



Trulifi MIB Guide

1 Introduction

The Trulifi Controller Application allows users to monitor the status of their Controllers and the respective connected Trulifi Access Points (=Modem) through Network Management Systems (NMS) via Simple Network Management Protocol (SNMP).

This document introduces the LiFi Management Information Base (MIB) file of the Trulifi Controller Application. It describes how Object Identifiers (OIDs) in the LiFi MIB are used with the user's preferred NMS software. This document is primarily intended for users handling IT-systems, having enhanced IT and networking background and knowledge.

2 LiFi MIB

The LiFi MIB exposes over 360 Trulifi related parameters. These can be retrieved by an SNMP Management Application Platform or by Management

Command-line Utilities, issuing SNMP GET Requests to the Trulifi Controller.

Over 60 parameters can be modified using SNMP. These can be changed by an SNMP Management Application or by Management Command-line Utilities, issuing SNMP SET Requests to the Trulifi Controller.

The Trulifi Controller Application does not provide SNMP trap capability.

The Object-Identifier (OID) of the LiFi MIB is: 1.3.6.1.4.1.56314.1.1.1 which consists two main groups, one representing the Trulifi Controller (OID: .1.1.1, Name: lifiController) and one representing the LiFi Modems (OID: .1.1.2, Name: lifiModem).

In the next chapters of this document the structure of subgroups is described.

Table 2:1 LiFi MIB

OID	NAME
.1.1.1	lifiController
.1.1.2	lifiModem

3 LiFi Controller Table

The lifiController table provides general information about the Trulifi Controller. The table is split in two sub-tables

Table 3:1 LiFi Controller Table

OID	NAME
.1.1.1.1	lifiControllerDeviceInfo
.1.1.1.2	lifiControllerDeviceTop

3.1 LiFi Controller Device Info Table

The LiFi Controller Device Info table provides general information about the lifiController device itself. The following parameters are exposed in the lifiControllerDeviceInfo table.

Table 3:2 LiFi Controller Device Info table

OID	NAME	Description	Type	Access
.1.1.1.1.1	lifiControllerDeviceInfoName	A string value uniquely identifying the Lifi Controller. Commonly the DNS host name	DISPLAYSTRING	read-only
.1.1.1.1.2	lifiControllerDeviceNumberOfModems	The number of modems controlled by this Controller Device	INTEGER32	read-only
.1.1.1.1.3	lifiControllerDeviceAllModemsResetAlertStatus	This object clears all the pending alerts of all the modems.	INTEGER	read-write
.1.1.1.1.4	lifiControllerDeviceNumberOfPendingAlerts	The number of entries in the lifiControllerPendingAlertTable table.	INTEGER32	read-only

3.2 LiFi Controller Device Top Table

This table provides specific Device information related to the UNIX “top”-command (Table of Processes). The following parameters are exposed in the lifiControllerDeviceTop table

OID	NAME	Description	Type	Access
.1.1.1.2.1	lifiControllerDeviceTopSystemTime	This object provides the current system time.	DISPLAYSTRING	read-only
.1.1.1.2.2	lifiControllerDeviceTopSystemUpTime	This object provides the time the system is up.	DISPLAYSTRING	read-only
.1.1.1.2.3	lifiControllerDeviceTopNbUsers	This object provides the number of users logged-on on this system.	INTEGER32	read-only
.1.1.1.2.4	lifiControllerDeviceTopLoadAvg1	This object provides the average number of jobs in the run queue over the last minute.	INTEGER32	read-only
.1.1.1.2.5	lifiControllerDeviceTopLoadAvg5	This object provides the average number of jobs in the run queue over the last 5 minutes.	INTEGER32	read-only
.1.1.1.2.6	lifiControllerDeviceTopLoadAvg15	This object provides the average number of jobs in the run queue over the last 15 minutes.	INTEGER32	read-only
.1.1.1.2.7	lifiControllerDeviceTopTasksTotal	This object provides the total number of processes.	INTEGER32	read-only
.1.1.1.2.8	lifiControllerDeviceTopTasksRunning	This object provides the total number of processes running, not sleeping.	INTEGER32	read-only
.1.1.1.2.9	lifiControllerDeviceTopTasksSleeping	This object provides the total number of processes sleeping.	INTEGER32	read-only
.1.1.1.2.10	lifiControllerDeviceTopTasksStopped	This object provides the total number of processes stopped.	INTEGER32	read-only
.1.1.1.2.11	lifiControllerDeviceTopTasksZombie	This object provides the total number of processes zombie.	INTEGER32	read-only
.1.1.1.2.12	lifiControllerDeviceTopCpuUser	This object provides the total CPU User Time spent, in %	INTEGER32	read-only
.1.1.1.2.13	lifiControllerDeviceTopCpuSystem	This object provides the total CPU System Time spent, in %.	INTEGER32	read-only
.1.1.1.2.14	lifiControllerDeviceTopCpuNice	This object provides the total CPU Nice Time spent, in %.	INTEGER32	read-only
.1.1.1.2.15	lifiControllerDeviceTopCpuIdle	This object provides the total CPU Idle Time spent, in %.	INTEGER32	read-only
.1.1.1.2.16	lifiControllerDeviceTopCpuNotIdle	This object provides the total CPU not Idle Time spent (=100%-Idle Time), in %.	INTEGER32	read-only
.1.1.1.2.17	lifiControllerDeviceTopCpuIOWait	This object provides the total CPU IO Wait Time spent, in %.	INTEGER32	read-only
.1.1.1.2.18	lifiControllerDeviceTopCpuHWInt	This object provides the total CPU on Hardware IRQ. This is the amount of time the CPU has been servicing hardware interrupts, in %.	INTEGER32	read-only

.1.1.1.2.19	lifiControllerDeviceTopCpuSWInt	This object provides the total CPU on Software Interrupts. This is the amount of time the CPU has been servicing software interrupts, in %.	INTEGER32	read-only
.1.1.1.2.20	lifiControllerDeviceTopCpuStolen	This object provides the total CPU Time Stolen from a virtual machine, in %.	INTEGER32	read-only
.1.1.1.2.21	lifiControllerDeviceTopMemTotal	This object provides the Total Memory of the system, in kbytes.	GAUGE32	read-only
.1.1.1.2.22	lifiControllerDeviceTopMemFree	This object provides the Free Memory of the system. It is the part of the RAM that currently contains no information, in kbytes.	GAUGE32	read-only
.1.1.1.2.23	lifiControllerDeviceTopMemUsed	This object provides the Used Memory of the system. It is the part of the RAM that currently contains information, in kbytes.	GAUGE32	read-only
.1.1.1.2.24	lifiControllerDeviceTopMemCachedAndBuffers	This object provides the amount of RAM that contains data buffered for IO, in kbytes.	GAUGE32	read-only
.1.1.1.2.25	lifiControllerDeviceTopMemAvail	This object provides the amount of RAM that is available, in kbytes.	GAUGE32	read-only
.1.1.1.2.26	lifiControllerDeviceTopPMemAvail	This object provides the ratio between the available memory and the total memory, in %.	GAUGE32	read-only
.1.1.1.2.27	lifiControllerDeviceTopSwapTotal	This object provides the Total amount of Swap space, in kbytes.	GAUGE32	read-only
.1.1.1.2.28	lifiControllerDeviceTopSwapFree	This object provides the Free amount of Swap space, in kbytes.	GAUGE32	read-only
.1.1.1.2.29	lifiControllerDeviceTopSwapUsed	This object provides the Used amount of Swap space, in kbytes.	GAUGE32	read-only
.1.1.1.2.30	lifiControllerDeviceTopPSwapFree	This object provides the ratio between the free swap and the the total swap, in %.	GAUGE32	read-only
.1.1.1.2.31	lifiControllerDeviceTopInAlertStatus	This object provides if an alert is pending for one of the Top objects.	INTEGER	read-only
.1.1.1.2.32	lifiControllerDeviceTopResetAlertStatus	This object clears all the pending alerts of the Top objects.	INTEGER	read-write

4 LiFi Modem Table

The lifiModem group provides specific LiFi related information. The information is related to the LiFi modems which are controlled via the LiFi Controller. The group is split in 11 sub-groups, each representing a separate topic

Table 4:1 LiFi Modem Table

OID	NAME
.1.1.2.1	lifiModemDevice
.1.1.2.2	lifiModemTime
.1.1.2.3	lifiModemEthernet
.1.1.2.4	lifiModemLiFi
.1.1.2.5	lifiModemIP
.1.1.2.6	lifiModemDNS
.1.1.2.7	lifiModemDHCPv4
.1.1.2.8	lifiModemDHCPv6
.1.1.2.9	lifiModemQoS
.1.1.2.11	lifiModemMulticast

4.1 LiFi Modem Device Group

The lifiModemDevice group provides general information about a LiFi Modem. The group is further divided into two sub-groups.

Table 4:2 LiFi Modem Device Group

OID	NAME
.1.1.2.1.1	lifiModemDeviceInfo
.1.1.2.1.2	lifiModemDeviceFactoryResetProfile

4.1.1 LiFi Modem Device Info Group

The device info group contains three tables; the general information, the memory status and the CPU status of a modem. Each table holds more information.

