DOCSIS interface description

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1. COAX

1.1 DOCSIS (ANGA Template)

The interface specification for the passive network termination point, the access to the DOCSIS network and the generic network and provisioning requirements are covered in the document in **Appendix A**, referred as **base specification** throughout this document.

The base specification was discussed and created in a forum under participation of several cable network operator, external consultants and cable industry experts and moderated by ANGA.

The base specification in its current form references the industry standard DOCSIS 3.0 and incorporates the relevant parts of the PHY, MULPI, OSSI and SEC specifications.

Any additions or MSO specific changes or amendments are covered in this document.

1.2 Scope

This document contains MSO specific information and specifications, beyond the definitions made in the base specification, for customer owned network termination devices which can be connected and operated on the MSO network.

Any information provided in this document must be taken into account, evaluated and any technical specifications and requirements must be fulfilled to claim full compatibility of the device to the MSO network. Definitions in this document supersede definitions and assumptions made in the base specification.

The equipment vendor is liable for damages and defects and must ensure proper operation, there is no obligation by the MSO to evaluate any customer owned network termination to proof compatibility or detect malfunctions.

The MSO operates the service in Germany, so any specifications and all certificates must follow the European version or subsections in the specification documents. This especially applies to:

- DOCSIS → Euro DOCSIS Specifications, MIBS and X.509 certificate chain
- PacketCable → EuroPacketCable Specifications, MIBS and X.509 certificate chain

1.3 MSO Name and relevant specification parts

MSO	Specification Part		Supported by MSO
SYNVIA	1.	COAX	X
SYNVIA	1.1	DOCSIS (ANGA Template)	X
SYNVIA	1.2	Scope	X
SYNVIA	1.3	MSO Name and relevant specification parts	X
SYNVIA	1.4	Definitions and abbreviations	X
SYNVIA	1.4.1	Definitions	X
SYNVIA	1.4.2	Abbreviations	X
SYNVIA	1.5	Basic Service Definition	X
SYNVIA	1.6	L1 Network Access	X
SYNVIA	1.7	L2 network Access	X
SYNVIA	1.8	IP (Internet) Services	X
SYNVIA	1.8.1	IPv4 operations	X
SYNVIA	1.8.1.1	DHCP IPv4 Operation	X
SYNVIA	1.8.1.2	PPPoE IPv4 Operation	
SYNVIA	1.8.2	IPv6 operations	X
SYNVIA	1.8.3	DS-lite operations	X
SYNVIA	1.9	Voice Services	X
SYNVIA	1.9.1	PacketCable 1.x based Voice Services	X
SYNVIA	1.9.2	SIP based voice services	X
SYNVIA	1.10	Other Services	X
SYNVIA	1.11	Management, service and support	X

1.4 Definitions, symbols and abbreviations

1.4.1 Definitions

Cable Modem (CM): modulator-demodulator at subscriber locations intended for use in conveying data Communications on a cable television system

Cable Modem Termination System (CMTS): cable modem termination system, located at the cable television system headend or distribution hub, which provides complementary functionality to the cable modem to enable data connectivity to a wide-area network

Cable Network: coaxial-based broadband access network in the form of either an all-coax or Hybrid-Fibre/Coax (HFC) network

Carrier Hum Modulation: peak-to-peak magnitude of the amplitude distortion relative to the RF carrier signal level due to the fundamental and low-order harmonics of the power-supply frequency

Composite Second Order beat (CSO): peak of the average level of distortion products due to second-order non-linearity's in cable system equipment

Composite Triple Beat (CTB): peak of the average level of distortion components due to third-order non-linearity's in cable system equipment

customer: human being or organization that accesses the network in order to communicate via the services provided by the network

downstream: in cable television, the direction of transmission from the headend to the subscriber

dynamic range: ratio between the greatest signal power that can be transmitted over a multichannel analogue transmission system without exceeding distortion or other performance limits, and the least signal power that can be utilized without exceeding noise, error rate or other performance limits

group delay: difference in transmission time between the highest and lowest of several frequencies through a device, circuit or system

High Frequency (HF): Used in the present document to refer to the entire subsplit (5 MHz to 30 MHz) and extended subsplit (5 MHz to 65 MHz) band used in return channel communications over the cable television network

hum modulation: undesired modulation of the television visual carrier by the fundamental or low-order harmonics of the power supply frequency, or other low-frequency disturbances

