DOCSIS Set-top Gateway (DSG) Interface Specification

SP-DSG-I01-020228

Issued Specification

Notice

Document Status Sheet

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Key to Document Status Codes:

Work in Progress	An incomplete document, designed to guide discussion and generate feedback, that may include several alternative requirements for consideration.
Draft	A document in specification format considered largely complete, but lacking review by Members and vendors. Drafts are susceptible to substantial change during the review process.
Issued	A stable document, which has undergone rigorous member and vendor review and is suitable for product design and development, cross-vendor interoperability, and for certification testing.
Released	A stable document, reviewed, tested and validated, suitable to enable cross-vendor interoperability.

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1 SCOPE

1.1 Introduction and Overview

This interface specification is one of a family of interface specifications designed to facilitate the implementation of data services over Hybrid Fiber Coax (HFC) cable networks, as well as over coaxial-only cable networks. Figure 1-1, on the following page, provides the context for this specification in relation to the data over cable reference architecture and the other interface specifications in the family.

This specification defines the interface requirements for transport of a class of service known as "Out-Of-Band (OOB) messaging" between a set-top network controller (or servers) and the customer premise equipment (CPE). In general, the CPE is intended to be a digital set-top terminal (Host), but may include other CPE devices, such as Residential Gateways or other electronic equipment. Traditionally, the physical transport of this Out-Of-Band messaging has been carried over dedicated channels, as specified by SCTE/DVS-167 [SCTE1] and SCTE/DVS-178 [SCTE2]. This specification defines the applicable communications standards and protocols needed to implement an Out-Of-Band messaging interface to the CPE using DOCSIS transport. It applies to cable systems employing HFC and coaxial architectures. Specifically, the scope of this specification is to:

- Describe the communications protocols and standards to be employed
- Specify the data communication requirements and parameters that will be common to all units

The intent of this document is to specify open protocols, with a preference for existing, well-known and well-accepted standards. This interface specification is written to provide the minimal set of requirements for satisfactory communication between the set-top network controller and the CPE device over DOCSIS transport. "DOCSIS Set-top Gateway" (DSG) shall be the general term used to describe this interface.

1.2 Purpose of document

Cable operators have deployed millions of digital set-top terminals enabling broadcast and interactive services. They have also deployed millions of DOCSIS cable modems with the associated infrastructure, CMTS, routers, and network connectivity. There is significant interest in enabling high-speed data communications to set-top terminals for advanced services that leverage the existing infrastructure of digital video and DOCSIS networks. Cable Television Laboratories, Inc. and CableLabs member companies, have decided to prepare a series of interface specifications that will permit the early definition, design, development and deployment of data-over-cable and OpenCable™ systems on an uniform, consistent, open, non-proprietary, multi-vendor interoperable basis.

The intended service will allow transparent uni-directional and bi-directional transport of Out-Of-Band messaging over Internet Protocol (IP), between the cable system headend and customer locations, over an all-coaxial or hybrid-fiber/coax (HFC) cable network. This is shown in simplified form in Figure 1-1.

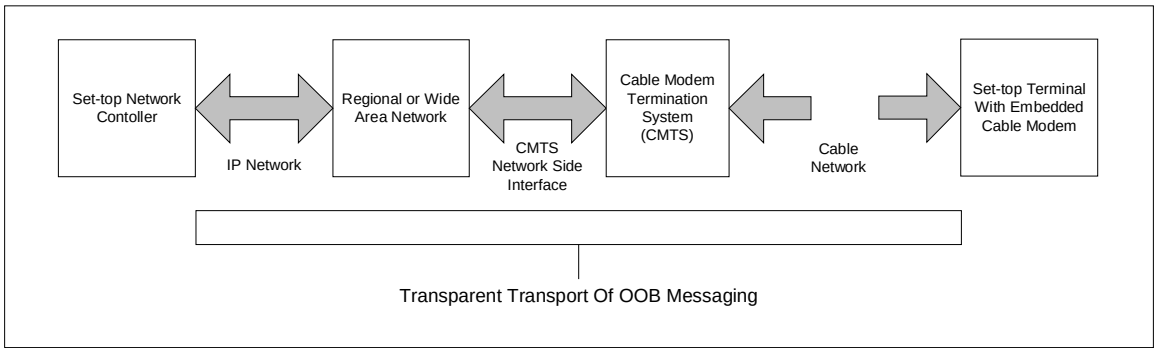

Figure 1-1 – Transparent Out-Of-Band Messaging Via DOCSIS

The transmission path over the cable system is realized at the headend by a Network Controller that is responsible for managing the set-top terminals, a regional or wide area IP network connecting the Network Controller to the CMTS, a Cable Modem Termination System (CMTS), and, at each customer location, a set-top terminal with an embedded Cable Modem (Host). At the headend (or hub), the interface to the data-over-cable system is called the Cable Modem Termination System - Network-Side Interface (CMTS-NSI) and is specified in [DOCSIS2].

The intent is for the cable operators to transparently transport OOB messaging traffic between these interfaces, including but not limited to IP datagrams (TCP and UDP) in either unicast, broadcast, or multicast forms.

1.3 Reference Architecture

The reference architecture for the data-over-cable services and interfaces is shown in Figure 1-2.