Table 4:3 LiFi Modem Device Info Group

OID	NAME
.1.1.2.1.1.1	lifiModemDeviceInfoTable
.1.1.2.1.1.2	lifiModemDeviceMemoryStatusTable
.1.1.2.1.1.3	lifiModemDeviceCPUStatusTable

LiFi Modem Device Info Table

OID	NAME	Description	Type	Access
.1.1.2.1.1.1.1	lifiModemIndex	This object indexes the lifiModemDeviceInfoTable.	INTEGER32	not-accessible
.1.1.2.1.1.1.2	lifiModemNumber	This object is equal to the index with which a Modem is identified by a management application	INTEGER32	read-only
.1.1.2.1.1.1.3	lifiModemDeviceInfoManufacturer	Device Manufacturer (human readable string).	DISPLAYSTRING	read-only
.1.1.2.1.1.1.4	lifiModemDeviceInfoManufacturerOUI	The OUI (Organizationally Unique Identifier) is a 24-bit number that uniquely identifies a vendor or manufacturer. They are purchased and assigned by the IEEE. The OUI is basically the first three octets of a MAC address.	DISPLAYSTRING	read-only
.1.1.2.1.1.1.5	lifiModemDeviceInfoProductClass	Identifier of the class of product for which the serial number applies.	DISPLAYSTRING	read-only
.1.1.2.1.1.1.6	lifiModemDeviceInfoModelName	Model name of the device (human readable string).	DISPLAYSTRING	read-only
.1.1.2.1.1.1.7	lifiModemDeviceInfoDescription	A full description of the device (human readable string).	DISPLAYSTRING	read-only
.1.1.2.1.1.1.8	lifiModemDeviceInfoSerialNumber	Identifier of the particular device that is unique for the indicated class of product and manufacturer.	DISPLAYSTRING	read-only
.1.1.2.1.1.1.9	lifiModemDeviceInfoHardwareVersion	A string identifying the particular device model and version.	DISPLAYSTRING	read-only
.1.1.2.1.1.1.10	lifiModemDeviceInfoSoftwareVersion	A string identifying the software version currently installed in the Device.	DISPLAYSTRING	read-only
.1.1.2.1.1.1.11	lifiModemDeviceInfoAdditionalSoftwareVersion	Comma-separated list (maximum list length 64) of strings. Each entry is an additional version. The total length of the entire string is limited to 4096 characters.	DISPLAYSTRING	read-only
.1.1.2.1.1.1.12	lifiModemDeviceInfoUptime	This parameter provides the time elapsed since the last reset of the system. In days, hours, minutes and seconds.	DISPLAYSTRING	read-only
.1.1.2.1.1.1.13	lifiModemDeviceInfoBootCount	The number of times the modem has booted, since production.	INTEGER32	read-only

LiFi Modem Device Memory Status

OID	NAME	Description	Type	Access
.1.1.2.1.1.2.1.1	lifiModemDeviceMemoryTotal	The total memory of the modem in kbytes.	GAUGE32	read-only
.1.1.2.1.1.2.1.2	lifiModemDeviceMemoryFree	The free memory of the modem in kbytes.	GAUGE32	read-only
.1.1.2.1.1.2.1.3	lifiModemDevicePMemoryFree	This object provides the ratio between the free memory and the total memory, in 0/0.	GAUGE32	read-only
.1.1.2.1.1.2.1.4	lifiModemDeviceMemoryInAlertStatus	This object indicates if an alert is pending for one of the modem device memory objects.	INTEGER	read-only
.1.1.2.1.1.2.1.5	lifiModemDeviceMemoryResetAlertStatus	This object clears all the pending alerts of the modem device memory objects.	INTEGER	read-write

LiFi Modem Device CPU Status

OID	NAME	Description	Type	Access
.1.1.2.1.1.3.1.1	lifiModemDeviceCPUUsage	The CPU usage of the modem, in 0/0.	GAUGE32	read-only
.1.1.2.1.1.3.1.2	lifiModemDeviceCPUInAlertStatus	This object indicates if an alert is pending for one of the modem device cpu objects.	INTEGER	read-only
.1.1.2.1.1.3.1.3	lifiModemDeviceCPUResetAlertStatus	This object clears all the pending alerts of the modem device cpu objects.	INTEGER	read-write

4.1.2 LiFi Modem Device Factory Reset Profile Group

The Reset profile group contains a single table.

OID	NAME
.1.1.2.1.2.1	lifiModemDeviceFactoryResetProfileTable

LiFi Modem Device Factory Reset Profile Table

OID	NAME	Description	Type	Access
.1.1.2.1.2.1.1.5	lifiModemDeviceFactoryReset	Is always false(2). When set to true(1) the factory settings are reset.	INTEGER	read-write

4.2 LiFi Modem Time Group

A Network Time Protocol (NTP) client is incorporated into the firmware of the LiFi Modems. In the LiFi Modem Time Group two tables are used to provide status information of the NTP client and to configure the NTP client.

OID	NAME
.1.1.2.2.1	lifiModemTimeTable
.1.1.2.2.2	lifiModemTimeNTPServerTable

LiFi Modem Time Table

OID	NAME	Description	Type	Access
.1.1.2.2.1.1	lifiModemTimeEntry	An entry (conceptual row) in the lifiModemTimeTable.	LifiModemTimeEntry	not-accessible
.1.1.2.2.1.1.1	lifiModemTimeEnable	A boolean indication if NTP is enabled on the modem. Can be set to true(1) or false(0)	INTEGER	read-write
.1.1.2.2.1.1.2	lifiModemTimeStatus	NTP client status. Enumeration of -Disabled. -Unsynchronized:absolute time has not yet been set. -Synchronized:device has acquired accurate absolute time. -Error_FailedToSynchronize:device failed to acquire accurate absolute time.	INTEGER	read-only
.1.1.2.2.1.1.3	lifiModemTimeCurrentLocalTime	Current time. It has the following format (separated by white spaces): -year -month (Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec), -month day (1-31), -hours:minutes:seconds. For example:2020-Aug-1,14:16:01	DISPLAYSTRING	read-only
.1.1.2.2.1.1.4	lifiModemTimeLocalTimeZone	The local time zone definition, as an offset to UTC. Accepted values are: UTC-12:00 or UTC-11:00 or UTC-10:00 or UTC-09:30 or UTC-09:00 or UTC-08:00 or UTC-07:00 or UTC-06:00 or UTC-05:00 or UTC-04:00 or UTC-03:30 or UTC-03:00 or UTC-02:00 or UTC-01:00 or UTC-00:00 or UTC+00:00 or UTC+01:00 or UTC+02:00or UTC+03:00 or UTC+03:30 or UTC+04:00 or UTC+04:30 or UTC+05:00 or UTC+05:30 or UTC+05:45 or UTC+06:00 or UTC+06:30 or UTC+07:00 or UTC+08:00 or UTC+08:45 or UTC+09:00 or UTC+09:30 or UTC+10:00 or UTC+10:30 or UTC+11:00 or UTC+12:00 or UTC+12:45 or UTC+13:00 or UTC+14:00.	DISPLAYSTRING	read-write
.1.1.2.2.1.1.5	lifiModemTimeNumberOfNTPServers	The maximum number of used NTP servers, such as clock.isc.org or time.google.com.	INTEGER32	read-only

LiFi Modem Time NTP Server Table

OID	NAME	Description	Type	Access
.1.1.2.2.2	lifiModemTimeNTPServerTable	A Table that lists the modems, and shows the NTP servers objects.	SEQUENCE OF LifiModemTimeNTPServerEntry	not-accessible
.1.1.2.2.2.1	lifiModemTimeNTPServerEntry	An entry (conceptual row) in the lifiModemTimeNTPServerTable.	LifiModemTimeNTPServerEntry	not-accessible
.1.1.2.2.2.1.1	lifiModemTimeNTPServerIndex	This object indexes the lifiModemTimeNTPServerTable.	INTEGER32	not-accessible
.1.1.2.2.2.1.2	lifiModemTimeNTPServerName	The DNS name of NTP the server.	DISPLAYSTRING	read-write

4.3 LiFi Modem Ethernet

The LiFi Modem Ethernet group contains information about the Ethernet interface. In general, there are two Ethernet interfaces available. Depending on which Trulifi model is used, either ETHA or ETHB is active, but never both simultaneously.

Platform	Ethernet Interface
Trulifi 6002.1	ETHA
Trulifi 6002.2	ETHA
Trulifi 6014.01	ETHB
Trulifi 6014.02	ETHB

LiFi Modem Ethernet group is split in one Table and another sub-group.

OID	NAME
.1.1.2.3.1	lifiModemEthernetTable
.1.1.2.3.3	lifiModemEthernetInterface

LiFi Modem Ethernet Table

OID	NAME	Description	Type	Access
.1.1.2.3.1	lifiModemEthernetTable	A Table that lists the modems, and shows the ethernet objects.	SEQUENCE OF LifiModemEthernetEntry	not-accessible
.1.1.2.3.1.1	lifiModemEthernetEntry	An entry (conceptual row) in the lifiModemEthernetTable.	LifiModemEthernetEntry	not-accessible
.1.1.2.3.1.1.1	lifiModemEthernetNumberOfInterfaces	The number of ethernet interfaces of the modem.	INTEGER32	read-only
.1.1.2.3.1.1.2	lifiModemEthernetResetStats	Is always false(2). When set to true(1) all ethernet interface statistics are reset to zero.	INTEGER	read-write
.1.1.2.3.1.1.3	lifiModemEthernetInAlertStatus	This object indicates if an alert is pending for one of the ethernet interface statistics objects.	INTEGER	read-only
.1.1.2.3.1.1.4	lifiModemEthernetResetAlertStatus	This object clears all the pending alerts of the ethernet interface statistics objects.	INTEGER	read-write

4.3.1 LiFi Modem Ethernet Interface Group

The Ethernet interface group contains parameters to configure the interface and to retrieve statistics on the interface.

OID	NAME
.1.1.2.3.3.1	lifiModemEthernetInterfaceTable
.1.1.2.3.3.2	lifiModemEthernetInterfaceStatsTable

LiFi Modem Ethernet Interface Table

OID	NAME	Description	Type	Access
.1.1.2.3.3.1	lifiModemEthernetInterfaceTable	A Table that lists the modems, and shows the ethernet interface objects.	SEQUENCE OF LifiModemEthernetInterfaceEntry	not-accessible
.1.1.2.3.3.1.1	lifiModemEthernetInterfaceEntry	An entry (conceptual row) in the lifiModemEthernetInterfaceTable.	LifiModemEthernetInterfaceEntry	not-accessible
.1.1.2.3.3.1.1.1	lifiModemEthernetInterfaceIndex	The lifiModemEthernetInterfaceTable index.	INTEGER32	not-accessible
.1.1.2.3.3.1.1.2	lifiModemEthernetInterfaceEnable	Indicates if Ethernet the interface is enabled (YES) or disabled (NO).	INTEGER	read-only
.1.1.2.3.3.1.1.3	lifiModemEthernetInterfaceStatus	This object returns the current operational state of the interface. Enumeration: -Up -Down -Unknown -Dormant -NotPresent -LowerLayerDown -Error	INTEGER	read-only
.1.1.2.3.3.1.1.4	lifiModemEthernetInterfaceName	The name of the ethernet interface.	INTEGER	read-only

.1.1.2.3.3.1.1.5	lifiModemEthernetInterfaceLastChange	The accumulated time since the interface entered its current operational state, in days, hours, minutes and seconds.	DISPLAYSTRING	read-only
.1.1.2.3.3.1.1.6	lifiModemEthernetInterfaceMACAddress	The object encodes the MAC address of the interface.	DISPLAYSTRING	read-only
.1.1.2.3.3.1.1.7	lifiModemEthernetInterfaceMaxBitRate	The data rate of Ethernet interface in Mbit/s. Can only be changed if Duplex Mode is not set to "auto"	INTEGER	read-write
.1.1.2.3.3.1.1.8	lifiModemEthernetInterfaceDuplexMode	The Duplex mode of the Ethernet interface.	INTEGER	read-write

LiFi Modem Ethernet Interface Stats Table

OID	NAME	Description	Type	Access
.1.1.2.3.3.2	lifiModemEthernetInterfaceStatsTable	A Table that lists the modems, and shows the ethernet interfaces statistics objects.	SEQUENCE OF LifiModemEthernetInterfaceStatsEntry	not-accessible
.1.1.2.3.3.2.1	lifiModemEthernetInterfaceStatsEntry	An entry (conceptual row) in the lifiModemEthernetInterfaceStatsTable.	LifiModemEthernetInterfaceStatsEntry	not-accessible
.1.1.2.3.3.2.1.1	lifiModemEthernetInterfaceStatsIndex	The ethernet interface statistics index.	INTEGER32	not-accessible
.1.1.2.3.3.2.1.2	lifiModemEthernetInterfaceStatsBytesSent	The number of transmitted (Tx) bytes through the ethernet interface.	COUNTER64	read-only
.1.1.2.3.3.2.1.3	lifiModemEthernetInterfaceStatsBytesReceived	The number of received (Rx) bytes through the ethernet interface.	COUNTER64	read-only
.1.1.2.3.3.2.1.4	lifiModemEthernetInterfaceStatsPacketsSent	The number of transmitted (Tx) packets through the ethernet interface.	COUNTER64	read-only
.1.1.2.3.3.2.1.5	lifiModemEthernetInterfaceStatsPacketsReceived	The number of received (Rx) packets through the ethernet interface.	COUNTER64	read-only

4.4 LiFi Modem LiFi Group

The LiFi Modem LiFi group contains information about the LiFi interface, i.e. towards the optical channel.