Hybrid Fibre/Coax (HFC) system: broadband bidirectional shared-media transmission system using fibre trunks between the headend and the fibre nodes, and coaxial distribution from the fibre nodes to the customer locations

impulse noise: noise characterized by non-overlapping transient disturbances

layer: subdivision of the Open System Interconnection (OSI) architecture, constituted by subsystems of the same rank

micro-reflections: echoes in the forward transmission path due to departures from ideal amplitude and phase characteristics

mid split: frequency division scheme that allows bi-directional traffic on a single coaxial cable

passive network termination point (pNTP): customer terminal with minimum optical/electrical spacing to the CMTS

PHYsical (PHY) layer: layer 1 in the Open System Interconnection (OSI) architecture; the layer that provides services to transmit bits or groups of bits over a transmission link between open systems and which entails electrical, mechanical and handshaking procedures

Quadrature Amplitude Modulation (QAM): method of modulating digital signals onto a radio-frequency carrier signal involving both amplitude and phase coding

Radio Frequency (RF): in cable television systems, this refers to electromagnetic signals in the range 5 MHz to 1 GHz

return loss (RL): parameter describing the attenuation of a guided wave signal (e.g. via a coaxial cable) returned to a source by a device or medium resulting from reflections of the signal generated by the source

terminal: equipment connected to a telecommunication network to provide access to one or more specific services

1.4.2 Abbreviations

BER	Bit Error Rate
C/N or CNR	Carrier-to-Noise Ratio
CENELEC	European Commitee for Electrotechnical Standardization CM Cable Modem
CPE	Customer Premise Equipment
CoNT	Customer Owned Network Termination Device
CSO	Composite Second Order beat
CTB	Composite Triple Beat
DIN	Deutsches Institut für Normung
DOCSIS	Data Over Cable Service Interface Specifications
ETSI	European Telecommunications Standards Institute
FM	Frequency Modulation
HF	High Frequency
HFC	Hybrid-Fibre/Coax
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
MER	Modulation Error Ratio
MGCP	Media Gateway Control Protocol
NCS	Network Control Signalling
PER	Packet Error Rate
POTS	Plain old telephony service
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase-Shift Keying
RF	Radio Frequency
pNTP	passive Network Termination Point
SIP	Session Initiation Protocol
TI	Terminal Input
SNR	Signal to Noise Ratio
MIB	Management Information Base

RFC	Request for Comment
MSO	Multiple Service Operator
L[1-7]	OSI Layer [1-7]

1.5 Basic Service Definition

The MSO grants network access to compatible devices which are following the MSO Interface specification. The customer will be able to use the following services, which are referenced as basic services throughout this document:

- L1 Network Access
- L2 Network Access
- IP (Internet) Service
- Voice Service

1.6 L1 Network Access

The CoNT must be capable of bonding a minimum number of downstream and upstream channels. Those minimum requirements are

Bandwidth	0 – 200 Mbit/s	8 SC QAM	Downstream
Bandwidth	200 – 400 Mbit/s	16 SC QAM	Downstream
Bandwidth	0 – 20 Mbit/s	4 Channels	Upstream

Minimum channel requirements for bandwidths beyond the previously shown limits are calculated with the following formula :

# of SC QAM x 50 Mbit/s = achievable bandwidth downstream

Vendors may offer CoNT with higher bonding capabilities in downstream and upstream direction.

1.7 L2 network access

The L2 network access is entirely covered in the base specification

1.8 IP (Internet) Services

The following section provides information regarding the IP and Internet Services which will be provided by the MSO. The following definition is set:

- IPv4 support is mandatory
- IPv6 support is mandatory

- DS-lite support is mandatory

The specification only references RFC's which must be supported in addition to the base RFC's which are mandatory to provide basic IPv4, IPv6 and DS-lite protocol operations.

1.8.1 IPv4 operations

Internet Protocol Version 4 is a widely used protocol in data communication over different types of networks. The logical connection between participating devices is set up by providing identification to each device.

In order to use the internet service, a compatible device must retrieve identification data (IP address) from the MSO backend systems. IPv4 addresses will only be assigned dynamically and may change on any network connect or device restart.