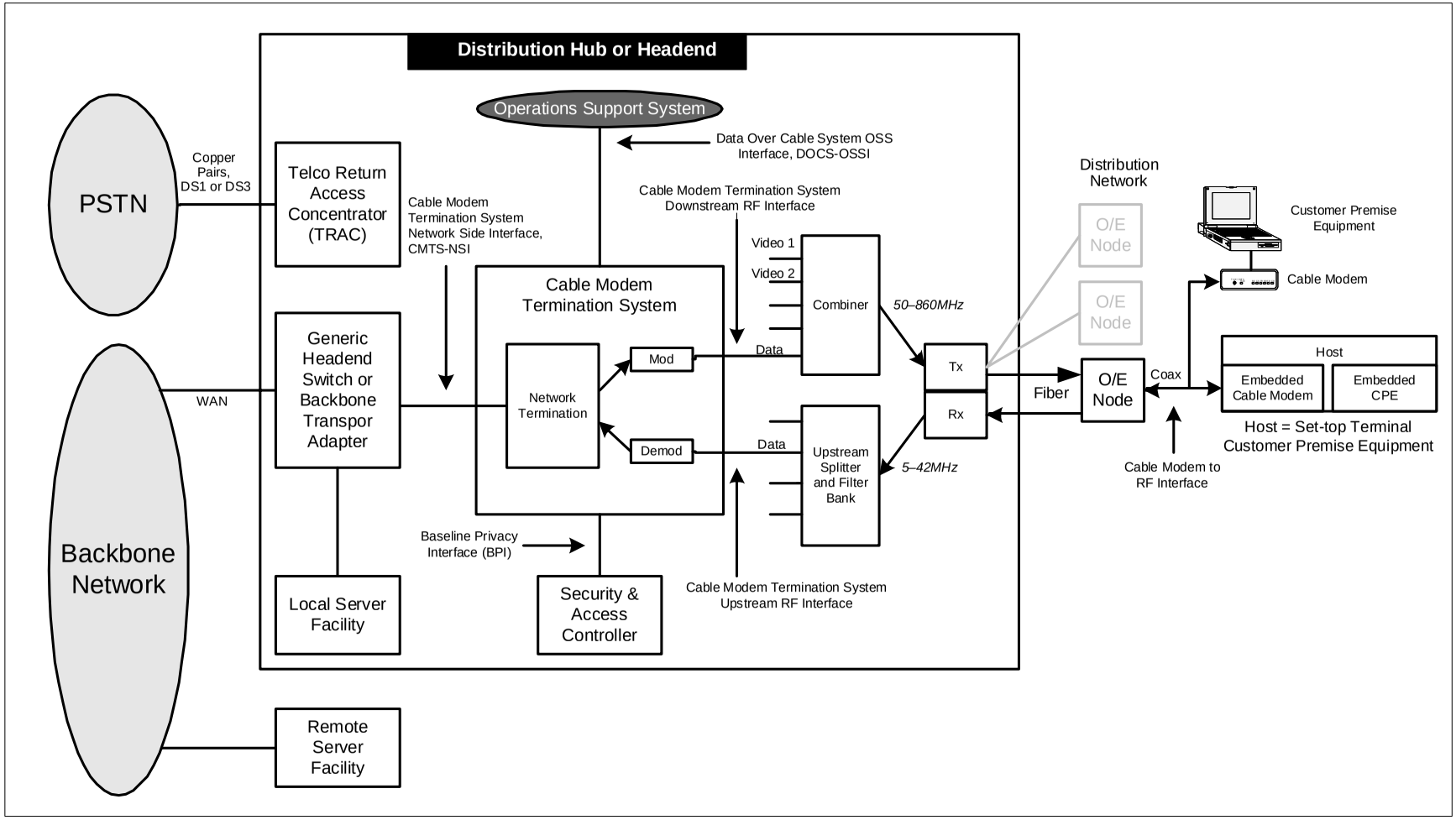

Figure 1-2 – Data-Over-Cable Reference Architecture

The DOCSIS Set-top Gateway architecture is an adaptation of the DOCSIS reference architecture shown in Figure 1-2 above. Figure 1-3 below shows how the DOCSIS Set-top Gateway layers on the DOCSIS reference architecture. As shown in this figure there are potentially multiple servers (1 to L) that function as the Set-top Network Controller, a regional IP network or IP backbone that connects these servers to potentially multiple CMTS (1 to N) located in distribution hubs or headends, an HFC/Cable Network that connects the CMTS to the Hosts located in the subscriber's home. The DOCSIS Set-top Gateway as shown in this diagram can be implemented in the CMTS or it may be implemented in a separate piece of equipment. The logical view of the DOCSIS Set-top Gateway is shown in Figure 1-4.

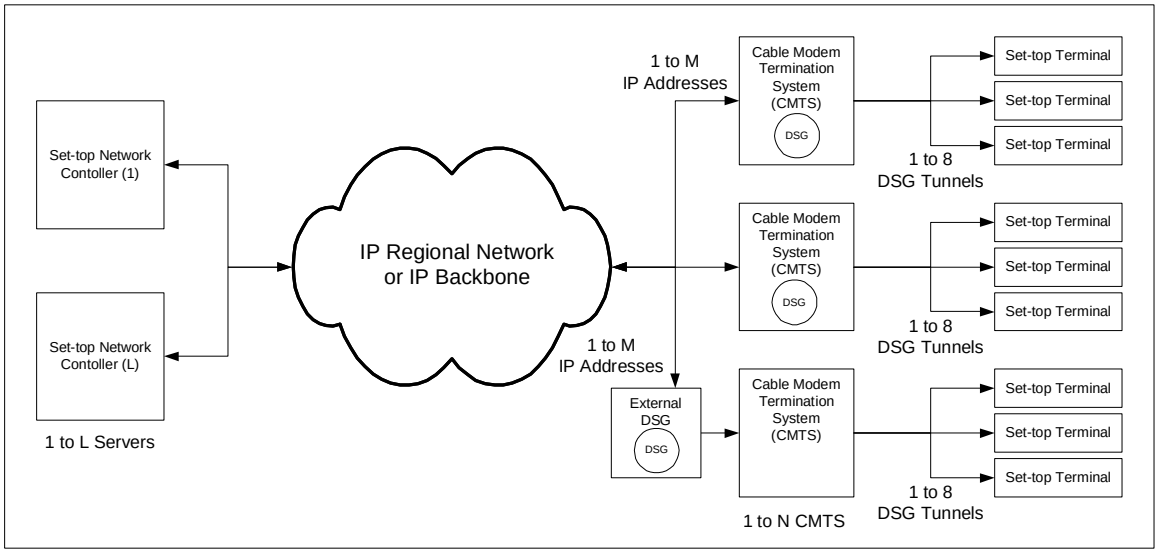

Figure 1-3 – DOCSIS Set-top Gateway Physical Diagram

The DOCSIS Set-top Gateway maps IP datagrams received on its IP Network Interface to DSG Tunnels on the DOCSIS transport. In particular, the DOCSIS Set-top Gateway:

- Receives IP datagrams (either unicast or multicast) on potentially multiple IP addresses (1 to M)
- It then maps these datagrams to potentially multiple DSG Tunnels (1 to 8) on the DOCSIS transport and forwards them on to the Hosts

Although it is likely that there will be a one-to-one mapping between IP address and DSG Tunnel, no restrictions are placed on this mapping. One IP address may be mapped to one or more DSG Tunnels and Multiple IP addresses may be mapped to one or more DSG Tunnels.

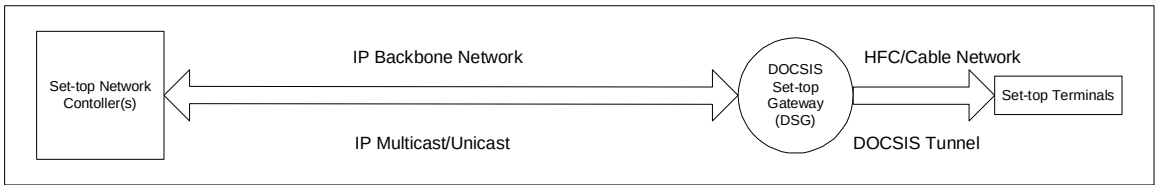

Figure 1-4 – DOCSIS Set-top Gateway Logical Diagram

1.4 Organization of document

The remainder of this document is organized as follows:

- Section 2 – Provides both normative and informative references for this specification.
- Section 3 – Provides definitions of terms used in this specification.
- Section 4 – Provides definitions of abbreviations used in this specification.
- Section 5 – Provides the detailed specification of assumptions, constraints, and requirements for the DOCSIS Set-top Gateway.
- Annex A – Provides the DOCSIS Set-top Gateway MIB definition.
- Appendix I – Is the list of acknowledgments.
- Appendix II – Provides the ECN revision history.

1.5 Requirements (Conformance Notation)

Throughout this document, the words that are used to define the significance of particular requirements are capitalized. These words are:

"MUST"	This word or the adjective "REQUIRED" means that the item is an absolute requirement of this specification.
"MUST NOT"	This phrase means that the item is an absolute prohibition of this specification.
"SHOULD"	This word or the adjective "RECOMMENDED" means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighed before choosing a different course.
"SHOULD NOT"	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
"MAY"	This word or the adjective "OPTIONAL" means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.

2 REFERENCES

The following standards and other references contain provisions, which through reference in this text, constitute the whole or parts of a document to which it is necessary to conform in order to claim compliance to this specification. At the time of publication, the editions indicated were valid. All references are subject to revision; users of this specification are therefore encouraged to investigate the possibility of applying the most recent edition of the standards and other references listed below.

2.1 Normative References

[DOCSIS1] Data-Over-Cable Service Interface Specifications, Radio Frequency Interface Specification, SP-RFIv1.1-I07-010829.

[DOCSIS2] Data-Over-Cable Service Interface Specifications, Cable Modem Termination System – Network Side Interface Specification, SP-CMTS-NSII01-960702.