LiFi Modem LiFi group is split in one Table and another sub-group.

OID	NAME
.1.1.2.3.1	lifiModemLiFiTable
.1.1.2.3.3	lifiModemLiFiInterface

LiFi Modem LiFi Table

OID	NAME	Description	Type	Access
.1.1.2.4.1	lifiModemLiFiTable	A Table that lists the modems, and shows the LiFi objects.	SEQUENCE OF LifiModemLiFiEntry	not-accessible
.1.1.2.4.1.1	lifiModemLiFiEntry	An entry (conceptual row) in the lifiModemLiFiTable.	LifiModemLiFiEntry	not-accessible
.1.1.2.4.1.1.1	lifiModemLiFiNumberOfInterfaces	The number of ethernet interface of the modem.	INTEGER32	read-only
.1.1.2.4.1.1.2	lifiModemLiFiResetStats	Is always false(2). When set to true(1) the lifi interface statistics are reset to zero.	INTEGER	read-write
.1.1.2.4.1.1.3	lifiModemLiFiAlertStatus	This object indicates if an alert is pending for one of the LiFi interface statistics objects.	INTEGER	read-only
.1.1.2.4.1.1.4	lifiModemLiFiResetAlertStatus	This object clears all the pending alerts of the LiFi interface statistics objects.	INTEGER	read-write

.1.1.2.4.1.1.5	lifiModemLiFiAssociatedDeviceInAlertStatus	This object indicates if an alert is pending for one of the LiFi interface associated device objects.	INTEGER	read-only
.1.1.2.4.1.1.6	lifiModemLiFiAssociatedDeviceResetAlertStatus	This object clears all the pending alerts of the LiFi interface associated device objects.	INTEGER	read-write

4.4.1 LiFi Modem LiFi Interface Group

The LiFi Interface Group contains operational and statistical information about the interface, as well as all associated devices, e.g. Trulifi USB keys.

OID	NAME
.1.1.2.4.3.1	lifiModemLiFiInterfaceTable
.1.1.2.4.3.2	lifiModemLiFiInterfaceStatsTable
.1.1.2.4.3.4	lifiModemLiFiInterfaceAssociatedDeviceTable

LiFi Modem LiFi Interface Table

OID	NAME	Description	Type	Access
.1.1.2.4.3.1	lifiModemLiFiInterfaceTable	A Table that lists the modems, and shows the LiFi interfaces objects.	SEQUENCE OF LifiModemLiFiInterfaceEntry	not-accessible
.1.1.2.4.3.1.1	lifiModemLiFiInterfaceEntry	An entry (conceptual row) in the lifiModemLiFiInterfaceTable.	LifiModemLiFiInterfaceEntry	not-accessible
.1.1.2.4.3.1.1.1	lifiModemLiFiInterfaceIndex	The LiFi interface index.	INTEGER32	not-accessible
.1.1.2.4.3.1.1.2	lifiModemLiFiInterfaceEnable	Set to true(1) to enable the G.hn interface of this node. Set to false(2) to disable the G.hn interface of this node.	INTEGER	read-write
.1.1.2.4.3.1.1.3	lifiModemLiFiInterfaceStatus	This object returns the current operational state of the interface. Enumeration of: -Up -Down -Unknown -Dormant -NotPresent -LowerLayerDown -Error	INTEGER	read-only
.1.1.2.4.3.1.1.4	lifiModemLiFiInterfaceLastChange	The accumulated time since the interface entered its current operational state, in days, hours, minutes and seconds.	DISPLAYSTRING	read-only
.1.1.2.4.3.1.1.5	lifiModemLiFiInterfaceMACAddress	This object encodes the MAC address of the modem.	DISPLAYSTRING	read-only
.1.1.2.4.3.1.1.6	lifiModemLiFiInterfaceFirmwareVersion	This object contains the version information regarding the image currently running.	DISPLAYSTRING	read-only
.1.1.2.4.3.1.1.7	lifiModemLiFiInterfaceConnectionType	This object represents the medium type that the node currently operates on: -1:Power line baseband -2:Phone line baseband -3:Coax baseband -4:Coax RF -5:Plastic optical fiber -6:LiFi -7:Other	INTEGER	read-only
.1.1.2.4.3.1.1.8	lifiModemLiFiInterfaceDomainName	The Domain Name of this domain.	DISPLAYSTRING	read-only
.1.1.2.4.3.1.1.9	lifiModemLiFiInterfaceDomainNameIdentifier	The Domain Network Identifier of this domain.	INTEGER32	read-only
.1.1.2.4.3.1.1.10	lifiModemLiFiInterfaceDomainIdentifier	The Domain Id of this domain.	INTEGER32	read-only
.1.1.2.4.3.1.1.11	lifiModemLiFiInterfaceDeviceIdentifier	The Device Id of this node.	INTEGER32	read-only
.1.1.2.4.3.1.1.12	lifiModemLiFiInterfaceMaxBitRate	The estimated application-layer throughput. It is a global estimation, not for a specific link. In Kbps.	GAUGE32	read-only
.1.1.2.4.3.1.1.13	lifiModemLiFiInterfaceNumberOfAssociatedDevices	The number of end points associated with this LiFi interface.	INTEGER32	read-only

LiFi Modem Interface Stats Table

OID	NAME	Description	Type	Access
.1.1.2.4.3.2	lifiModemLiFiInterfaceStatsTable	A Table that lists the online modems, and shows the LiFi interface statistics objects.	SEQUENCE OF LifiModemLiFiInterfaceStatsEntry	not-accessible
.1.1.2.4.3.2.1	lifiModemLiFiInterfaceStatsEntry	An entry (conceptual row) in the lifiModemLiFiInterfaceStatsTable.	LifiModemLiFiInterfaceStatsEntry	not-accessible
.1.1.2.4.3.2.1.1	lifiModemLiFiInterfaceStatsIndex	The LiFi interface index.	INTEGER32	not-accessible
.1.1.2.4.3.2.1.2	lifiModemLiFiInterfaceStatsBytesSent	The total number of bytes transmitted out of the interface, including framing characters. More specifically, this is the total number of MPDU bytes transmitted or retransmitted by the node through a physical medium (i.e., PMI defined in [Clause 5.2.1/G.9960]), which correspond to data LPDUs (i.e., data packets) and framing overhead (e.g., LFH, LPH, LPCS defined in [Clause 8.1/G.9961]). It does not include transmitted bytes contributed by management LPDUs (i.e., management packets). Note: LPDUs in mixed LLC frame blocks are considered data LPDUs.	COUNTER64	read-only
.1.1.2.4.3.2.1.3	lifiModemLiFiInterfaceStatsBytesReceived	The total number of bytes received on the interface, including framing characters. More specifically, this is the total number of MPDU bytes received by the node through a physical medium, which correspond to data LPDUs and framing overhead. It does not include received bytes contributed by management LPDUs. It can include blocks with errors. Note: LPDUs in mixed LLC frame blocks are considered data LPDUs.	COUNTER64	read-only
.1.1.2.4.3.2.1.4	lifiModemLiFiInterfaceStatsPacketsSent	The total number of packets transmitted out of the interface. More specifically, this is the total number of APDUs requested for transmission by a higher layer (i.e., outbound APDUs at the x1 reference point defined in [Clause 5.2.1/G.9960]) that were transmitted by the node through the physical medium. It does not include transmitted LCDUs.	COUNTER64	read-only
.1.1.2.4.3.2.1.5	lifiModemLiFiInterfaceStatsPacketsReceived	The total number of packets received on the interface. More specifically, this is the total number of APDUs delivered to a higher layer (i.e., inbound APDUs at the x1 reference point) that were received by the node through the physical medium. It does not include received LCDUs.	COUNTER64	read-only
.1.1.2.4.3.2.1.6	lifiModemLiFiInterfaceStatsErrorsSent	The total number of outbound packets that could not be transmitted because of errors. More specifically, this is the total number of APDUs that were requested for transmission by a higher layer (i.e., outbound APDUs at the x1 reference point defined in [Clause 5.2.1/G.9960]) but could not be transmitted because of errors (e.g., APDUs containing CRC errors).	COUNTER64	read-only
.1.1.2.4.3.2.1.7	lifiModemLiFiInterfaceStatsErrorsReceived	The total number of inbound packets that contained errors preventing them from being delivered to a higher-layer protocol. More specifically, this is the total number of received APDUs that contained errors preventing them from being delivered to a higher layer (i.e., inbound APDUs at the x1 reference point defined in [Clause 5.2.1/G.9960]). The possible causes of error are: incorrect CRC, incorrect MIC,	COUNTER64	read-only