1.8.1.1 DHCP IPv4 Operation

The following RFC's must be supported for an address assignment performed via DHCP:

- RFC951, updated by 1395, 1497, 1532, 1542, 5494
- RFC2131, updated by 3396, 4361, 5494, 6842
- RFC2132

Any static or stateless configuration approach of IP address information, DNS services or routes on the WAN connection is incompatible with the MSO requirements and specifications.

1.8.1.2 PPPoE IPv4 Operation

The following RFC's must be supported for an address assignment performed via PPPoE:

- RFC 1661, updated by 2153
- RFC 1662, RFC 2516

Any static configuration of IP address information, DNS services or routes on the WAN connection is incompatible with the MSO requirements and specifications.

1.8.2 IPv6 operations

Internet Protocol Version 6 is the successor of IPv4 and supports a much larger number of nodes due to an increased address space. The logical connection between participating devices is set up by providing identification to each device.

In order to use the internet service, a compatible device must retrieve identification data (IP address / Ipv6 prefix) from the MSO backend systems. IPv6 addresses and IPv6 prefixes will only be assigned dynamically and are subject to change on any network connect or device restart.

IPv6 addresses on the WAN side are exclusively provided through DHCPv6, SLAAC is not supported and must remain disabled.

The following RFC's must be supported:

- RFC2131 (IPv4)
- RFC2132 (IPv4 and IPv6)
- RFC3315, updated by 4361, 5494, 6221, 6422, 6644, 7083, 7227, 7283, 7550
- RFC6221, RFC6422, RFC6644, RFC6842

Any static or stateless configuration approach of IP address information, DNS services or routes on the WAN connection is incompatible with the MSO requirements and specifications.

1.8.3 DS-lite operations

DS-lite is a very important IPv4 – IPv6 transition technology and must be supported by any router which connects to the MSO network. The MSO may drop single stack or dual stack operation at any time and move to an IPv6 only network where the customer owned network termination devices will operate as a B4 element.

The following RFC's must be supported for DS-Lite operation:

- RFC6233, updated by RFC 7335

1.9 Voice Services

1.9.1 PacketCable 1.x based Voice Services

Telephony services are provided leveraging the PacketCable Standard in Version 1.x. The following section describes the relevant PacketCable specifications for the voice service.

The PacketCable based voice services do not use any credentials due to the principle of centralized call logic and sophisticated device identification through certificates and provisioning.

The following PacketCable Specifications are relevant:

Specification	Title	IF spec relevant
PKT-SP-ASP1.5-I02-070412	Audio Server Protocol	
PKT-SP-ATPBX1.5-I01-060419	Analog Trunking for PBX Specification	
PKT-SP-BV16-Codec1.5-I01-031030	BroadVoice 16 Speech Codec Specification	x
PKT-SP-CMSPROV1.5-I02-070412	CMS Subscriber Provisioning	
PKT-SP-CMSS1.5-I07-120412	CMS to CMS Signaling	
PKT-SP-CODEC1.5-I04-120412	Audio/Video Codecs	x
PKT-SP-DQOS1.5-I04-090624	Dynamic Quality-of-Service	x
PKT-SP-EM1.5-I03-070412	Event Messages	x
PKT-SP-ESP1.5-I02-070412	Electronic Surveillance	x
PKT-SP-EVEMIB1.5-I02-050812	Management Event MIB Specification	x
PKT-SP-MEM1.5-I05-100527	Management Event Mechanism	x
PKT-SP-MIB-EXMTA1.5-I01-050128	MTA Extension MIB	x
PKT-SP-MIB-EXSIG1.5-I05-121030	Signaling Extension MIB	x
PKT-SP-MIB-MTA1.5-I01-050128	MTA MIB	x
PKT-SP-MIBS1.5-I03-090624	MIBs Framework Specification	x
PKT-SP-NCS1.5-I04-120412	Network-Based Call Signaling Protocol	x
PKT-SP-PROV1.5-I04-090624	MTA Device Provisioning	x
PKT-SP-SEC1.5-I03-090624	Security	x

PKT-SP-TGCP1.5-I04-120412	PSTN Gateway Call Signaling Protocol Specification	

1.9.2 SIP based voice services

SIP based voice service are provided based on the IETF RFC 3261 standard and its extensions. SIP services, opposite to PacketCable based voice services, are not auto provisioned, the customer must enter and apply the data manually. The SIP credentials follow the schema shown below, equipment vendors should provide a compatible input interface for data entry into the device:

SIP username:	(^0|^0049)([2-9])(\d{5,}).{10,20}
SIP authname:	(^0|^0049)([2-9])(\d{5,}).{10,20}
SIP password:	(?=.*\d)(?=.*[a-z])(?=.*[A-Z]).{6,10}
SIP registrar:	<host>.<domain>.tld
SIP proxy:	<host>.<domain>.tld

1.10 Other services

There are no other services supported by the MSO.