[DOCSIS3] Data-Over-Cable Service Interface Specifications, Radio Frequency Interface Specification, SP-RFI-C01-011119.

2.2 Informative References

[DOCSIS4] Data-Over-Cable Service Interface Specifications, Operations Support System Interface Specification, SP-OSSIv1.1-I04-010829.

[DOCSIS5] Data-Over-Cable Service Interface Specifications, Baseline Privacy Plus Interface Specification, SP-BPI+-I07-010829.

[OC1] – OpenCable™ Host Device Core Functional Requirements, OC-SP-HOST-CFR-I07-01228.

[OC2] – OpenCable™ HOST-POD Interface Specification, OC-SP-HOSTPOD-IF-I08-011221.

[OC3] – OpenCable™ Application Platform Specification, OC-SP-OCAP1.0-I01-011221.

[OC4] – OpenCable™ Advanced Host Device CORE Functional Requirements, OC-SP-ADVHOST-CFR-WIP08-020225.

[SCTE1] – Digital Broadband Delivery System: Out of Band Transport - Mode B, SCTE DVS 167, Rev, 2 – March 10,2000.

[SCTE2] – Digital Broadband Delivery System: Out of Band Transport - Mode A, SCTE DVS 178, Rev. 3 – February 25, 2000.

2.3 Reference Acquisition

CableLabs Specifications:

Cable Television Laboratories, Inc., 400 Centennial Parkway, Louisville, CO 80027;
Phone 303-661-9100; Fax 303-661-9199; Internet: http://www.cablelabs.com /

SCTE/DVS Specifications:

SCTE - Society of Cable Telecommunications Engineers Inc., 140 Philips Road, Exton, PA 19341
Phone: 610-363-6888 / 800-542-5040, Fax: 610-363-5898, Internet: http://www.scte.org/

3 TERMS AND DEFINITIONS

This specification defines the following terms:

- Set-top Terminal – Customer premise equipment (CPE) providing subscription and pay-per-view broadcast television services and interactive TV services.
- Host – A set-top terminal that contains an embedded cable modem and an embedded CPE component.
- Embedded Cable Modem – A DOCSIS cable modem that is integrated into the customer premise equipment.
- Embedded CPE – The portion of the Host device that supports the application environment.
- Network Controller – This is the computer system responsible for managing the set-top terminals or Hosts within a cable system. It manages set-top terminals or Hosts through control and information messages sent via a dedicated Out-Of-Band channel.
- DSG Tunnel – This is a broadcast IP datagram stream originating at the DOCSIS Set-top Gateway and carrying Out-Of-Band messages intended for set-top terminals. It is carried over the downstream DOCSIS channel and is identified by a well know Ethernet MAC address. The well-known Ethernet unicast MAC address is reserved and published by the CA/POD provider. Multiple DSG tunnels may exist on a single downstream DOCSIS channel.
- Out-Of-Band Messaging –The control and information messages sent from the Network Controller to one or more set-top terminals or Hosts requiring a dedicated channel constitute Out-Of-Band Messaging. This includes the following types of messages:
    - Conditional Access (CA) messages including entitlements
    - System Information (SI) messages
    - Electronic Program Guide (EPG) messages
    - Emergency Alert System (EAS) messages
    - Other generic messages

4 ABBREVIATIONS AND ACRONYMS

This specification uses the following abbreviations:

CA	Conditional Access
CM	Cable Modem
CMTS	Cable Modem Termination System
CPE	Customer Premises Equipment
DOCSIS	Data Over Cable Service Interface Specifications
DSG	DOCSIS Set-top Gateway
DVS	Digital Video Subcommittee
EAS	Emergency Alert System
EPG	Electronic Program Guide
HFC	Hybrid Fiber Coax

IP	Internet Protocol
MAC	Media Access Control
MTA	Multimedia Terminal Adaptor
OOB	Out-Of-Band
POD Module	Point Of Deployment Module
SCTE	Society of Cable Telecommunications Engineers
SI	System Information
TCP	Transmission Control Protocol
UDP	User Datagram Protocol

Table 4-1 – Abbreviations and Acronyms

5 DOCSIS SET-TOP GATEWAY

The DOCSIS Set-top Gateway is intended to provide transparent transport of Out-Of-Band messaging that is traditionally carried on dedicated channels, specifically those defined in SCTE/DVS-167 [SCTE1] and SCTE/DVS-178 [SCTE2], over a DOCSIS channel. The following sections detail the requirements and normative behavior of the DOCSIS Set-top Gateway and the Host for this service.

5.1 Assumptions and Constraints (Informative)

The DOCSIS Set-top Gateway will exist within a constrained environment. This section details the assumptions regarding the Host and the remainder of the environment that are required in order to enable this service.

- A Host using the DOCSIS Set-top Gateway service must coexist with other DOCSIS devices on the same DOCSIS channel (CM+PC, MTA, etc.)
- The Host must be able to function in either a one-way or two-way environment. The functionality available in a one-way environment may be limited to:
    - Analog NTSC audio-visual programming: (clear, non-scrambled).
    - Digital standard definition audio-visual programming utilizing MPEG-2 main profile @ main level video and Dolby AC-3 audio:
    - broadcast (clear), subscription-based (scrambled or encrypted), and call-ahead Pay-Per-View (PPV) (scrambled or encrypted).

      Call-ahead Pay-Per-View is a paid service in which the viewer pre-subscribes selected programming via telephone.
    - Pass through of digital high definition audio-visual programming.
- Since the DOCSIS Set-top Gateway provides a one-way stream of Out-Of-Band messages, DOCSIS Baseline Privacy Interface (BPI), Baseline Privacy Plus Interface (BPI+), and Quality of Service (QoS) do not apply to the DSG transport.
- The DOCSIS Set-top Gateway specification must work for both embedded and POD (removable) security implementations.
- The DOCSIS Set-top Gateway specification must not require modifications to existing DOCSIS protocols.

- The DOCSIS Set-top Gateway specification must not impact the security of the CA systems negatively.
- The Host must use a two-way IP session over DOCSIS for all return traffic. For example,
    - An Out-Of-Band polling message is sent from the network controller server to the set-top via the DOCSIS Set-top Gateway
    - The Host and/or POD module response to the message is returned to the headend via IP over DOCSIS
- The Host cable modem must follow standard DOCSIS initialization and registration process, with the following specific exceptions (as specified by [OC4]):
    - In acquiring the appropriate DOCSIS downstream channel, the set-top will search for the first DOCSIS channel that contains the well known Ethernet MAC address(es) reserved by the CA/POD provider.
    - The Host must only attempt to register on the network after acquiring the appropriate DOCSIS downstream channel.
    - The Host and embedded DOCSIS cable modem must not reboot under circumstances in which the DOCSIS T4 timer expires due to reasons such as reverse channel impairments or periodic maintenance adjustment failure. Rather, it will continue to receive and process the DOCSIS forward channel.
    - The Host must periodically attempt to re-register after loss of the upstream channel. The re-registration process is detailed in [OC4] and includes the following steps:
        1. Ranging
        2. Obtain IP parameters via DHCP
        3. Obtain Time of Day
        4. Download configuration file
        5. Registration (involving the registration request and response and ack for DOCSIS 1.1).

The Figure 5-1 shows a state transition diagram between the one-way and two-way modes of operation.