		incorrect MIC size, and incorrect size of packet.		
.1.1.2.4.3.2.1.8	lifiModemLiFiInterfaceStatsUnicastPacketsSent	The total number of packets requested for transmission which were not addressed to a multicast or broadcast address at this layer, including those that were discarded or not sent. More specifically, this is the total number of APDUs that were requested for transmission by a higher layer (i.e., outbound APDUs at the x1 reference point) and which were addressed to a unicast address at this layer. It includes APDUs that were discarded or not sent.	COUNTER64	read-only
.1.1.2.4.3.2.1.9	lifiModemLiFiInterfaceStatsUnicastPacketsReceived	The total number of received packets, delivered by this layer to a higher layer, which were not addressed to a multicast or broadcast address at this layer. More specifically, this is the total number of received APDUs that were delivered to a higher layer (i.e., inbound APDUs at the x1 reference point) and which were addressed to a unicast address at this layer.	COUNTER64	read-only
.1.1.2.4.3.2.1.10	lifiModemLiFiInterfaceStatsDiscardPacketsSent	The total number of outbound packets which were chosen to be discarded even though no errors had been detected to prevent their being transmitted. One possible reason for discarding such a packet could be to free up buffer space. More specifically, this is the total number of APDUs that were requested for transmission by a higher layer (i.e., outbound APDUs at the x1 reference point) but chosen to be discarded even though no errors had been detected to prevent their being transmitted (e.g., buffer overflow).	COUNTER64	read-only
.1.1.2.4.3.2.1.11	lifiModemLiFiInterfaceStatsDiscardPacketsReceived	The total number of inbound packets which were chosen to be discarded even though no errors had been detected to prevent their being delivered. One possible reason for discarding such a packet could be to free up buffer space. More specifically, this is the total number of received APDUs that were chosen to be discarded even though no errors had been detected to prevent their being delivered.	COUNTER64	read-only
.1.1.2.4.3.2.1.12	lifiModemLiFiInterfaceStatsMulticastPacketsSent	The total number of packets that higher-level protocols requested for transmission and which were addressed to a multicast address at this layer, including those that were discarded or not sent. More specifically, this is the total number of APDUs that were requested for transmission by a higher layer (i.e., outbound APDUs at the x1 reference point) and which were addressed to a multicast address at this layer. It includes APDUs that were discarded or not sent.	COUNTER64	read-only
.1.1.2.4.3.2.1.13	lifiModemLiFiInterfaceStatsMulticastPacketsReceived	The total number of received packets, delivered by this layer to a higher layer, which were addressed to a multicast address at this layer. More specifically, this is the total number of received APDUs that were delivered to a higher layer (i.e., inbound APDUs at the x1 reference point) and which were addressed to a multicast address at this layer.	COUNTER64	read-only
.1.1.2.4.3.2.1.14	lifiModemLiFiInterfaceStatsBroadcastPacketsSent	The total number of packets that higher-level protocols requested for transmission and which were addressed to a broadcast address at this layer, including those that were discarded or not sent. More	COUNTER64	read-only

		specifically, this is the total number of APDUs that were requested for transmission by a higher layer (i.e., outbound APDUs at the x1 reference point) and which were addressed to a broadcast address at this layer. It includes APDUs that were discarded or not sent.		
.1.1.2.4.3.2.1.15	lifiModemLiFiInterfaceStatsBroadcastPacketsReceived	The total number of received packets, delivered by this layer to a higher layer, which were addressed to a broadcast address at this layer. More specifically, this is the total number of received APDUs that were delivered to a higher layer (i.e., inbound APDUs at the x1 reference point) and which were addressed to a broadcast address at this layer.	COUNTER64	read-only
.1.1.2.4.3.2.1.16	lifiModemLiFiInterfaceStatsUnknownProtoPacketsReceived	The total number of packets received via the interface which were discarded because of an unknown or unsupported protocol. More specifically, this is the total number of APDUs received by the management that were discarded because of an unknown or unsupported protocol.	COUNTER64	read-only
.1.1.2.4.3.2.1.17	lifiModemLiFiInterfaceStatsQoS MgmtBytesSent	The total number of MPDU bytes transmitted by the node through a physical medium, which correspond to management LPDUs and framing overhead.	COUNTER64	read-only
.1.1.2.4.3.2.1.18	lifiModemLiFiInterfaceStatsQoS MgmtBytesReceived	The total number of MPDU bytes received by the node through a physical medium, which correspond to management LPDUs and framing overhead.	COUNTER64	read-only
.1.1.2.4.3.2.1.19	lifiModemLiFiInterfaceStatsQoS MgmtPacketsSent	The total number of LCDUs requested for transmission by a management layer (i.e., outbound LCDUs generated in LLC defined in [Clause 8.1.3/G.9961]) that were transmitted by the node through a physical medium.	COUNTER64	read-only
.1.1.2.4.3.2.1.20	lifiModemLiFiInterfaceStatsQoS MgmtPacketsReceived	The total number of LCDUs delivered to a management layer (i.e., outbound LCDUs generated in LLC defined in [Clause 8.1.3/G.9961]) that were transmitted by the node through a physical medium.	COUNTER64	read-only
.1.1.2.4.3.2.1.21	lifiModemLiFiInterfaceStatsQoSBlocksSent	The total number of LPDUs that were transmitted by the node through a physical medium, regardless of new or retransmitted LPDUs.	COUNTER64	read-only
.1.1.2.4.3.2.1.22	lifiModemLiFiInterfaceStatsQoSBlocksReceived	The total number of LPDUs that were received by the node through a physical medium, regardless of new or retransmitted LPDUs.	COUNTER64	read-only
.1.1.2.4.3.2.1.23	lifiModemLiFiInterfaceStatsQoSBlocksReSent	The total number of LPDUs that were retransmitted.	COUNTER64	read-only
.1.1.2.4.3.2.1.24	lifiModemLiFiInterfaceStatsQoSBlocksRetransmissionRate	Retransmission rate = $\text{BlocksReSent} / \text{BlocksSent}$.	GAUGE32	read-only
.1.1.2.4.3.2.1.25	lifiModemLiFiInterfaceStatsQoSBlocksErrorReceived	The total number of received LPDUs that contained errors. Note the following relationships hold: $\text{PacketsSent} + \text{ErrorsSent} + \text{DiscardPacketsSent} = \text{UnicastPacketsSent} + \text{MulticastPacketsSent} + \text{BroadcastPacketsSent}$. $\text{PacketsReceived} = \text{UnicastPacketsReceived} + \text{MulticastPacketsReceived} + \text{BroadcastPacketsReceived}$.	COUNTER64	read-only
.1.1.2.4.3.2.1.26	lifiModemLiFiInterfaceStatsQoSBlocksErrorRate	Block error rate = $\text{BlocksErrorReceived} / \text{BlocksReceived}$.	GAUGE32	read-only

LiFi Modem LiFi Interface Associated Device Table

The `lifiModemLiFiInterfaceAssociatedDeviceTable` shows data of each associated device (LiFi USB keys) to a specific modem, i.e. MAC-Address, PHY rate and such.

OID	NAME	Description	Type	Access
.1.1.2.4.3.4	<code>lifiModemLiFiInterfaceAssociatedDeviceTable</code>	A Table that lists the online modems, and shows the LiFi interface associated devices objects.	SEQUENCE OF <code>LifiModemLiFiInterfaceAssociatedDeviceEntry</code>	not-accessible
.1.1.2.4.3.4.1	<code>lifiModemLiFiInterfaceAssociatedDeviceEntry</code>	An entry (conceptual row) in the <code>lifiModemLiFiInterfaceAssociatedDeviceTable</code> .	<code>LifiModemLiFiInterfaceAssociatedDeviceEntry</code>	not-accessible
.1.1.2.4.3.4.1.1	<code>lifiModemLiFiInterfaceAssociatedDeviceIndex</code>	This object indexes the <code>lifiModemLiFiInterfaceAssociatedDeviceTable</code> .	INTEGER32	not-accessible
.1.1.2.4.3.4.1.2	<code>lifiModemLiFiInterfaceAssociatedDeviceMACAddress</code>	This object displays the MAC address of the associated device.	DISPLAYSTRING	read-only
.1.1.2.4.3.4.1.3	<code>lifiModemLiFiInterfaceAssociatedDeviceID</code>	This object displays the Device ID of the associated device.	INTEGER32	read-only
.1.1.2.4.3.4.1.4	<code>lifiModemLiFiInterfaceAssociatedDeviceTxPhyRate</code>	PHY rate in Kbytes/sec used to transmit data to the node registered.	GAUGE32	read-only
.1.1.2.4.3.4.1.5	<code>lifiModemLiFiInterfaceAssociatedDeviceRxPhyRate</code>	PHY rate in Kbytes/sec used to receive data from the node registered.	GAUGE32	read-only
.1.1.2.4.3.4.1.6	<code>lifiModemLiFiInterfaceAssociatedDeviceActive</code>	This object indicates the presence of the associated device.	INTEGER	read-only
.1.1.2.4.3.4.1.7	<code>lifiModemLiFiInterfaceAssociatedDeviceLastUpdate</code>	The accumulated time since the interface entered its current operational state, in days, hours, minutes and seconds.	DISPLAYSTRING	read-only
.1.1.2.4.3.4.1.8	<code>lifiModemLiFiInterfaceAssociatedDeviceReceivedFrames</code>	This object contains the number of received frames.	COUNTER64	read-only
.1.1.2.4.3.4.1.9	<code>lifiModemLiFiInterfaceAssociatedDeviceReceivedLPDU</code>	This object contains the total number of received LPDUS, including invalid and errors.	COUNTER64	read-only
.1.1.2.4.3.4.1.10	<code>lifiModemLiFiInterfaceAssociatedDeviceErrorLPDU</code>	This object displays the percentage of LPDUs with errors.	GAUGE32	read-only
.1.1.2.4.3.4.1.11	<code>lifiModemLiFiInterfaceAssociatedDeviceAbortLPDU</code>	This object displays the percentage of aborted LPDUs.	GAUGE32	read-only

4.5 LiFi Modem IP

The Trulifi firmware includes a TCP/IP stack. The stack itself is not needed for the standard use of the Trulifi devices, however it is needed if the WebUI of the LiFi Modem needs to be accessed. The WebUI uses the standard HTTP protocol and can be accessed via the configured IPv4/6 addresses.

The LiFi Modem IP group provides parameters to configure these IPv4 and IPv6 addresses and is organized in 4 tables.

OID	NAME
.1.1.2.5	<code>lifiModemIP</code>
.1.1.2.5.1	<code>lifiModemIPInterface</code>
.1.1.2.5.1.1	<code>lifiModemIPInterfaceTable</code>
.1.1.2.5.1.2	<code>lifiModemIPInterfaceIPv4AddressTable</code>
.1.1.2.5.1.3	<code>lifiModemIPInterfaceIPv6AddressTable</code>
.1.1.2.5.1.4	<code>lifiModemIPInterfaceIPv6PrefixTable</code>

LiFi Modem IP Interface Table

This table provides a status overview of the different IP interfaces of a specific LiFi Modem.