1.11 Management, service and support

The management, service and support responsibility for the network termination device will shift from the MSO to the customer and respectively to the equipment supplier. Nevertheless, the MSO may require access to the CoNT under some circumstances. The customer must actively permit this support access and may open it to the MSO personnel on a case by case or permanent basis. Any use of this support access and any data retrieval should be controllable and auditable by the customer.

It is therefore recommended that equipment vendors implement certain control mechanisms which enable the customer to limit management and support access.

The following Management OID's shall be accessible by the MSO if the customer permits the remote management operation. Any other MIB access is not required and should be blocked on the CoNT.

RF Parameter Modem	
Index OID	1.3.6.1.2.1.2.2.1.1
Sequence	2
MIB Name	RFC1213-MIB
is Table	Y
TableName	ifTable

RF Parameter Modem DS 1	
Index OID	1.3.6.1.2.1.2.2.1.1
Sequence	3
MIB Name	RFC1213-MIB
is Table	Y
TableName	ifTable

RF Parameter Modem US 1	
Index OID	1.3.6.1.2.1.2.2.1.1
Sequence	4
MIB Name	RFC1213-MIB
is Table	Y
TableName	ifTable

RF Parameter Modem DS n (bonding)	
Index OID	1.3.6.1.2.1.2.2.1.1
Sequence	[48-79]
MIB Name	RFC1213-MIB
is Table	Y
TableName	ifTable

RF Parameter Modem US n (bonding)	
Index OID	1.3.6.1.2.1.2.2.1.1
Sequence	[80-87]
MIB Name	RFC1213-MIB
is Table	Y
TableName	ifTable

Modem Serial Number	
Index OID	1.3.6.1.2.1.69.1.1.4
Sequence	0
MIB Name	DOCS-CABLE-DEVICE-MIB
is Table	N
TableName	N/A

Time and Date	
Index OID	1.3.6.1.2.1.69.1.1.2
Sequence	0
MIB Name	DOCS-CABLE-DEVICE-MIB
is Table	N
TableName	N/A

Current SW Version	
Index OID	1.3.6.1.2.1.69.1.3.5
Sequence	0
MIB Name	DOCS-CABLE-DEVICE-MIB
is Table	N
TableName	N/A

System Description	
Index OID	1.3.6.1.2.1.1.1
Sequence	0
MIB Name	RFC1213-MIB
is Table	N
TableName	N/A

DOCSIS HF Downstream Parameters	
Index OID	1.3.6.1.2.1.2.2.1.1
Sequence	any
MIB Name	DOCS-IF-MIB
is Table	Y
TableName	docsIfDownstreamChannelTable

DOCSIS HF Upstream Parameters	
Index OID	1.3.6.1.2.1.2.2.1.1
Sequence	any
MIB Name	DOCS-IF-MIB
is Table	Y
TableName	docsIfUpstreamChannelTable
DOCSIS HF Quality Parameters	
Index OID	1.3.6.1.2.1.2.2.1.1
Sequence	any
MIB Name	DOCS-IF-MIB
is Table	Y
TableName	docsIfSignalQualityTable

DOCSIS HF TX Power	
Index OID	1.3.6.1.2.1.10.127.1.2.2.1.3
Sequence	0
MIB Name	DOCS-IF-MIB
is Table	N
TableName	N/A

2. GPON

2.1 Scope

This Chapter contains carrier specific information and specifications, for customer owned network termination devices which can be connected and operated on the network. The described interface is the interconnection R/S point between the Fiber Termination and the ONT as denoted in Broadband Forum TR156.