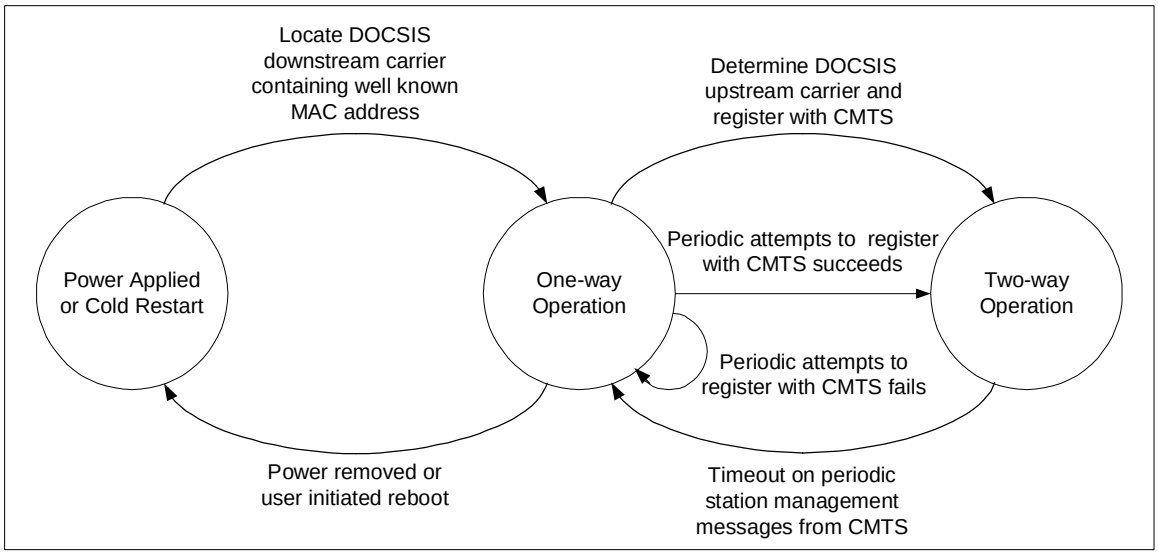

Figure 5-1 – Host State Transition Diagram

5.2 Normative Requirements

The following are the normative requirements for the DOCSIS Set-top Gateway:

- The DOCSIS Set-top Gateway MUST provide one-way downstream transport for Out-Of-Band messaging.
- The DOCSIS Set-top Gateway MUST support multiple simultaneous Conditional Access systems.
- The DOCSIS Set-top Gateway MUST support an aggregate throughput of 2.048 Mbps per Conditional Access system. Informative note: Currently deployed Conditional Access systems require as much as 2.048 Mbps for Out-Of-Band messaging.
- The DOCSIS Set-top Gateway MUST rate limit the aggregate output to 2.048 Mbps per Conditional Access system. Informative note: The buffer capacity contained in the OpenCable™ Advanced Host is limited and data rates in excess of 2.048 Mbps can potentially overflow this buffer.
- The DOCSIS Set-top Gateway MUST support up to 8 DSG Tunnels per Conditional Access System. Informative note: Currently, five potentially independent Out-Of-Band message flows have been identified. Allowing 60% headroom for future expansion was considered adequate.
- The DOCSIS Set-top Gateway MUST be configurable to support forwarding on one or more DOCSIS downstream channels (see Annex A for specification of the MIB to manage this configuration parameter).
- If Dynamic Channel Change (DCC) is implemented and used to change downstream channels, then the OOB Messaging data MUST be forwarded onto all DOCSIS downstream channels.
- The DOCSIS Set-top Gateway MAY be implemented either on a CMTS or on a separate piece of equipment.
- There MAY be a many-to-one mapping of the DOCSIS Set-top Gateway IP addresses to the DSG Tunnels. Alternatively, a one-to-one mapping MAY be used.
- The mapping of IP address(es) to DSG Tunnels MUST be configured in the DOCSIS Set-top Gateway (see Annex A for specification of the MIB to manage this configuration parameter). The IP address(es) SHOULD belong to the Host subnet. These mappings consist of an IP address on the in-bound side of the DSG and the well-known Ethernet MAC address assigned to the DSG Tunnel. The well-known Ethernet unicast MAC address is reserved and published by the CA/POD provider.
- The DOCSIS Set-top Gateway's IP address(es) MAY be part of a multicast group if the network controller chooses to send all of the Out-Of-Band Messaging data to all DOCSIS Set-top Gateways simultaneously via IP Multicast.
- Equally, the Out-Of-Band Messaging data MAY be sent via unicast to each DOCSIS Set-top Gateway individually if the Network Controller chooses not to use IP multicast.
- DOCSIS Set-top Gateway MUST be supported on a DOCSIS 1.0 and DOCSIS 1.1 implementation.
- The minimum data rate of one packet per second MUST be maintained on this interface to keep the acquisition time of the appropriate DOCSIS channel to less than one second. The intent is that the data be present at a sufficiently high rate such that in the process of searching for and trying to acquire a DOCSIS channel, no exorbitant amount of time needs to be spent on any DOCSIS channel that does not carry OOB data.

- The DOCSIS Set-top Gateway MUST forward the IP packets received at its configured IP address(es) by performing a MAC level rewrite (replace destination MAC address with the DSG Tunnel MAC address and source MAC address with the DSG HFC side MAC address) of the destination Ethernet MAC address to the corresponding DSG Tunnel address. The IP packet MUST remain unchanged. This is shown in detail in Figure 5-2.