OID	NAME	Description	Type	Access
.1.1.2.5.1.1	lifiModemIPInterfaceTable	A Table that lists the modems, and shows the IP interface objects.	SEQUENCE OF LifiModemIPInterfaceEntry	not-accessible
.1.1.2.5.1.1.1	lifiModemIPInterfaceEntry	An entry (conceptual row) in the lifiModemIPInterfaceTable.	LifiModemIPInterfaceEntry	not-accessible
.1.1.2.5.1.1.1.1	lifiModemIPInterfaceEnabled	This object returns if the IP interface is enabled. Returns true(1) or false(2).	INTEGER	read-only
.1.1.2.5.1.1.1.2	lifiModemIPInterfaceIPv4Enabled	This object returns if the IPv4 interface is enabled. Returns true(1) or false(2).	INTEGER	read-only
.1.1.2.5.1.1.1.3	lifiModemIPInterfaceIPv6Enabled	This object returns if the IPv6 interface is enabled. Returns true(1) or false(2).	INTEGER	read-only
.1.1.2.5.1.1.1.4	lifiModemIPInterfaceStatus	This object returns the current operational state of the interface. (see [Section 4.2.2/TR-181i2]). Enumeration of: -Up -Down -Unknown -Dormant -NotPresent -LowerLayerDown -Error When Enable is false then Status SHOULD normally be Down (or NotPresent or Error if there is a fault condition on the interface). When Enable is changed to true then Status SHOULD change to Up if and only if the interface is able to transmit and receive network traffic; It SHOULD change to Dormant if and only if the interface is operable but is waiting for external actions before it can transmit and receive network traffic (and subsequently change to Up if still operable when the expected actions have completed); It SHOULD change to LowerLayerDown if and only if the interface is prevented from entering the Up state because one or more of the interfaces beneath it is down; It SHOULD remain in the Error state if there is an error or other fault condition detected on the interface; It SHOULD remain in the NotPresent state if the interface has missing (typically hardware) components; It SHOULD change to Unknown if the state of the interface can not be determined for some reason.	INTEGER	read-only
.1.1.2.5.1.1.1.5	lifiModemIPInterfaceName	This object returns the name of the IP interface.	INTEGER	read-only
.1.1.2.5.1.1.1.6	lifiModemIPInterfaceLastChange	The accumulated time since the interface entered its current operational state, in days, hours, minutes and seconds.	DISPLAYSTRING	read-only
.1.1.2.5.1.1.1.7	lifiModemIPInterfaceNumberOfIPv4Addresses	The number of IPv4 addresses of this interface.	INTEGER32	read-only
.1.1.2.5.1.1.1.8	lifiModemIPInterfaceNumberOfIPv6Addresses	The number of IPv6 addresses of this interface.	INTEGER32	read-only
.1.1.2.5.1.1.1.9	lifiModemIPInterfaceNumberOfIPv6Prefixes	The number of IPv6 prefixes of this interface.	INTEGER32	read-only

LiFi Modem IP Interface IPv4 Address Table

In total there are three IPv4 addresses which can be configured.

OID	NAME	Description	Type	Access
.1.1.2.5.1.2	lifiModemIPInterfaceIPv4AddressTable	A Table that lists the modems, and shows the IP interface IPv4 address objects.	SEQUENCE OF LifiModemIPInterfaceIPv4AddressEntry	not-accessible
.1.1.2.5.1.2.1	lifiModemIPInterfaceIPv4AddressEntry	An entry (conceptual row) in the lifiModemIPInterfaceIPv4AddressTable.	LifiModemIPInterfaceIPv4AddressEntry	not-accessible
.1.1.2.5.1.2.1.1	lifiModemIPInterfaceIPv4AddressIndex	This object indexes the lifiModemIPInterfaceIPv4AddressTable.	INTEGER32	not-accessible

.1.1.2.5.1.2.1.2	lifiModemIPInterfaceIPv4AddressEnabled	This object returns if the IPv4Address is enabled. True(1) or false(2).	INTEGER	read-only
.1.1.2.5.1.2.1.3	lifiModemIPInterfaceIPv4AddressStatus	This object returns the configuration status of the IPv4Address.	INTEGER	read-only
.1.1.2.5.1.2.1.4	lifiModemIPInterfaceIPv4Address	This object returns the IPv4 address of the node. Decimal format:x.y.z.w For example:10.10.1.2	IPADDRESS	read-write
.1.1.2.5.1.2.1.5	lifiModemIPInterfaceIPv4AddressSubnetMask	This object returns the IPv4 subnet mask of the node. Decimal format:x.y.z.w For example:255.255.255.0	IPADDRESS	read-write
.1.1.2.5.1.2.1.6	lifiModemIPInterfaceIPv4AddressingType	Addressing method used to assign the IP address. Enumeration of: -DHCP -IkeV2 (Assigned by IKEv2 [RFC5996]) -AutoIP -IPCP -Static	INTEGER	read-only

LiFi Modem IP Interface IPv6 Address Table

In total there are seven IPv6 addresses which can be configured.

OID	NAME	Description	Type	Access
.1.1.2.5.1.3	lifiModemIPInterfaceIPv6AddressTable	A Table that lists the modems, and shows the IP interface IPv6 address objects.	SEQUENCE OF LifiModemIPInterfaceIPv6AddressEntry	not-accessible
.1.1.2.5.1.3.1	lifiModemIPInterfaceIPv6AddressEntry	An entry (conceptual row) in the lifiModemIPInterfaceIPv6AddressTable.	LifiModemIPInterfaceIPv6AddressEntry	not-accessible
.1.1.2.5.1.3.1.1	lifiModemIPInterfaceIPv6AddressIndex	This object indexes the lifiModemIPInterfaceIPv6AddressTable.	INTEGER32	not-accessible
.1.1.2.5.1.3.1.2	lifiModemIPInterfaceIPv6AddressEnabled	This object returns if the IPv6Address is enabled(1) or disabled(2).	INTEGER	read-only
.1.1.2.5.1.3.1.3	lifiModemIPInterfaceIPv6AddressStatus	This object returns the configuration status of the IPv6Address.	INTEGER	read-only
.1.1.2.5.1.3.1.4	lifiModemIPInterfaceIPv6AddressIPAddressStatus	<p>The status of the address, in compliance with RFC4293. Most of the states correspond to states from the IPv6 Stateless Address Autoconfiguration protocol.</p> <ul style="list-style-type: none"> - The preferred(1) state indicates that this is a valid address that can appear as the destination or source address of a packet. - The deprecated(2) state indicates that this is a valid but deprecated address that should no longer be used as a source address in new communications, but packets addressed to such an address are processed as expected. - The invalid(3) state indicates that this isn't a valid address and it shouldn't appear as the destination or source address of a packet. - The inaccessible(4) state indicates that the address is not accessible because the interface to which this address is assigned is not operational. - unknown(5) state indicates that the status cannot be determined for some reason. - The tentative(6) state indicates that the uniqueness of the address on the link is being verified. Addresses in this state should not be used for general communication and should only be used to determine the uniqueness of the address. - The duplicate(7) state indicates the address has been determined to be non-unique on the link and so must not be used. - The optimistic(8) state indicates the address is available for use, subject to 	INTEGER	read-only

		restrictions, while its uniqueness on a link is being verified. In the absence of other information, an IPv4 address is always preferred(1).		
.1.1.2.5.1.3.1.5	lifiModemIPInterfaceIPv6Address	This object displays the IPv6 address of the interface. Hexadecimal format:16-byte numbers separated by colons (:) For example: 0000:0000:0000:0000:0000:0000:0000:0000	InetAddressIPv6	read-write
.1.1.2.5.1.3.1.6	lifiModemIPInterfaceIPv6AddressOrigin	The origin of the address, in compliance with RFC4293. - manual(2) indicates that the address was manually configured to a specified static address, e.g., by user configuration. - dhcp(4) indicates an address that was assigned to this system by a DHCP server. - linklayer(5) indicates an address created by IPv6 stateless auto-configuration. - random(6) indicates an address chosen by the system at random, e.g., an IPv4 address within 169.254/16, or an RFC 3041 privacy address..	INTEGER	read-only

LiFi Modem IP Interface IPv6 Prefix Table

In total there are seven IPv6 prefixes which can be configured.

OID	NAME	Description	Type	Access
.1.1.2.5.1.4	lifiModemIPInterfaceIPv6PrefixTable	A Table that lists the modems, and shows the IP interface IPv6 prefix objects.	SEQUENCE OF LifiModemIPInterfaceIPv6PrefixEntry	not-accessible
.1.1.2.5.1.4.1	lifiModemIPInterfaceIPv6PrefixEntry	An entry (conceptual row) in the lifiModemIPInterfaceIPv6PrefixTable.	LifiModemIPInterfaceIPv6PrefixEntry	not-accessible
.1.1.2.5.1.4.1.1	lifiModemIPInterfaceIPv6PrefixIndex	This object indexes the lifiModemIPInterfaceIPv6PrefixTable.	INTEGER32	not-accessible
.1.1.2.5.1.4.1.2	lifiModemIPInterfaceIPv6PrefixEnabled	This object indicates if the IPv6 prefix is enabled or not.	INTEGER	read-only
.1.1.2.5.1.4.1.3	lifiModemIPInterfaceIPv6PrefixStatus	The status of this IPv6Prefix table entry. Enumeration of: -Disabled -Enabled	INTEGER	read-only
.1.1.2.5.1.4.1.4	lifiModemIPInterfaceIPv6PrefixPrefixStatus	The status of the address, in compliance with RFC4293. Most of the states correspond to states from the IPv6 Stateless Address Autoconfiguration protocol. - The preferred(1) state indicates that this is a valid address that can appear as the destination or source address of a packet. - The deprecated(2) state indicates that this is a valid but deprecated address that should no longer be used as a source address in new communications, but packets addressed to such an address are processed as expected. - The invalid(3) state indicates that this isn't a valid address and it shouldn't appear as the destination or source address of a packet. - The inaccessible(4) state indicates that the address is not accessible because the interface to which this address is assigned is not operational. - unknown(5) state indicates that the status cannot be determined for some reason. - The tentative(6) state indicates that the uniqueness of the address on the	INTEGER	read-only