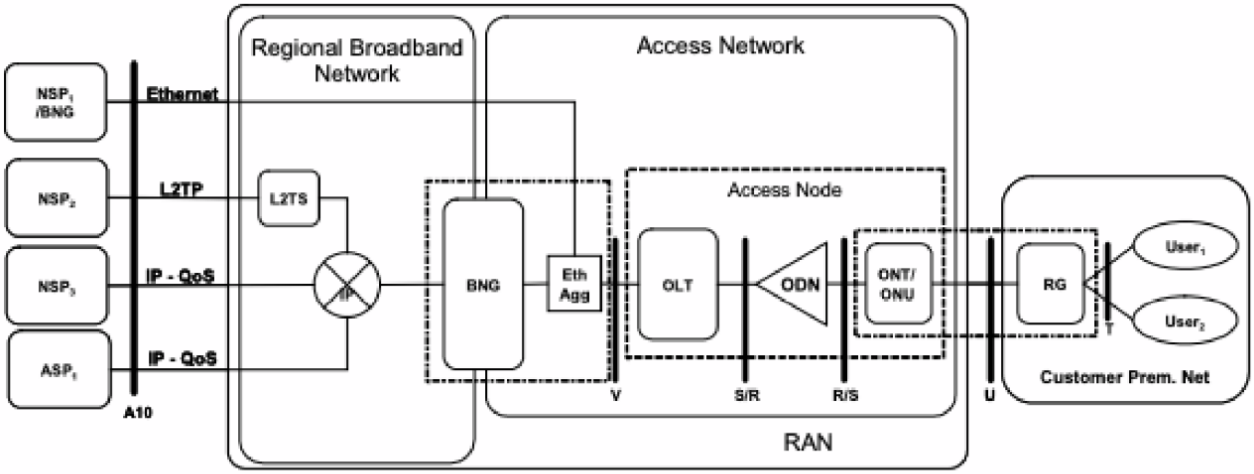

Figure 1 – Network architecture for Ethernet-based GPON aggregation

2.2 Definitions, symbols and abbreviations

The definitions and abbreviations are copied from the TR156 (Broadband Forum), section 2.1 and section

2.2.1 Definitions

DBA: A process, by which the Optical Line Terminal (OLT) distributes the upstream PON capacity between the traffic-bearing entities within Optical Network Units (ONUs), based on the dynamic indication of their activity status and their configured traffic contracts.
GEM: G-PON Encapsulation Method (GEM). A data frame transport scheme used in GPON systems that is connection-oriented and that supports fragmentation of the user data frames into variable sized transmission fragments.
GEM Port: An abstraction on the GTC adaptation sublayer representing a logical connection associated with a specific client traffic flow. The GTC adaptation sublayer is a sublayer of the GPON Transmission Convergence layer that supports the functions of user data fragmentation and de-fragmentation, GEM encapsulation, GEM frame delineation, and GEM Port\-ID filtering.
GEM Port Id: A 12-bit value which is assigned by the OLT to the individual logical connections transported over the GPON interface and which is carried in the header of all the GEM frames associated with the given logical connection.
GPON Interface: The interface at reference points S/R and R/S as specified in ITU-T G.984.1. This is a PON-specific interface that supports all the protocol elements necessary to allow transmission between OLT and ONUs.
GPON Network: An OLT connected using an Optical Distribution Network (ODN) to one or more ONUs or ONTs. A GPON network is a subset of the Access Network.
OLT Optical Line Termination (OLT): A device that terminates the common (root) endpoint of an ODN, implements a PON protocol, such as that defined by G.984, and adapts PON PDUs for uplink