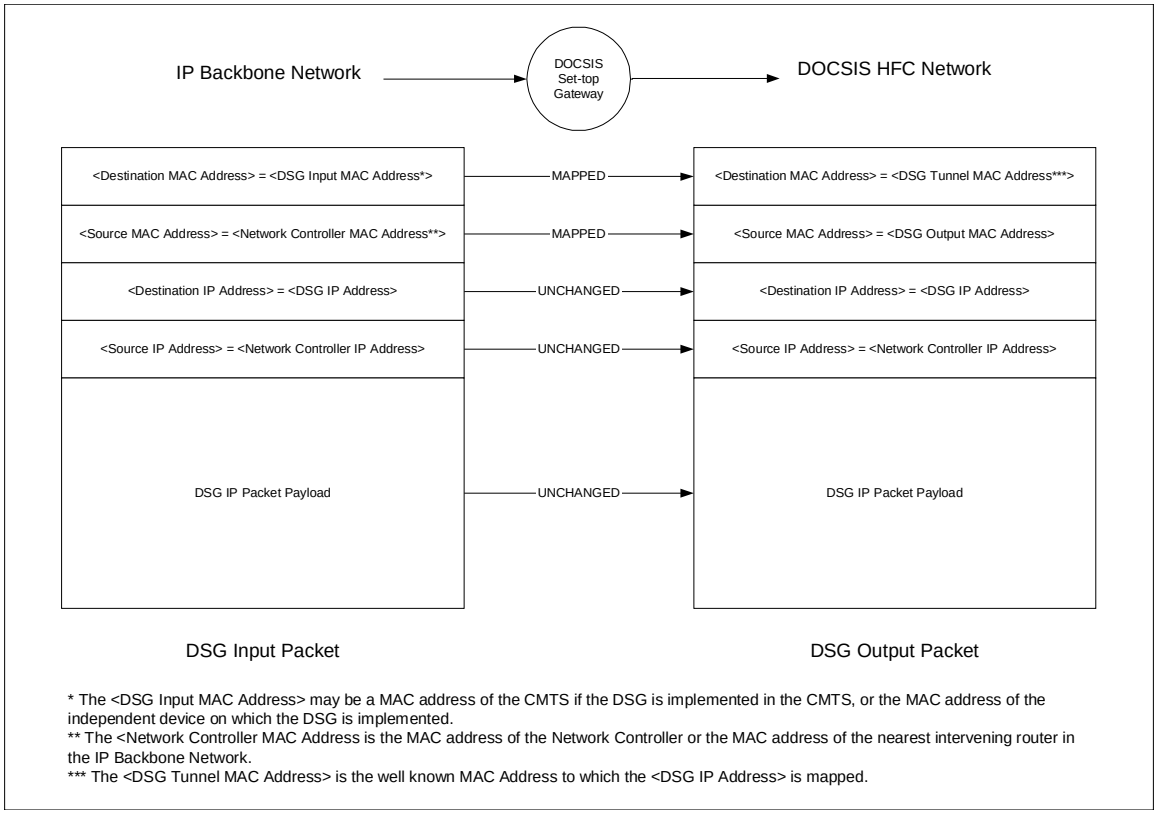

Figure 5-2 - DSG Packet Processing

- The DOCSIS Set-top Gateway MUST not forward packets of protocol types other than IP onto the DSG Tunnel.
- The downstream DOCSIS PDUs encapsulating the DSG OOB messages MUST have Function Code bits set to the Packet PDU codepoint.
- The DOCSIS Set-top Gateway MUST be able to filter packets based on port number and protocol type.
- There MUST be support for a maximum of eight well-known Ethernet MAC addresses per Conditional Access system or POD provider that can be used for the DSG Tunnels over the DOCSIS network.
- The well-known Ethernet MAC addresses MUST be Ethernet addresses reserved by the Conditional Access system or POD provider.
- The choice of which DOCSIS downstream channels (one or more) the DOCSIS Set-top Gateway will use to forward the Out-Of-Band Messaging data is a DOCSIS Set-top Gateway configuration parameter (see Annex A for specification of the MIB to manage this configuration parameter).
- The DOCSIS Set-top Gateway MAY use source address verification to prevent forwarding of packets originating from other than a trusted Network Controller.

- The DOCSIS Set-top Gateway MAY use dedicated links, Secure Sockets Layer (SSL/TSL), virtual private networks (VPN), IPSec or other means to provide secure connections between it and the Network Controller. The specifics of how this may be implemented are beyond the scope of this document.
- The DOCSIS Set-top Gateway SHOULD use the following IP address for access to the DSG MIBs:
    - When the DSG is implemented in the CMTS it should use the IP address used to access the other DOCSIS MIBs.
    - When the DSG is implemented in a standalone device it should use the device's network IP address.