		<p>link is being verified. Addresses in this state should not be used for general communication and should only be used to determine the uniqueness of the address.</p> <ul style="list-style-type: none"> - The duplicate(7) state indicates the address has been determined to be non-unique on the link and so must not be used. - The optimistic(8) state indicates the address is available for use, subject to restrictions, while its uniqueness on a link is being verified. In the absence of other information, an IPv4 address is always preferred(1). 		
.1.1.2.5.1.4.1.5	lifiModemIPInterfaceIPv6Prefix	This object displays the IPv6 address prefix of the interface. This parameter can only be modified if the Origin is set to "manual".	INTEGER32	read-write
.1.1.2.5.1.4.1.6	lifiModemIPInterfaceIPv6PrefixOrigin	<p>This object displays the origin of the prefix, in compliance with RFC4293.</p> <ul style="list-style-type: none"> - manual(2) indicates a prefix that was manually (static) configured. - wellknown(3) indicates a well-known prefix, e.g., 169.254/16 for IPv4 auto-configuration or fe80::/10 for IPv6 link-local addresses. Well known prefixes may be assigned by IANA, the address registries, or by specification in a standards track RFC. - dhcp(4) indicates a prefix that was assigned by a DHCP server. - routeradv(5) indicates a prefix learned from a router advertisement. <p>Note:while IpAddressOriginTC and IpAddressPrefixOriginTC are similar, they are not identical. The first defines how an address was created, while the second defines how a prefix was found.</p>	INTEGER	read-only
.1.1.2.5.1.4.1.7	lifiModemIPInterfaceIPv6PrefixStaticType	<p>Static prefix sub-type. For a Static prefix, this can be set to PrefixDelegation or Child, thereby creating an unconfigured prefix of the specified type that will be populated in preference to creating a new instance. This allows the ACS to pre-create 'prefix slots' with known path names that can be referenced from elsewhere in the data model before they have been populated. Enumeration of:</p> <ul style="list-style-type: none"> - Static (Prefix is a 'normal' Static prefix) - Inapplicable (Prefix is not Static, so this parameter does not apply, READONLY) - PrefixDelegation (Prefix will be populated when a PrefixDelegation prefix needs to be created) - Child (Prefix will be populated when a Child prefix needs to be created. In this case, the ACS needs also to set ParentPrefix and might want to set ChildPrefixBits (if parent prefix is not set, or goes away, then the child prefix will become operationally disabled)) This mechanism works as follows: When this parameter is set to PrefixDelegation or Child, the instance becomes a 'prefix slot' of the specified type. Such an instance can be administratively enabled (Enable =true) but will remain operationally disabled (Status =Disabled) until it has been populated. When a new prefix of type T is needed, the CPE will look for 	INTEGER	read-only

		<p>a matching unpopulated instance, i.e. an instance with (Origin,StaticType,Prefix) = (Static,T,"")</p> <p>If the CPE finds at least one such instance it will choose one and populate it. If already administratively enabled, it will immediately become operationally enabled. If the CPE finds no such instances, it will create and populate a new instance with (Origin,StaticType) =(T,T). If the CPE finds more than one such instance, the algorithm via which it chooses which instance to populate is implementation-specific. When a prefix that was populated via this mechanism becomes invalid, the CPE will reset Prefix to an empty string. This does not affect the value of the Enable parameter. The prefix StaticType can only be modified if Origin is manual.</p>		
--	--	---	--	--

4.6 LiFi Modem DNS

A Domain Name System (DNS) client is incorporated into the firmware. The DNS clients are referred to as resolvers in DNS protocol terminology. This feature enables the translation of domain names into IP addresses and vice versa. This feature enables the configuration of remote servers, such as the Network Time Protocol (NTP) server, by using the DNS URLs.

OID	NAME
.1.1.2.6	lifiModemDNS
.1.1.2.6.1	lifiModemDNSTable
.1.1.2.6.2	lifiModemDNSClientTable
.1.1.2.6.3	lifiModemDNSClientServerTable

LiFi Modem DNS Table

OID	NAME	Description	Type	Access
.1.1.2.6.1	lifiModemDNSTable	A Table that lists the modems, and shows the DNS objects.	SEQUENCE OF lifiModemDNSEntry	not-accessible
.1.1.2.6.1.1	lifiModemDNSEntry	An entry (conceptual row) in the lifiModemDNSTable.	lifiModemDNSEntry	not-accessible
.1.1.2.6.1.1.1	lifiModemDNSSupportedRecords	<p>The DNS record types that are supported by the device. It is a comma-separated list of strings. Each list item can be one of the following:</p> <ul style="list-style-type: none"> - A ([RFC1035]) - AAAA ([RFC3596]) - SRV ([RFC2782]) - PTR ([RFC1035]) <p>Example: 'A,AAAA'.</p>	DISPLAYSTRING	read-only

LiFi Modem DNS Client Table

Provides information about the DNS client status.

OID	NAME	Description	Type	Access
.1.1.2.6.2	lifiModemDNSClientTable	A Table that lists the modems, and shows the DNS client objects.	SEQUENCE OF lifiModemDNSClientEntry	not-accessible
.1.1.2.6.2.1	lifiModemDNSClientEntry	An entry (conceptual row) in the lifiModemDNSClientTable.	lifiModemDNSClientEntry	not-accessible

.1.1.2.6.2.1.1	lifiModemDNSClientEnabled	This object tells if the client is enabled for DNS or not.	INTEGER	read-only
.1.1.2.6.2.1.2	lifiModemDNSClientStatus	The status of the DNS client. Enumeration of: -Disabled -Enabled	INTEGER	read-only
.1.1.2.6.2.1.3	lifiModemDNSClientNumberOfServers	This object provides the status of the DNS client.	INTEGER32	read-only

LiFi Modem DNS Client Server Table

Provides information about the DNS server the client is connected to.

OID	NAME	Description	Type	Access
.1.1.2.6.3	lifiModemDNSClientServerTable	A Table that lists the modems, and shows the DNS client server objects.	SEQUENCE OF LifiModemDNSClientServerEntry	not-accessible
.1.1.2.6.3.1	lifiModemDNSClientServerEntry	An entry (conceptual row) in the lifiModemDNSClientServerTable.	LifiModemDNSClientServerEntry	not-accessible
.1.1.2.6.3.1.1	lifiModemDNSClientServerIndex	This object indexes the lifiModemDNSClientServerTable.	INTEGER32	not-accessible
.1.1.2.6.3.1.2	lifiModemDNSClientServerIPVersion	This object indicates if the DNS is for IPv4 or IPv6.	INTEGER	read-only
.1.1.2.6.3.1.3	lifiModemDNSClientServerEnabled	This object indicates if the DNS is enabled or not.	INTEGER	read-only
.1.1.2.6.3.1.4	lifiModemDNSClientServerStatus	The status of the DNS client. Enumeration of: -Disabled -Enabled	INTEGER	read-only
.1.1.2.6.3.1.5	lifiModemDNSClientDNSServer	This object identifies the DNS server IP addresses. Note:DNSServer is only writable when Type is Static; otherwise, DNSServer is automatically configured as result of DHCP, IPCP, or RA received DNS server information.	DISPLAYSTRING	read-write
.1.1.2.6.3.1.6	lifiModemDNSClientServerType	This object gives the type. Method used to assign the DNSServer address. Enumeration of: <ul style="list-style-type: none"> - DHCPv4 - DHCPv6 - RouterAdvertisement - IPCP - Static 	INTEGER	read-only

4.7 LiFi Modem DHCPv4

The Trulifi firmware includes a Dynamic Host Configuration Protocol (DHCP) client to automatically configure the basic IP parameters (IP address, subnet, mask, default gateway address, option-82, and option-125) from a DHCP server in the network.

OID	NAME	Description	Type	Access
.1.1.2.7	lifiModemDHCPv4			
.1.1.2.7.1	lifiModemDHCPv4ClientTable	A Table that lists the modems, and shows the DHCPv4 client objects.	SEQUENCE OF LifiModemDHCPv4ClientEntry	not-accessible
.1.1.2.7.1.1	lifiModemDHCPv4ClientEntry	An entry (conceptual row) in the lifiModemDHCPv4ClientTable.	LifiModemDHCPv4ClientEntry	not-accessible
.1.1.2.7.1.1.1	lifiModemDHCPv4ClientEnable	This object indicates if DHCP is enabled for that client. Set true(1) to set and false(2) to unset.	INTEGER	read-write
.1.1.2.7.1.1.2	lifiModemDHCPv4ClientStatus	The status of the DHCP Client . Enumeration of: <ul style="list-style-type: none"> - Disabled - Enabled - Error_Misconfigured - Bound The Error_Misconfigured value indicates that a necessary configuration value is undefined or invalid. 	INTEGER	read-only

.1.1.2.7.1.1.3	lifiModemDHCPv4ClientDNSServers	Comma-separated list (maximum list length 255) of IPv4Addresses. Items represent DNS Server IPv4 Address(es) received from the DHCP server. An empty string when Status is not equal to Bound. The Value is the information received via DHCP Option 6.	DISPLAYSTRING	read-only
.1.1.2.7.1.1.4	lifiModemDHCPv4ClientLeaseTimeRemaining	This object provides the remaining time of the IP address lease. in days, hours, minutes and seconds, or infinite.	DISPLAYSTRING	read-only
.1.1.2.7.1.1.5	lifiModemDHCPv4ClientDHCPsServer	This object provides the IP name or address of the DHCP server.	DISPLAYSTRING	read-only

4.8 LiFi Modem DHCPv6

The Trulifi firmware includes a Dynamic Host Configuration Protocol (DHCP) client to automatically configure the basic IP parameters (IP address, subnet, mask, default gateway address, option-82, and option-125) from a DHCP server in the network.

OID	NAME	Description	Type	Access
.1.1.2.8	lifiModemDHCPv6			
.1.1.2.8.1	lifiModemDHCPv6ClientTable	A Table that lists the modems, and shows the dhcpv6 client objects.	SEQUENCE OF LifiModemDHCPv6ClientEntry	not-accessible
.1.1.2.8.1.1	lifiModemDHCPv6ClientEntry	An entry (conceptual row) in the lifiModemDHCPv6ClientTable.	LifiModemDHCPv6ClientEntry	not-accessible
.1.1.2.8.1.1.1	lifiModemDHCPv6ClientEnable	This object indicates if DHCP is enabled for that client. Set true(1) to set and false(2) to unset.	INTEGER	read-write
.1.1.2.8.1.1.2	lifiModemDHCPv6ClientStatus	The status of the DHCPv6 client entry. Enumeration of: - Disabled - Enabled - Error_Misconfigured - Bound The Error_Misconfigured value indicates that a necessary configuration value is undefined or invalid.	INTEGER	read-only
.1.1.2.8.2	lifiModemDHCPv6ClientServerTable	A Table that lists the modems, and shows the dhcpv6 client server objects.	SEQUENCE OF LifiModemDHCPv6ClientServerEntry	not-accessible
.1.1.2.8.2.1	lifiModemDHCPv6ClientServerEntry	An entry (conceptual row) in the lifiModemDHCPv6ClientServerTable.	LifiModemDHCPv6ClientServerEntry	not-accessible
.1.1.2.8.2.1.1	lifiModemDHCPv6ClientServerDUID	This object provides the DHCP Unique Identifier. The DHCP unique identifier (DUID) is used by a client to get an IP address from a DHCPv6 server. It has a 2-byte DUID type field, and a variable-length identifier field up to 128 bytes. Its actual length depends on its type. The server compares the DUID with its database and delivers configuration data (address, lease times, DNS servers, etc.) to the client. The first 16 bits of a DUID contain the DUID type, of which there are four types. The meaning of the remaining DUID depends on the type. Four types are identified in RFC 8415: - Link-layer address plus time (DUID-LLT) - Vendor-assigned unique ID based on enterprise number (DUID-EN) - Link-layer address (DUID-LL) - UUID-based DUID (DUID-UUID)	OCTET STRING	read-only

4.9 LiFi Modem QoS

The Trulifi firmware implements Quality of Service (QoS) based on:

- IEEE 802.1p (VLAN)
- DSCP
- Custom user defined rules

Additionally, the Trulifi firmware implements a predefined set of traffic prioritization rules for commonly found traffic, such as, ARP and TCP IPv4 and IPv6.