communications over the provider service interface. The OLT provides management and maintenance functions for the subtended ODN and ONUs.
ONT Optical Network Termination (ONT): A single subscriber device that terminates any one of the distributed (leaf) endpoints of an ODN, implements a PON protocol, and adapts PON PDUs to subscriber service interfaces. An ONT is a special case of an ONU.
ONU Optical Network Unit (ONU): A generic term denoting a device that terminates any one of the distributed (leaf) endpoints of an ODN, implements a PON protocol, and adapts PON PDUs to subscriber service interfaces. In some contexts, an ONU implies a multiple subscriber device.
Subscriber: A billable entity.
T\-CONT: A traffic-bearing object within an ONU that represents a group of logical connections, is managed via the ONU Management and Control Channel (OMCC), and is treated as a single entity for the purpose of upstream bandwidth assignment on the PON.
Traffic Flow: A sequence of frames or packets traversing a particular reference point within a network that share a specific frame/packet header pattern. For example, an Ethernet traffic flow can be identified by any combination of specific source MAC address, destination MAC, VLAN ID, 802.1p bits, etc.
Traffic Classes (TC): Traffic Classes are the set of upstream and downstream supported forwarding behaviours in the network element.
U interface: U interface is a short form of expressing one or more of the interfaces defined in this Technical Report or in TR-101 at the U reference point. It is also essentially equivalent to a subscriberfacing interface at the access node.
V interface: V interface is a short form of expressing one or more of the interfaces defined in TR\-101 at the V reference point. It is also essentially equivalent to a network facing interface at the access node.

2.2.2 Abbreviations

Abbreviation	Meaning
ADSL	Asymmetric Digital Subscriber Line
AES	Advanced Encryption Standard
AN	Access Node
ASP	Application Service Provider
ATM	Asymmetric Transfer Mode
BTS	Base Transceiver Station
CB	Cellular Backhaul
CPE	Customer Premises Equipment
CPN	Customer Premises Network
DSCP	DiffServ Code Point
DSL	Digital Subscriber Line
FE	Fast Ethernet (100Mbps)
FITH	Fiber into the Home
FTTC	Fiber to the Curb
FTTH	Fiber to the Home
FTTO	Fiber to the Office

FTTP	Fiber to the Premises, including buildings
GE	Gigabit Ethernet (1000Mbps)
GEM	Generic Encapsulation Method
GPM	GPON Physical Media layer
GPON	Gigabit-capable Passive Optical Network
GTC	GPON Transmission Convergence layer – as defined in G.984.3
MAC	Media Access Control
MDU	Multi-Dwelling Unit
MTU	Multi-Tenant Unit – or Maximum Transmission Unit
NSP	Network Service Provider
ODN	Optical Distribution Network – as defined in G.984.1
OLT	Optical Line Termination – as defined in G.984.1
OMCI	ONU Management and Control Interface
ONT	Optical Network Termination – as defined in G.984.1
ONU	Optical Network Unit – as defined in G.984.1
POTS	Plain Old Telephone Service
RBN	Regional Broadband Network
RG	Residential Gateway
RNC	Radio Network Controller
SFU	Single Family Unit – a type of residence
TDM	Time-Division Multiplexing
TLS	Transparent LAN Service – a common synonym for Business Ethernet Services
TR	Technical Report
VDSL	Very high speed Digital Subscriber Line
xDSL	Any variety of DSL

2.3 Basic Service Definition

The carrier uses the ONT serial number for OLT registration purposes. (ITU-T G.988) The customer must provide the ONT\-ID to the carrier, who is using this information in the provisioning.
The carrier grants network access to compatible devices which are following this Interface specification. The customer will be able to use the following services, which are referenced as basic services throughout this document:
L1 Network Access
L2 Network Access
IP (Internet) Service
Voice Service

2.4 Physical layer requirements

Comply with ITU-T G.942.2 specification
Single mode fiber operation (ITU-T G652 D)
Connector Type: LC/APC 8°
Wavelength: Downstream: 1490 nm (1480–1500 nm); Upstream: 1310 nm (1260–1360 nm)
Line rates (max): Downstream 2.488 Gbps; Upstream 1.244 Gbps

2.5 Data Link Layer requirements

GPON encapsulation method must be supported
Dynamic bandwidth assignment payload processing must be supported
ONT status reporting must be supported
FEC upstream must be supported
FEC downstream must be supported
Tagged and untagged traffic from the UNI interface must be supported
Upstream: Traffic received from a UNI port (one or many) must be mapped to a single GEM port
P-bit must be supported on VLAN basis

2.6 IP (Internet) Services

The following section provides information regarding the IP and Internet Services which will be provided by the carrier. The following definition is set:
\- IPv4 support is mandatory
\- IPv6 support is mandatory
\- DS\-lite support is mandatory
\- PPPoE support is mandatory
The specification only references RFC's which must be supported in addition to the base RFC's which are mandatory to provide basic IPv4, IPv6 and DS\-lite protocol operations.