Annex A. DOCSIS Out-Of-Band Gateway MIB Definition (Normative)

```
DOCSIS-SETTOP-GATEWAY-MIB DEFINITIONS ::= BEGIN

IMPORTS
        MODULE-IDENTITY,
        OBJECT-TYPE,
        Unsigned32,
        Integer32,
        Counter32
                FROM SNMPv2-SMI
        DisplayString,
        TruthValue,
        MacAddress,
        RowStatus
                FROM SNMPv2-TC
        OBJECT-GROUP,
        MODULE-COMPLIANCE
                FROM SNMPv2-CONF
        clabProjDocsis
                FROM CLAB-DEF-MIB
        InetAddressType,
        InetAddress
                FROM INET-ADDRESS-MIB
        InterfaceIndex
                FROM IF-MIB; -- RFC2233

dsgMIB MODULE-IDENTITY
       LAST-UPDATED "200228020000Z" -- February 28, 2002
       ORGANIZATION "Cable Television Laboratories, Inc."
       CONTACT-INFO
            "          Ralph W. Brown
            Postal:    Cable Television Laboratories, Inc.
            400 Centennial Parkway
            Louisville, Colorado 80027-1266
            U.S.A.
            Phone:     +1 303-661-9100
            Fax:       +1 303-661-9199
            E-mail:    r.brown@cablelabs.com"
       DESCRIPTION
            "This is the MIB Module for the DOCSIS Set-top Gateway
            (DSG).  The DSG provides a one-way IP datagram transport
            for Out-Of-Band (OOB) messaging to cable set-top terminals.
            The one-way IP datagram transport is called a DSG Tunnel.
            A DSG Tunnel is a broadcast IP datagram stream originating
            at the DOCSIS Set-top Gateway and carrying Out-Of-Band
            messages intended for set-top terminals. It is carried over
            one or more downstream DOCSIS channels and is identified by
            a well know Ethernet unicast MAC address. The well-known
            Ethernet unicast MAC address is reserved and published
            by the CA/POD provider.  A CA/POD provider is limited to
            eight DSG Tunnels to transport their OOB Messaging.
            Multiple DSG Tunnels may exist on a single downstream DOCSIS
            channel.
```

```
            This MIB is implemented as four groups, the CA Vendor Table,
            the DSG Tunnel Table, the Downstream Table, and the DSG IP
            Filter Table.

            1) The CA Vendor Table associates a CA Vendor Name with a CA
               Vendor Index and the number of DOCSIS downstream channels
               carrying this CA OOB messaging (a value of zero implies
               all downstream channels carry the associated CA Vendor's
               OOB messaging streams).

            2) The DSG Tunnel Table associates an input IP Address and
               an output MAC Address with a CA Vendor Index and a Tunnel
               number (1 through 8).

            3) The Downstream Table associates a CA Vendor Index with a
               DOCSIS downstream channel interface index (IfIndex).

            4) The DSG IP Filter Table associates an IP filter with a
               DSG Tunnel.  This allows the DSG to be configured to
               reject or accept (forward) IP packets based on source and
               destination address/mask, protocol, source/dest port and
               TOS/mask.

            These tables are all dynamic in nature.  Individual rows can
            be created or deleted as necessary.  In general, the DSG is
            configured once per CA system."
        REVISION      "200110090000Z"
        DESCRIPTION
            "Initial revision, published as part of DOCSIS Set-top
            Gateway Specification."
        REVISION      "200228020000Z"
        DESCRIPTION
            "Updated to support IPv4 and IPv6 IP addresses and to
            correct a number of minor errors."
        ::= { clabProjDocsis 1 }

-- The CA Vendor Table contains the CA Vendor Index, the CA Vendor
-- Name, the Number of Downstream Channels, and the Enabled/Disabled
-- status.

dsgCaVendor OBJECT IDENTIFIER ::= { dsgMIB 1 }

dsgCaVendorNextIndex OBJECT-TYPE
        SYNTAX       Unsigned32(0..65535)
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
                "Identifies a hint for the next value of
dsgCaVendorIndex
                to be used in a row creation attempt for the
dsgCaVendorTable
                table.  If no new rows can be created, this object will
                have a value of zero."
        ::= { dsgCaVendor 1 }

dsgCaVendorTable OBJECT-TYPE
        SYNTAX       SEQUENCE OF DsgCaVendorEntry
        MAX-ACCESS   not-accessible
        STATUS       current
        DESCRIPTION
```

```
                "The DSG CA Vendor Table associates a CA Vendor Index
                with the CA Vendor Name and the number of downstream
                channels that carry the CA Vendor's OOB Messaging."
        ::= { dsgCaVendor 2 }

dsgCaVendorEntry OBJECT-TYPE
        SYNTAX      DsgCaVendorEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "An entry in the CA Vendor Table.  Rows are created by
                an SNMP SET request setting the value of
                dsgCaVendorRowStatus  to 'createAndGo' or
                'createAndWait'.  Rows are deleted by an SNMP SET
                request setting the value of dsgCaVendorRowStatus to
                'destroy'."
        INDEX   { dsgCaVendorIndex }
        ::= { dsgCaVendorTable 1 }

DsgCaVendorEntry ::= SEQUENCE {
                dsgCaVendorIndex     Unsigned32,
                dsgCaVendorName      DisplayString,
                dsgNumberOfChannels  Unsigned32,
                dsgCaVendorEnabled   TruthValue,
                dsgCaVendorRowStatus RowStatus
        }

dsgCaVendorIndex OBJECT-TYPE
        SYNTAX      Unsigned32(1..65535)
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "The row index into the CA Vendor Table"
        ::= { dsgCaVendorEntry 1 }

dsgCaVendorName OBJECT-TYPE
        SYNTAX      DisplayString
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                "The name of the CA Vendor.  Cannot be changed
                if the value of dsgCaVendorRowStatus is active."
        ::= { dsgCaVendorEntry 2 }

dsgNumberOfChannels OBJECT-TYPE
        SYNTAX      Unsigned32(0..65535)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                "The number of DOCSIS downstream channels on
                which the CA Vendor's OOB messages are carried.
                A value of zero implies that the CA Vendor's
                OOB messages are carried on ALL DOCSIS downstream
                channels.  Cannot be changed if the value of
                dsgCaVendorRowStatus is active."
        ::= { dsgCaVendorEntry 3 }

dsgCaVendorEnabled OBJECT-TYPE
        SYNTAX      TruthValue
        MAX-ACCESS  read-create
```

```
        STATUS      current
        DESCRIPTION
                "The enabled/disabled status of the CA Vendor's
                OOB Message forwarding.  A value of true indicates
                that DSG forwards OOB messages onto the DSG Tunnel.
                A value of false indicates that no OOB messages
                are forwarded."
        DEFVAL { true }
        ::= { dsgCaVendorEntry 4 }

dsgCaVendorRowStatus OBJECT-TYPE
        SYNTAX      RowStatus
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                "The status of the row."
        ::= { dsgCaVendorEntry 5 }

-- The DSG Tunnel Table - contains the DSG Tunnel Index, the input
-- IP Address, the output MAC Address, the CA Vendor Index, and the
-- Tunnel Number (1..8)."

dsgTunnel OBJECT IDENTIFIER ::= { dsgMIB 2 }

dsgTunnelNextIndex OBJECT-TYPE
        SYNTAX       Unsigned32(0..65535)
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
                "Identifies a hint for the next value of dsgTunnelIndex
                to be used in a row creation attempt for the
                dsgTunnelTable table.  If no new rows can be created,
                this object will have a value of zero."
        ::= { dsgTunnel 1 }

dsgTunnelTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF DsgTunnelEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "The DSG Tunnel Table associates an input IP Address and
                an output MAC Address with a CA Vendor Index and a
                Tunnel number (1 through 8)."
        ::= { dsgTunnel 2 }

dsgTunnelEntry OBJECT-TYPE
        SYNTAX      DsgTunnelEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "An entry in the DSG Tunnel Table.  Rows are created by
                an SNMP SET request setting the value of
                dsgTunnelRowStatus  to 'createAndGo' or 'createAndWait'.
                Rows are deleted by an SNMP SET request setting the
                value of dsgTunnelRowStatus to 'destroy'."
        INDEX   { dsgInputAddress, dsgOutputAddress }
        ::= { dsgTunnelTable 1 }

DsgTunnelEntry ::= SEQUENCE {
                dsgTunnelIndex       Unsigned32,
```

```
                dsgInputAddressType  InetAddressType,
                dsgInputAddress      InetAddress,
                dsgOutputAddress     MacAddress,
                dsgTunnelNumber      Integer32,
                dsgTunnelRowStatus   RowStatus
        }

dsgTunnelIndex OBJECT-TYPE
        SYNTAX      Unsigned32(1..65535)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                "The row index into the DSG Tunnel table"
        ::= { dsgTunnelEntry 1 }

dsgInputAddressType OBJECT-TYPE
        SYNTAX      InetAddressType
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                "The type of internet address of dsgFilterIpSaddr.
                Cannot be changed if the value of dsgTunnelRowStatus
                is active."
        ::= { dsgTunnelEntry 2 }

dsgInputAddress OBJECT-TYPE
        SYNTAX      InetAddress
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                "The DSG Tunnel Input IP address.  Cannot be changed
                if the value of dsgTunnelRowStatus is active."
        ::= { dsgTunnelEntry 3 }

dsgOutputAddress OBJECT-TYPE
        SYNTAX      MacAddress