4.9.1 Rule Order Prioritization

Using Trulifi firmware, you can define the priority order between IEEE 802.1p (VLAN) and DSCP. If you enable custom and predefined rules for commonly found traffic, the Trulifi firmware applies them with a higher priority than the rules of IEEE802.1p and DSCP. The following values are available to configure prioritization rules:

VLAN

The classification is only based on VLAN information.

DSCP

The classification is only based on DSCP information.

VLAN_DSCP

The classification is based on VLAN and DSCP. If there are any contradictory classifications, the VLAN information prevails.

DSCP_VLAN

The classification is based on VLAN and DSCP. If there are any contradictory classifications, the DSCP information prevails.

OID	NAME	Description	Type	Access
.1.1.2.9.1.1.1	lifiModemQoSRuleOrder	QoS Rules order, multiple active rules are separated by comma, first listed rule has highest priority. - VLAN: The classification is only based on VLAN information. - DSCP: The classification is only based on DSCP information. - VLAN_DSCP: The classification is based on VLAN and DSCP. If there are any contradictory classifications, the VLAN information prevails. - DSCP_VLAN: The classification is based on VLAN and DSCP. If there are any contradictory classifications, the DSCP information prevails.	INTEGER	read-write

4.9.2 IEEE 802.1p Support (VLAN)

The IEEE 802.1p is part of the IEEE 802.1D standard which defines a set of eight classes of services expressed as the 3-bit PCP field in IEEE 802.1Q header (the VLAN header) in the Ethernet frame. The Trulifi firmware implements the mapping between IEEE 802.1p traffic classes and ITU-T G.Vlc traffic classes. The following table lists the corresponding configuration parameters.

OID	NAME	Description	Type	Access
.1.1.2.9.4.1.1	lifiModemQoSvlanEnable	Enables or disables VLAN QoS rules. If disabled, the rule will not be applied by the QoS Engine	INTEGER	read-write
.1.1.2.9.4.1.2	lifiModemQoSvlanOBK	Mapping of each 802-1p value to a Class Value. Changes show only effect if	INTEGER	read-write

		RulesOrder include '802-1p'. Priority Code Point 0:Background		
.1.1.2.9.4.1.3	lifiModemQoSvlan1BE	Mapping of each 802-1p value to a Class Value. Changes show only effect if RulesOrder include '802-1p'. Priority Code Point 1:Best Effort	INTEGER	read-write
.1.1.2.9.4.1.4	lifiModemQoSvlan2EE	Mapping of each 802-1p value to a Class Value. Changes show only effect if RulesOrder include '802-1p'. Priority Code Point 2:Excellent Effort	INTEGER	read-write
.1.1.2.9.4.1.5	lifiModemQoSvlan3CA	Mapping of each 802-1p value to a Class Value. Changes show only effect if RulesOrder include '802-1p'. Priority Code Point 3:Critical Applications	INTEGER	read-write
.1.1.2.9.4.1.6	lifiModemQoSvlan4VI	Mapping of each 802-1p value to a Class Value. Changes show only effect if RulesOrder include '802-1p'. Priority Code Point 4:Voice < 100 ms latency and jitter	INTEGER	read-write
.1.1.2.9.4.1.7	lifiModemQoSvlan5VO	Mapping of each 802-1p value to a Class Value. Changes show only effect if RulesOrder include '802-1p'. Priority Code Point 5:Voice < 10 ms latency and jitter	INTEGER	read-write
.1.1.2.9.4.1.8	lifiModemQoSvlan6IC	Mapping of each 802-1p value to a Class Value. Changes show only effect if RulesOrder include '802-1p'. Priority Code Point 6:Internetnetwork Control	INTEGER	read-write
.1.1.2.9.4.1.9	lifiModemQoSvlan7NC	Mapping of each 802-1p value to a Class Value. Changes show only effect if RulesOrder include '802-1p'. Priority Code Point 7:Network Control	INTEGER	read-write

4.9.3 DSCP Support

The Differentiated Services (DiffServ) is a traffic management model which specifies a mechanism for classifying and managing network traffic and providing quality of service (QoS) on IP networks. The DiffServ architecture uses a 6-bit Differentiated Service Code Point (DSCP), which replaces the ToS field in IPv4. In the DS field, a range of eight values is used to enable backwards compatibility with IP precedence specifications in the outdated ToS field. The Trulifi firmware implements mapping between the DSCP and ITU-T G.Vlc classes. The following table lists the corresponding parameters.

OID	NAME	Description	Type	Access
.1.1.2.9.3.1.1	lifiModemQoSdscpenable	Enables or disables DSCP rules. If disabled, the rule will not be applied by the QoS Engine	INTEGER	read-write
.1.1.2.9.3.1.2	lifiModemQoSdscpcs0	Mapping of each DSCP value to a Class Value. Changes show only effect if RulesOrder include 'DSCP'. Differentiated Services Code Point Class Selector 0	INTEGER	read-write
.1.1.2.9.3.1.3	lifiModemQoSdscpcs1	Mapping of each DSCP value to a Class Value. Changes show only effect if RulesOrder include 'DSCP'. Differentiated Services Code Point Class Selector 1	INTEGER	read-write
.1.1.2.9.3.1.4	lifiModemQoSdscpcs2	Mapping of each DSCP value to a Class Value. Changes show only effect if RulesOrder include 'DSCP'. Differentiated Services Code Point Class Selector 2	INTEGER	read-write
.1.1.2.9.3.1.5	lifiModemQoSdscpcs3	Mapping of each DSCP value to a Class Value. Changes show only effect if RulesOrder include 'DSCP'. Differentiated Services Code Point Class Selector 3	INTEGER	read-write
.1.1.2.9.3.1.6	lifiModemQoSdscpcs4	Mapping of each DSCP value to a Class Value. Changes show only effect if RulesOrder include 'DSCP'. Differentiated Services Code Point Class Selector 4	INTEGER	read-write
.1.1.2.9.3.1.7	lifiModemQoSdscpcs5	Mapping of each DSCP value to a Class Value. Changes show only effect if RulesOrder include 'DSCP'. Differentiated Services Code Point Class Selector 5	INTEGER	read-write
.1.1.2.9.3.1.8	lifiModemQoSdscpcs6	Mapping of each DSCP value to a Class Value. Changes show only effect if	INTEGER	read-write

		RulesOrder include 'DSCP'. Differentiated Services Code Point Class Selector 6		
.1.1.2.9.3.1.9	lifiModemQoSdscpcs7	Mapping of each DSCP value to a Class Value. Changes show only effect if RulesOrder include 'DSCP'. Differentiated Services Code Point Class Selector 7	INTEGER	read-write

4.9.4 Custom QoS Rules

The Trulifi firmware allows configuration of user-defined prioritization rules by delegating a pattern matching rule and a set of packet classification rules. There are two pattern matching rules, which can be enabled independently. A packet matching rule can be defined as follows:

Offset

Offset inside the Ethernet packet where the bitmask and pattern should be applied. The offset is in 16-bit units. Offset 0 is the first byte of an Ethernet packet (the destination MAC address LSB).

Bitmask

16-bit bitmask can be applied to the value in the Ethernet packet for the specified offset.

Pattern

16-bit pattern. If the result of applying the bitmask to the value is equal to the pattern, the rule results are matched.

The matching rules are applied to incoming packets through the Ethernet interface. If there is a match, the classification rules are applied to the packet. The classification rules are defined similarly to the packet matching rules. Up to eight classification rules for each matching rule can be defined.

OID	NAME	Description	Type	Access
.1.1.2.9.2.1.1.1	lifiModemQoSCustomEnable	Enables or disables the Custom QoS rules. If disabled, the custom rules will not be applied by the QoS Engine	INTEGER	read-write
.1.1.2.9.2.1.1.2	lifiModemQoSNumberOfCustomMatchingRules	This object provides the number of QoS custom matching rules.	INTEGER32	read-only
.1.1.2.9.2.1.1.3	lifiModemQoSNumberOfCustomClassificationRules	This object provides the number of QoS custom classification rules.	INTEGER32	read-only

OID	NAME	Description	Type	Access
.1.1.2.9.2.2.1	lifiModemQoSCustomMatchingRuleEntry	An entry (conceptual row) in the lifiModemQoSCustomMatchingRuleTable.	LifiModemQoSCustomMatchingRuleEntry	not-accessible
.1.1.2.9.2.2.1.1	lifiModemQoSCustomMatchingRuleIndex	This object indexes the lifiModemQoSCustomMatchingRuleTable.	INTEGER32	not-accessible
.1.1.2.9.2.2.1.2	lifiModemQoSCustomMatchingRuleEnable	Enables or disables a matching rule. If disabled, the rule will not be applied by the QoS Engine	INTEGER	read-write
.1.1.2.9.2.2.1.3	lifiModemQoSCustomMatchingRuleOffset	Offset inside the Ethernet packet where the bitmask and pattern should be applied. The offset is in 16-bit units. Offset 0 is the first byte of an Ethernet packet (the destination MAC address LSB).	INTEGER32	read-write
.1.1.2.9.2.2.1.4	lifiModemQoSCustomMatchingRuleBitmask	Bitmask:16-bit bitmask can be applied to the value in the Ethernet packet for the specified offset.	INTEGER32	read-write
.1.1.2.9.2.2.1.5	lifiModemQoSCustomMatchingRulePattern	16-bit pattern. If the result of applying the bitmask to the value is equal to the pattern, the rule results are matched.	INTEGER32	read-write

Custom QoS Matching Rules

Custom QoS Classification Rules

OID	NAME	Description	Type	Access
.1.1.2.9.2.3.1	lifiModemQoSCustomClassificationRuleEntry	An entry (conceptual row) in the lifiModemQoSCustomClassificationRuleTable.	LifiModemQoSCustomClassificationRuleEntry	not-accessible
.1.1.2.9.2.3.1.1	lifiModemQoSCustomClassificationRuleIndex	This object indexes the lifiModemQoSCustomClassificationRuleTable.	INTEGER32	not-accessible
.1.1.2.9.2.3.1.2	lifiModemQoSCustomClassificationRuleEnable	Enables or disables a classification rule. If disabled, the rule will not be applied by the QoS Engine	INTEGER	read-write
.1.1.2.9.2.3.1.3	lifiModemQoSCustomClassificationRuleOffset	Offset inside the Ethernet packet where the bitmask and pattern should be applied. The offset is in 16-bit units. Offset 0 is the first byte of an Ethernet packet (the destination MAC address LSB).	INTEGER32	read-write
.1.1.2.9.2.3.1.4	lifiModemQoSCustomClassificationRuleBitmask	Bitmask:16-bit bitmask can be applied to the value in the Ethernet packet for the specified offset.	INTEGER32	read-write
.1.1.2.9.2.3.1.5	lifiModemQoSCustomClassificationRulePattern	16-bit pattern. If the result of applying the bitmask to the value is equal to the pattern, the rule results are matched.	INTEGER32	read-write
.1.1.2.9.2.3.1.6	lifiModemQoSCustomClassificationRulePriority	Defines the priority with which a matching packet is treated. 1 lowest and 7 highest priority.	INTEGER	read-write

4.9.5 Predefined QoS Rules

The Trulifi firmware implements a set of predefined rules to enable the prioritization of commonly found traffic types such as:

TCP/IP ACK frames

Prioritizing TCP packets that carry only ACK frames reduces round-trip time and prevents losses on these frames under congested environments. This improves the performance of TCP traffic.