2.6.1 IPv4 operations

Internet Protocol Version 4 is a widely used protocol in data communication over different types of networks. The logical connection between participating devices is set up by providing identification to each device.

In order to use the internet service, a compatible device must retrieve identification data (IP address) from the carrier backend systems. IPv4 addresses will only be assigned dynamically and may change on any network connect or device restart.

2.6.1.1 DHCP IPv4 Operation

The following RFC's must be supported for an address assignment performed via DHCP:
- RFC951, updated by 1395, 1497, 1532, 1542, 5494
- RFC2131, updated by 3396, 4361, 5494, 6842
- RFC2132

Any static or stateless configuration approach of IP address information, DNS services or routes on the WAN connection is incompatible with the carrier requirements and specifications.

- RFC 1661, updated by 2153
- RFC 1662, RFC 2516

Any static configuration of IP address information, DNS services or routes on the WAN connection is

incompatible with the carrier requirements and specifications.

2.6.1.2 PPPoE IPv4 Operation

The following RFC's must be supported for an address assignment performed via PPPoE:

- RFC 1661, updated by 2153
- RFC 1662, RFC 2516

Any static configuration of IP address information, DNS services or routes on the WAN connection is incompatible with the carrier requirements and specifications.

2.6.2 IPv6 operations

Internet Protocol Version 6 is the successor of IPv4 and supports a much larger number of nodes due to an increased address space. The logical connection between participating devices is set up by providing identification to each device.
In order to use the internet service, a compatible device must retrieve identification data (IP address / Ipv6 prefix) from the MSO backend systems. IPv6 addresses and IPv6 prefixes will only be assigned dynamically and are subject to change on any network connect or device restart.
IPv6 addresses on the WAN side are exclusively provided through DHCPv6, SLAAC is not supported and must remain disabled.

The following RFC's must be supported:

- RFC2131 (IPv4)
- RFC2132 (IPv4 and IPv6)
- RFC3315, updated by 4361, 5494, 6221, 6422, 6644, 7083, 7227, 7283, 7550
- RFC6221, RFC6422, RFC6644, RFC6842

Any static or stateless configuration approach of IP address information, DNS services or routes on the WAN connection is incompatible with the MSO requirements and specifications.

2.6.3 DS-lite operations

DS\-lite is a very important IPv4 – IPv6 transition technology and must be supported by any router which connects to the MSO network. The MSO may drop single stack or dual stack operation at any time and move to an IPv6 only network where the customer owned network termination devices will operate as a B4 element.

The following RFC's must be supported for DS\-Lite operation:

- RFC6233, updated by RFC 7335

2.7 Voice Services

2.7.1 SIP based voice services

SIP based voice service are provided based on the IETF RFC 3261 standard and its extensions. SIP services, opposite to PacketCable based voice services, are not auto provisioned, the customer must enter the data manually in his device. The SIP credentials follow the schema shown below, equipment vendors should provide a compatible input interface for data entry into the device:

SIP username: (^0|^0049) ([2-9]) (\d{5, }).{10,20}
SIP authname: (^0|^0049) ([2-9]) (\d{5, }).{10,20}
SIP password: (?=.*\d) (?=.*[a-z] (?=.*[A-Z]).{6,10}
SIP registrar: <host>.<domain>.tld
SIP proxy: <host>.<domain>.tld

2.8 Other services

There are no other services supported by the MSO.

2.9 Management, service and support

2.9.1 ONT / ONU Management Requirements

The management, service and support responsibility for the network termination device will shift from the carrier to the customer and respectively to the equipment supplier. Nevertheless, the carrier requires access to the device to ensure a proper network operation and perform necessary configuration and monitoring on the equipment.
- ONT states
- UNI port states (one or many per ONT)
- Power Status (on / off / gasp)

2.9.2 Registration and Activation

The carrier uses the ONT serial number for OLT registration purposes. (ITU-T G.988) The customer must provide the ONT\-ID to the carrier, who is using this information in the provisioning.
Any change of the ONT\-ID must be reported by the customer to the carrier support.

3. Safeguard clause

If any of the information provided in this document are invalid or otherwise, then to the extent and within the jurisdiction which that information is illegal, invalid or unenforceable, it shall be severed and deleted from this clause and the remaining information shall survive, remain in full force and effect and continue to be binding and enforceable.

Appendix A