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                "The the DSG Tunnel Output MAC address.  Cannot be
                changed if the value of dsgTunnelRowStatus is active."
        ::= { dsgTunnelEntry 4 }

dsgTunnelNumber OBJECT-TYPE
        SYNTAX      Integer32(1..8)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                "The CA Vendor's DSG Tunnel Number (1..8) for this
entry."
        ::= { dsgTunnelEntry 5 }

dsgTunnelRowStatus OBJECT-TYPE
        SYNTAX      RowStatus
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                "The status of the row."
        ::= { dsgTunnelEntry 6 }
```

```
-- The Downstream Table contains the DSG Downstream Index, the CA
-- Vendor Index, and the DOCSIS downstream channel Interface Index
-- (IfIndex).

-- The Downstream Table associates a CA Vendor Index with a DOCSIS
-- downstream channel interface index (IfIndex).  All DSG Tunnels
-- with that CA Vendor Index are carried on this DOCSIS downstream
-- channel.  Note: this table only exists if one or more CA Vendors
-- OOB messages are carried on a sub-set of the available DOCSIS
-- downstream channels, i.e. dsgNumberOfChannels is non-zero for
-- any entry in the CA Vendor Table.

dsgDownstream OBJECT IDENTIFIER ::= { dsgMIB 3 }

dsgDownstreamNextIndex OBJECT-TYPE
        SYNTAX       Unsigned32(0..65535)
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
                "Identifies a hint for the next value of
                dsgDownstreamIndex to be used in a row creation attempt
                for the dsgDownstreamTable table.  If no new rows can be
                created, this object will have a value of zero."
        ::= { dsgDownstream 1 }

dsgDownstreamTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF DsgDownstreamEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "The DSG Downstream Table associates a CA Vendor Index
                with a DOCSIS downstream channel interface index
               (IfIndex)."
        ::= { dsgDownstream 2 }

dsgDownstreamEntry OBJECT-TYPE
        SYNTAX      DsgDownstreamEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "An entry in the DSG Downstream Table.  Rows are created
                by an SNMP SET request setting the value of
                dsgDownstreamRowStatus to 'createAndGo' or
                'createAndWait'.  Rows are deleted by an SNMP SET
                request setting the value of dsgDownstreamRowStatus
                to 'destroy'."
        INDEX   { dsgDownstreamCaIndex, dsgDownstreamIfIndex }
        ::= { dsgDownstreamTable 1 }

DsgDownstreamEntry ::= SEQUENCE {
                dsgDownstreamIndex       Unsigned32,
                dsgDownstreamCaIndex     Unsigned32,
                dsgDownstreamIfIndex     InterfaceIndex,
                dsgDownstreamRowStatus   RowStatus
        }

dsgDownstreamIndex OBJECT-TYPE
        SYNTAX      Unsigned32(1..65535)
        MAX-ACCESS  read-create
        STATUS      current
```

```
        DESCRIPTION
                "The row index into the DSG Downstream table"
        ::= { dsgDownstreamEntry 1 }

dsgDownstreamCaIndex OBJECT-TYPE
        SYNTAX      Unsigned32
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                "The CA Vendor Index associated with this downstream
                channel."
        ::= { dsgDownstreamEntry 2 }

dsgDownstreamIfIndex OBJECT-TYPE
        SYNTAX      InterfaceIndex(1..2147483647)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                "The Interface Index associated with this downstream
                channel."
        ::= { dsgDownstreamEntry 3 }

dsgDownstreamRowStatus OBJECT-TYPE
        SYNTAX      RowStatus
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                "The status of the row."
        ::= { dsgDownstreamEntry 4 }

-- The DSG IP Filter Table contains the IP filter control, the DSG
-- tunnel index, the broadcast/multicast indication, the source IP
-- address/mask, the destination IP address/mask, the protocol type,
-- source IP port range, the destination IP port range, the TOS
-- type/mask, number of packet matches, and the continue flag.

dsgFilterIp OBJECT IDENTIFIER ::= { dsgMIB 4 }

-- The default behavior for packets that do not match any IP
-- filter is defined by dsgFilterIpDefault.

dsgFilterIpDefault OBJECT-TYPE
        SYNTAX INTEGER {
                        discard(1),
                        accept(2)
                }
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
                "If set to discard(1), all packets not matching an IP
                filter will be discarded. If set to accept(2), all
                packets not matching an IP filter will be accepted for
                further processing (e.g., bridging).  At initial system
                startup, this object returns accept(2)."
        ::= { dsgFilterIp 1 }

dsgFilterIpNextIndex OBJECT-TYPE
        SYNTAX       Unsigned32(0..65535)
        MAX-ACCESS   read-only
        STATUS       current
```

```
        DESCRIPTION
                "Identifies a hint for the next value of
                dsgFilterIpIndex to be used in a row creation attempt
                for the dsgFilterIpTable table.  If no new rows can be
                created, this object will have a value of zero."
        ::= { dsgFilterIp 2 }

dsgFilterIpTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF DsgFilterIpEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "A list of filters to apply to IP traffic.  Filter
                application is ordered by the filter index.  Packets
                which match no filters are discarded or forwarded
                according to the setting of dsgFilterIpDefault.

                Any IP packet can theoretically match multiple rows of
                this table.  When considering a packet, the table is
                scanned in row index order (e.g. filter 10 is checked
                before filter 20).  If the packet matches that filter
                (which means that it matches ALL criteria for that row),
                the packet is rejected or accepted according to the
                dsgFilterIpControl. If the packet was discarded
                processing is complete.  If dsgFilterIpContinue is set
                to true, the filter comparison continues with the next
                row in the table looking for additional matches."
        ::= { dsgFilterIp 3 }

dsgFilterIpEntry OBJECT-TYPE
        SYNTAX      DsgFilterIpEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Describes a filter to apply to IP traffic received on a DSG
             Tunnel input IP address.  All identity objects in this
             table (e.g. source and destination address/mask, protocol,
             and source/dest port) must match their respective fields in
             the packet for any given filter to match."
        INDEX { dsgFilterIpIndex }
        ::= { dsgFilterIpTable 1 }

DsgFilterIpEntry ::= SEQUENCE {
            dsgFilterIpIndex            Integer32,
            dsgFilterIpControl          INTEGER,
            dsgFilterIpTunnel           Unsigned32,
            dsgFilterIpBroadcast        TruthValue,
            dsgFilterIpSaddrType        InetAddressType,
            dsgFilterIpSaddr            InetAddress,
            dsgFilterIpSmaskType        InetAddressType,
            dsgFilterIpSmask            InetAddress,
            dsgFilterIpDaddrType        InetAddressType,
            dsgFilterIpDaddr            InetAddress,
            dsgFilterIpDmaskType        InetAddressType,
            dsgFilterIpDmask            InetAddress,
            dsgFilterIpProtocol         Integer32,
            dsgFilterIpSourcePortLow    Integer32,
            dsgFilterIpSourcePortHigh   Integer32,
            dsgFilterIpDestPortLow      Integer32,
            dsgFilterIpDestPortHigh     Integer32,
```

```
            dsgFilterIpTos              OCTET STRING,
            dsgFilterIpTosMask          OCTET STRING,
            dsgFilterIpMatches          Counter32,
            dsgFilterIpContinue         TruthValue,
            dsgFilterIpRowStatus        RowStatus
        }

dsgFilterIpIndex OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Index used to order the application of filters.
             The filter with the lowest index is always applied
             first."
        ::= { dsgFilterIpEntry 1 }

dsgFilterIpControl OBJECT-TYPE
        SYNTAX INTEGER {
            discard(1),
            accept(2)
        }
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "If set to discard(1), all packets matching this filter
             will be discarded and scanning of the remainder of the
             filter list will be aborted. If set to accept(2), all
             packets matching this filter will be accepted for further
             processing (e.g., bridging). If dsgFilterIpContinue
             is set to true, see if there are other matches, otherwise
             done.

             If is dsgFilterIpContinue is set to true, continue
             scanning the table for other matches, otherwise done."
        DEFVAL { discard }
        ::= { dsgFilterIpEntry 2 }

dsgFilterIpTunnel OBJECT-TYPE
        SYNTAX      Unsigned32
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The DSG Tunnel to which this filter applies. The
             value corresponds to a DSG Tunnel in the DSG Tunnel Table."
        ::= { dsgFilterIpEntry 3 }

dsgFilterIpBroadcast OBJECT-TYPE
        SYNTAX      TruthValue
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "If set to true(1), the filter only applies to multicast
             and broadcast traffic. If set to false(2), the filter
             applies to all traffic."
        DEFVAL { false }
        ::= { dsgFilterIpEntry 4 }

dsgFilterIpSaddrType OBJECT-TYPE
        SYNTAX      InetAddressType
```

```
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The type of internet address of dsgFilterIpSaddr."