ARP

Frames used for address resolution. Prioritizing these packets guarantees that the ARP protocol continues working under congested environments. The following table lists the corresponding configuration parameters.

Default

Default Class value assigned to a packet when:

- Both Custom and VLAN mapping are disabled, or
- Custom enabled, but no Matching Rule is met, or
- VLAN is enabled, but VLAN tag is not valid.

OID	NAME	Description	Type	Access
.1.1.2.9.1.1.2	lifiModemQoSARPPriority	Defines the priority for ARP requests. Prioritizing these packets guarantees that the ARP protocol continues working under congested environments. The following table lists the corresponding configuration parameters.	INTEGER	read-write
.1.1.2.9.1.1.3	lifiModemQoSSTCPAckPriority	Defines the priority for TCP acknowledgements. Prioritizing TCP packets that carry only ACK frames reduces round-trip time and prevents losses on these frames under congested environments. This improves the performance of TCP traffic.	INTEGER	read-write
.1.1.2.9.1.1.4	lifiModemQoSDefaultPriority	Defines the default priority. Default Class value assigned to a packet when:	INTEGER	read-write

		-Both Custom and VLAN mapping are disabled, or -Custom enabled, but no Matching Rule is met, or -VLAN is enabled, but VLAN tag is not valid.		
--	--	--	--	--

4.10 LiFi Modem Multicast

In Internet Protocol Television (IPTV) networks, the LiFi network must route multicast video flows based on the IGMP and MLD control traffic coming from the IPTV operator.

IGMP and MLD snooping is used to dynamically configure interfaces so that multicast traffic flows entering the LiFi network are only routed to users who specifically need that traffic flow.

4.10.1 IGMP and MLD Snooping

To efficiently route multicast traffic flows, the LiFi firmware can snoop on both IGMP and MLD protocol packets. This means:

- Any IGMP v1, v2, or v3 and/or MLD v1, v2 packet is inspected internally, with very little CPU overhead.
- The appropriate routes are created, updated, or deleted according to the packet that is received.

By default, both IGMP and MLD snooping are enabled in LiFi products.

Because IGMP works on IP addresses and LiFi devices are based on MAC addresses, a mapping of multicast IP address to a destination host MAC is performed. This IP to MAC conversion is later used to update the bridge with the appropriate route for that MAC address.

OID	NAME	Description	Type	Access
.1.1.2.11.1.1.1	lifiModemMulticastIGMPEnable	Set to enable/disable the Internet Group Management Protocol snooping. Set to true(1) and unset with false(2).	INTEGER	read-write
.1.1.2.11.1.1.2	lifiModemMulticastMLDEnable	Set to enable/disable the Multicast Listener Discovery snooping. Set to true(1) and unset with false(2).	INTEGER	read-write

4.10.2 Routing Multicast Traffic

Queries are sent between the source host and the receiving host to determine the route that will be taken to identify the video source identity and to enable video streaming. The video source node is the LiFi node that is closest to the video server (typically the Modem). The video source is identified based on the reception of an IGMP, MLD, or a multicast router advertisement packet through an Ethernet port.

If the video source is not identified because of a lack in IGMP, MLD, or multicast router advertisement packets, the Trulifi network can be configured to:

- Drop reports and leave packets. This is done by default.
- Broadcast reports and leave packets.

Note: A multicast set up should generate queries periodically to determine which groups are still active and able to detect the video source node.

General queries are sent to all LiFi nodes. Specific queries are sent only to nodes having reported an interest in the queried Multicast IP. Reports are used to populate the bridge associating the converted IP multicast address into a MAC with the correct route indication. Reports are sent towards the video source node which is in charge of forwarding the reports towards the video server through its Ethernet interface.

OID	NAME	Description	Type	Access
.1.1.2.11.1.1.3	lifiModemMulticastBroadcastReportEnable	Set to enable/disable the Broadcasting Report behaviour. -If set to TRUE, the node is configured to broadcast reports depending on configuration in parameter lifiModemMulticastBroadcastReportMode. -If set to FALSE, Reports are sent only to the video source if it is known.	INTEGER	read-write

		The term 'video source' refers to the node which Ethernet port is connected directly to the Home Gateway. It is advisable to set it to FALSE in IGMP v1 and v2 scenarios with more than one STB. If not, broadcasted reports could lead to prevent other STB to join the reported channel (as they think there is no need to transmit the report packet again).		
.1.1.2.11.1.1.4	lifiModemMulticastBroadcastReportMode	Report broadcast forwarding behaviour when the lifiModemMulticastBroadcastReportEnable is enabled. -If 0 then broadcast reports only when the video source is unknown. -If 1 then broadcast reports always. -If 2 then broadcast reports always if IGMPv3 and only when video source is unknown in others. The term 'video source' refers to the node which Ethernet port is connected directly to the Home Gateway.	INTEGER	read-write

4.10.3 Multicast Address Ranges

There are a maximum of four multicast IPv4 address ranges available for configuration. By default, there is only one range defined (224.0.0.0–239.254.255.255). Any IGMP packet address within the valid ranges is snooped, and its potential associated multicast flow is routed using a unicast address. IGMP packets and their associated multicast data flows outside of the valid range are dropped. Defining ranges makes it possible to exclude multicast traffic from being routed as multicast traffic.

OID	NAME	Description	Type	Access
.1.1.2.11.1.1.7	lifiModemMulticastNumberOfIGMPIPRanges	This object shows the number of IGMPIPRanges.	INTEGER32	read-only
.1.1.2.11.2	lifiModemMulticastIGMPIPRangeTable	A Table that lists the online modems, and shows the multicast igmp range objects.	SEQUENCE OF LifiModemMulticastIGMPIPRangeEntry	not-accessible
.1.1.2.11.2.1	lifiModemMulticastIGMPIPRangeEntry	An entry (conceptual row) in the lifiModemMulticastIGMPIPRangeTable.	LifiModemMulticastIGMPIPRangeEntry	not-accessible
.1.1.2.11.2.1.1	lifiModemMulticastIGMPIPRangeIndex	The modem multicast IGMP range index.	INTEGER32	not-accessible
.1.1.2.11.2.1.2	lifiModemMulticastIGMPIPRangeMin	This object shows the minimum value of the IGMP IP address range. Host Extensions for IP Multicasting [RFC1112] specifies the extensions required of a host implementation of the Internet Protocol (IP) to support multicasting. The multicast addresses are in the range 224.0.0.0 through 239.255.255.255. Address assignments are listed in the [RFC5771]. This object gives the lower boundary of the range.	DISPLAYSTRING	read-write
.1.1.2.11.2.1.3	lifiModemMulticastIGMPIPRangeMax	This object shows the maximum value of the IGMP IP address range. Host Extensions for IP Multicasting [RFC1112] specifies the extensions required of a host implementation of the Internet Protocol (IP) to support multicasting. The multicast addresses are in the range 224.0.0.0 through 239.255.255.255. Address assignments are listed in the [RFC5771]. This object gives the upper boundary of the range.	DISPLAYSTRING	read-write

4.10.4 IGMP and MLD Fast Leave

This feature consists of an immediate blocking of a multicast group for a given port when a LEAVE message is received from that port. This feature is enabled by default. The following table lists the corresponding configuration parameter.

OID	NAME	Description	Type	Access
.1.1.2.11.1.1.5	lifiModemMulticastFastLeave	If TRUE, when a Leave-Group is received from an specific port (LiFi or Ethernet), the multicast stream forwarding for this port is blocked. If FALSE, upon the reception of a Leave-Group, the multicast stream is forwarded until three Group-Specific or General Queries are sent for the group and no Reports are received.	INTEGER	read-write

4.10.5 Multicast Video Source Mode

The LiFi firmware can control the behaviour of a node when it receives an IGMP or MLD query packet. This behaviour is configured with the parameter that is described in the following table.

OID	NAME	Description	Type	Access
.1.1.2.11.1.1.6	lifiModemMulticastVideoSource	Video Source Mode. -AUTO, A query from LiFi or external interface turns node in video source. -FORCED, A query from LiFi is ignored and a query from external interface turns node in video source. -FORBIDDEN, A query from external interface is ignored, node will never be video source .	INTEGER	read-write

4.10.6 Multicast Summary

The LiFi firmware supports the following:

- IGMPv1 (RFC1112)
- IGMPv2 (RFC2236)
- IGMPv3 (RFC3376 + RFC5790). For more information, see the note below.
- MLDv1 (RFC2710)
- MLDv2 (RFC3810 + RFC5790). For more information, see the note below.
- Multicast Router Solicitation
- Multicast Router Advertisement
- IGMP and MLD fast leave
- Multicast video source mode
- Four ranges of addresses for multicast operation
- The maximum number of multicast channels supported is 128

Note:

- The current implementation of IGMPv3 and MLDv2 is based on recommendations described in RFC 5790 Lightweight Internet Group Management Protocol Version 3 (IGMPv3) and Multicast Listener Discovery Version 2 (MLDv2) protocols. Any report packages that display IS_IN {x}, TO_IN {x}, ALLOW{x}, IS_EX { } are considered a REPORT message. Other messages are considered LEAVE messages.
- Source filtering is not supported.