815	IP Datagram Reassembly Algorithms
RFC 813	Window and Acknowledgment Strategy in TCP/IP
RFC 793	(MIL STD 1778) Transmission Control Protocol (TCP)
RFC 792	Internet Control Message Protocol (ICMP)
RFC 791	(MIL STD 1777) Internetwork Protocol (IP)
RFC 768	User Datagram Protocol (UDP)
RFC 1918	Address Allocation for Private Internets – specifies IANA private network addresses - and their uses
RFC 1631	The IP Network Address Translator (NAT) - How to make the private home network access the internet
RFC 1531	Dynamic Host Configuration Protocol, Easy IP – Sections as appropriate for the role of the device.
RFC 1112	Host Extensions for IP Multicasting
RFC 1101	DNS Encoding of Network Names and Other Types
RFC 1035	Domain Names---Implementation and Specification
RFC 1034	Domain Names---Concepts and Facilities
RFC 1889	RTP: A Transport Protocol for Real-Time Applications
RFC 2131	Dynamic Host Configuration Protocol
RFC 2326	Real Time Streaming Protocol (RTSP)
RFC 2616	HTTP v1.1
RFC 3066	Tags for the Identification of Languages
Draft-IETF-IP1394-IPv4	IPv4 over 1394 – or corresponding RFC when ratified.
Draft-gentric-avt-rtsp-http-00	Gentric – or corresponding RFC when ratified

2.3 Informative References

1. DES, National Institute of Standards and Technology, U.S. Department of Commerce. Data Encryption Standard [NIST FIPS PUB 46-1], January 1988.
2. DH, American National Standards Institute. Accredited Standards Committee X9 Working Draft: American National Standard X9.42-1993: Public Key Cryptography for the Financial Services Industry: Management of Symmetric Algorithm Keys Using Diffie-Hellman. American Bankers Association, September 21, 1994.
3. DSS, National Institute of Standards and Technology, U.S. Department of Commerce. Digital Signature Standard [NIST FIPS PUB 186]. 18 May 1994.

4. PKCS-1, RSA Laboratories. PKCS #1: RSA Encryption Standard. Version 1.5, November 1993.
5. PKCS-7, RSA Laboratories. PKCS #7: Cryptographic Message Syntax Standard. Version 1.5, November 1993.
6. RFC-2119, S. Bradner, Key words for use in RFCs to Indicate Requirement Level
7. RFC-2268, Rivest, R. A Description of the RC2® Encryption Algorithm [RFC 2268]. March 1998.
8. TLS, Dierks, Tim and Christopher Allen. The TLS Protocol Version 1.0. Work in progress.
9. XMLCIM-WP, "XML as a Representation for Management Information - A White Paper", Roger Booth, Microsoft Corporation, 1998
(http://wbem.freerange.com/wbem/xml_whitepaper.doc)

3 Definitions and Abbreviations

3.1 Definitions

The following terms are used in this standard and commonly used in other industry publications. As used in this standard, they have the following meanings:

Access Line	A facility that connects the home to an external <i>access network</i> .
Access Network	A network external to the home.
Address	A sequence of characters that uniquely identify a network destination (endpoint) in a communication system.
ADSL	Asymmetric Digital Subscriber Line, a high-bandwidth access technology that uses the in-place copper loop. Bitrate is "asymmetric" in the directions to and from the home: To the home, bitrate may be between 1.544 Mb/s and 8.448 Mb/s (depending on the distance from the access provider's termination), while bitrate from the home may be between 16 kb/s and 640 kb/s (again, depending on distance).
Aggregation	A strong form of an <i>association</i> . For example, the containment relationship between a system and the components that make up the system can be called an <i>aggregation</i> . An <i>aggregation</i> is expressed as a <i>Qualifier</i> on the <i>association class</i> . <i>Aggregation</i> often implies, but does not require, that the aggregated <i>objects</i> have mutual dependencies.
Association	A <i>class</i> that expresses the relationship between two other <i>classes</i> . The relationship is established by the presence of two or more <i>references</i> in the <i>association class</i> pointing to the related <i>classes</i> .
Asynchronous Transmission	Data transmission between devices that are not synchronized with one another using a clocking mechanism or other technique.

AV/C	The Audio/Video Control language developed by the IEEE 1394 Trade Association used to control consumer audio/video equipment.
Bandwidth	The range of frequencies occupied by a signal
Bridging	Connecting two or more network segments or subnetworks at the Data Link layer of the OSI Reference Model.
Browser	A Presentation Engine that is capable of rendering HTML documents on a display.
CAL	The Common Application Language, developed as the control language for CEBus.
Cardinality	A relationship between two classes that allows more than one <i>object</i> to be related to a single <i>object</i> . For example, Microsoft Office™ is made up of the software elements Word, Excel, Access and PowerPoint.
Catalog	A set of service offers. A Client obtains a catalog from a Server, and uses the offers within the catalog to locate a service.
CEBus	The Consumer Electronics Bus, an EIA standard for home data networking on twisted pair, coax, powerline and IR; CEBus uses the CAL language for control.
CIM	Common Information Model is the schema of the overall managed environment. It is divided into a <i>Core model</i> , <i>Common model</i> and <i>extended schemas</i> .
CIM Schema	The schema representing the <i>Core</i> and <i>Common models</i> . Versions of this schema will be released by the DMTF over time as the schema evolves.
Class	A collection of instances, all of which support a common type; that is, a set of <i>properties</i> and <i>methods</i> . The common <i>properties</i> and <i>methods</i> are defined as <i>features</i> of the <i>class</i> . For example, the <i>class</i> called Modem represents all the modems present in a system.
Client	One of the two parties in a VHNE relationship (the other one being the Servers). The Client uses VHNE to obtain information and control/management information from the Servers.
Common model	A collection of <i>models</i> specific to a particular area, derived from the <i>Core model</i> . Included are the system <i>model</i> , the application <i>model</i> , the network <i>model</i> and the device <i>model</i> .
Conditional Access	The strategy and process that denies access to services based on authorization or payment.
Control	The vertical plane, or stack, in the network protocol model, which contains all of the protocol layers that are specifically dedicated to providing control and signaling. Control function can be from user to devices (user-to-device control), or between devices (device-to-device control).
Core model	A subset of <i>CIM</i> , not specific to any platform. The <i>Core model</i> is set of <i>classes</i> and <i>associations</i> that establish a conceptual framework for the <i>schema</i> of the rest of the managed