        ::= { dsgFilterIpEntry 5 }

dsgFilterIpSaddr OBJECT-TYPE
        SYNTAX      InetAddress
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The source IP address, or portion thereof, that is to be
             matched for this filter.  The source address is first
             masked (and'ed) against dsgFilterIpSmask before being
             compared  to this value.  A value of 0 for this object
             and 0 for the mask matches all IP addresses."
        DEFVAL { '00000000'h }
        ::= { dsgFilterIpEntry 6 }

dsgFilterIpSmaskType OBJECT-TYPE
        SYNTAX      InetAddressType
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The type of internet address of dsgFilterIpSmask."
        ::= { dsgFilterIpEntry 7 }

dsgFilterIpSmask OBJECT-TYPE
        SYNTAX      InetAddress
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "A bit mask that is to be applied to the source address
             prior to matching. This mask is not necessarily the same
             as a subnet mask, but 1's bits must be leftmost and
             contiguous."
        DEFVAL { '00000000'h }
        ::= { dsgFilterIpEntry 8 }

dsgFilterIpDaddrType OBJECT-TYPE
        SYNTAX      InetAddressType
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The type of internet address of dsgFilterIpDaddr."
        ::= { dsgFilterIpEntry 9 }

dsgFilterIpDaddr OBJECT-TYPE
        SYNTAX      InetAddress
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The destination IP address, or portion thereof, that is
             to be matched for this filter. The destination address is
             first masked (and'ed) against dsgFilterIpDmask before
             being compared  to this value.  A value of 0 for this
             object and 0 for the mask matches all IP addresses."
        DEFVAL { '00000000'h }
        ::= { dsgFilterIpEntry 10 }
```

```
dsgFilterIpDmaskType OBJECT-TYPE
        SYNTAX      InetAddressType
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The type of internet address of dsgFilterIpDmask."
        ::= { dsgFilterIpEntry 11 }

dsgFilterIpDmask OBJECT-TYPE
        SYNTAX      InetAddress
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "A bit mask that is to be applied to the destination
             address prior to matching. This mask is not necessarily
             the same as a subnet mask, but 1's bits must be leftmost
             and contiguous."
        DEFVAL { '00000000'h }
        ::= { dsgFilterIpEntry 12 }

dsgFilterIpProtocol OBJECT-TYPE
        SYNTAX Integer32 (0..256)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The IP protocol value that is to be matched. For example:
             icmp is 1, tcp is 6, udp is 17. A value of 256 matches
             ANY protocol."
        DEFVAL { 256 }
        ::= { dsgFilterIpEntry 13 }

dsgFilterIpSourcePortLow OBJECT-TYPE
        SYNTAX      Integer32 (0..65535)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "If dsgFilterIpProtocol is udp or tcp, this is the
             inclusive lower bound of the transport-layer source port
             range that is to be matched, otherwise it is ignored
             during matching."
        DEFVAL { 0 }
        ::= { dsgFilterIpEntry 14 }

dsgFilterIpSourcePortHigh OBJECT-TYPE
        SYNTAX      Integer32 (0..65535)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "If dsgFilterIpProtocol is udp or tcp, this is the
             inclusive upper bound of the transport-layer source port
             range that is to be matched, otherwise it is ignored
             during matching."
        DEFVAL { 65535 }
        ::= { dsgFilterIpEntry 15 }

dsgFilterIpDestPortLow OBJECT-TYPE
        SYNTAX      Integer32 (0..65535)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
```

```
            "If dsgFilterIpProtocol is udp or tcp, this is the
             inclusive lower bound of the transport-layer destination
             port range that is to be matched, otherwise it is ignored
             during matching."
        DEFVAL { 0 }
        ::= { dsgFilterIpEntry 16 }

dsgFilterIpDestPortHigh OBJECT-TYPE
        SYNTAX      Integer32 (0..65535)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "If dsgFilterIpProtocol is udp or tcp, this is the
             inclusive upper bound of the transport-layer destination
             port range that is to be matched, otherwise it is ignored
             during matching."
        DEFVAL { 65535 }
        ::= { dsgFilterIpEntry 17 }

dsgFilterIpMatches OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Counts the number of times this filter was matched.
             This object is initialized to 0 at boot, or at row
             creation, and is reset only upon reboot."
        ::= { dsgFilterIpEntry 18 }

dsgFilterIpTos  OBJECT-TYPE
        SYNTAX      OCTET STRING ( SIZE (1))
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "This is the value to be matched to the packet's
             TOS (Type of Service) value (after the TOS value
             is AND'd with dsgFilterIpTosMask).  A value for this
             object of 0 and a mask of 0 matches all TOS values."
        DEFVAL { '00'h }
        ::= { dsgFilterIpEntry 19 }

dsgFilterIpTosMask OBJECT-TYPE
        SYNTAX      OCTET STRING ( SIZE (1) )
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The mask to be applied to the packet's TOS value before
             matching."
        DEFVAL { '00'h }
        ::= { dsgFilterIpEntry 20 }

dsgFilterIpContinue OBJECT-TYPE
        SYNTAX      TruthValue
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "If this value is set to true, and dsgFilterIpControl
             is anything but discard (1), continue scanning and
             applying policies."
        DEFVAL { false }
```

```
        ::= { dsgFilterIpEntry 21 }

dsgFilterIpRowStatus OBJECT-TYPE
        SYNTAX      RowStatus
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Controls and reflects the status of rows in this
             table. Specifying only this object (with the appropriate
             index) on a DSG is sufficient to create a filter row which
             matches all inbound packets on the ethernet interface,
             and results in the packets being discarded.  Creation of
             the rows may be done via either create-and-wait or
             create-and-go, but the filter is not applied until this
             object is set to (or changes to) active. There is no
             restriction in changing any object in a row while this
             object is set to active."
        ::= { dsgFilterIpEntry 22 }

--
-- Conformance definitions
--
dsgConformance  OBJECT IDENTIFIER   ::= { dsgMIB 5 }
dsgGroups       OBJECT IDENTIFIER   ::= { dsgConformance 1 }
dsgCompliances  OBJECT IDENTIFIER   ::= { dsgConformance 2 }

dsgBasicCompliance MODULE-COMPLIANCE
        STATUS  current
        DESCRIPTION
            "The compliance statement for DOCSIS Set-top Gateway
systems."

MODULE  -- dsgMIB

-- mandatory groups

GROUP dsgCaVendorGroup
        DESCRIPTION
            "Mandatory in DOCSIS Set-top Gateway systems."

GROUP dsgTunnelGroup
        DESCRIPTION
            "Mandatory in DOCSIS Set-top Gateway systems."

GROUP dsgDownstreamGroup
        DESCRIPTION
            "Mandatory in DOCSIS Set-top Gateway systems."

GROUP dsgFilterIpGroup
        DESCRIPTION
            "Mandatory in DOCSIS Set-top Gateway systems."
         ::= { dsgCompliances 1 }

dsgCaVendorGroup OBJECT-GROUP
        OBJECTS {
             dsgCaVendorNextIndex,
             dsgCaVendorName,
             dsgNumberOfChannels,
             dsgCaVendorEnabled,
             dsgCaVendorRowStatus
```

```
        }
        STATUS      current
        DESCRIPTION
            "A collection of objects providing CA Vendor configuration."
        ::= { dsgGroups 1 }

dsgTunnelGroup OBJECT-GROUP
        OBJECTS {
             dsgTunnelNextIndex,
             dsgTunnelIndex,
             dsgInputAddressType,
             dsgInputAddress,
             dsgOutputAddress,
             dsgTunnelNumber,
             dsgTunnelRowStatus
        }
        STATUS      current
        DESCRIPTION
            "A collection of objects providing DSG Tunnel
            configuration."
        ::= { dsgGroups 2 }

dsgDownstreamGroup OBJECT-GROUP
        OBJECTS {
             dsgDownstreamNextIndex,
             dsgDownstreamIndex,
             dsgDownstreamCaIndex,
             dsgDownstreamIfIndex,
             dsgDownstreamRowStatus
        }
        STATUS      current
        DESCRIPTION
            "A collection of objects providing DSG Downstream
            configuration."
        ::= { dsgGroups 3 }

dsgFilterIpGroup OBJECT-GROUP
        OBJECTS {
             dsgFilterIpDefault,
             dsgFilterIpNextIndex,
             dsgFilterIpControl,
             dsgFilterIpTunnel,
             dsgFilterIpBroadcast,
             dsgFilterIpSaddrType,
             dsgFilterIpSaddr,
             dsgFilterIpSmaskType,
             dsgFilterIpSmask,
             dsgFilterIpDaddrType,
             dsgFilterIpDaddr,
             dsgFilterIpDmaskType,
             dsgFilterIpDmask,
             dsgFilterIpProtocol,
             dsgFilterIpSourcePortLow,
             dsgFilterIpSourcePortHigh,
             dsgFilterIpDestPortLow,
             dsgFilterIpDestPortHigh,
             dsgFilterIpTos,
             dsgFilterIpTosMask,
             dsgFilterIpMatches,
             dsgFilterIpContinue,
```

```
            dsgFilterIpRowStatus
        }
        STATUS      current
        DESCRIPTION
            "A collection of objects providing DSG IP Filtering
            configuration."
        ::= { dsgGroups 4 }

END
```

Appendix I. Acknowledgements (Informative)

We wish to heartily thank the vendor participants contributing directly to this document:

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Appendix II. Revision History (Informative)

Engineering Change Numbers

ECN	Date Ratified	Summary