Helium Operator Manual (CLI)

S.Wong

December 2011

Pace plc, Victoria Road, Saltaire BD18 3LF UK
Tel: +44 (0) 1274 532000 Fax: +44 (0) 1274 532010

1 GLOSSARY

Acronym	Meaning	Comments
ACS	Auto Configuration Server	
ADSL	Asymmetric Digital Subscriber Line	
AES	Advanced Encryption Standard	
CBR	Constant Bit Rate	
CLI	Command Line Interface	
CPE	Customer Premises Equipment	
DHCP	Dynamic Host Configuration Protocol	
DNS	Domain Name System	
DSCP	Differentiated Services Code Point	
DSLAM	Digital Subscriber Line Access Multiplexer	
DTMF	Dual-Tone Multi-Frequency	
ECN	Explicit Congestion Notification	
EF	Expedited Forwarding	
FTP	File Transfer Protocol	
FXO	Foreign eXchange Office	
FXS	Foreign eXchange Subscriber	Subscriber connection port
HTTP	HyperText Transfer Protocol	
ICMP	Internet Control Message Protocol	
IP	Internet Protocol	
LAN	Local Area Network	
LCP	Link Control Protocol	
LLC	Logical Link Control	
MGCP	Media Gateway Control Protocol	
PHB	Per-Hop Behaviour	The policy and priority applied to a packet when traversing a hop in a DiffServ network
PPP	Point-to-Point Protocol	
PPPoE	Point-to-Point Protocol over Ethernet	
QoS	Quality of Service	
RTP	Real Time Protocol	
SIP	Session Initiation Protocol	
SSID	Service Set Identifier	Wireless network name
TKIP	Temporal Key Integrity Protocol	
ToS	Type of Service	
UBR	Unsustainable Bit Rate	
USB	Universal Serial Bus	
VBR	Variable Bit Rate	
VoIP	Voice over IP	
WAN	Wide Area Network	
WPA	Wireless Protected Access	WIFI encryption
WPS	Wireless Protected Setup	Easy wireless setup by a button
VDSL	Very High-Speed Digital Subscriber Line	

2 REFERENCES

Function	Document reference	Comments
ebtables	http://ebtables.sourceforge.net/br_fw_ia/br_fw_ia.html	filtering tool for a Linux-based bridging firewall
DSCP et ToS	http://www.cisco.com/en/US/tech/tk543/tk757/technologies_tech_note09186a00800949f2.shtml	
TR069	http://www.broadband-forum.org/technical/download/TR-069_Amendment-2.pdf	
Tcpdump	http://www.tcpdump.org/tcpdump_man.html	

Table of contents

3 CONFIGURING THE CPE

Note that all parameters can be customized regarding the customer requirements.

3.1 CHANGING THE CONFIGURATION

This chapter shows you how to change some parameters of the configuration through the CLI.

First of all, open a Telnet session on the CPE and log with credentials *root/hemingway*.

Before using all commands listed below, you should first type this cli, in order to enter command line mode.

```
home login: root
Password:
~# cli
>
```

3.1.1 MAIN COMMANDS

The main commands you can use are:

cd *directory*	Go to the *directory*
cd ._	Go to the parent directory
cd _	Go to the root directory
ls	List the parameters in the current directory with their current value
ln	Show the values which can be used for the parameters
set *parameter value*	Set the *parameter* with this *value*
mk *number*	Create a new set of parameters in an array with the index *number*
rm *number*	Delete the set of parameters in array with the index *number*
fdump diff	Show the differences between the default configuration and the current one
applydiff	Apply differences between two configuration versions
fcommit	Commit all changes

3.1.2 CHANGING THE PARAMETERS

In the configuration, each '_' (underscore) stands for a move of directory or the parameter in the directory. Here is an example:

```
LANDevice_1_IPInterface_1_Enable=1
```

This can be done in CLI as followed:

```
> cd LANDevice
LANDevice > cd 1
LANDevice_1 > cd IPInterface
LANDevice_1_IPInterface > cd 1
LANDevice_1_IPInterface_1 > set Enable 1
```

Or also directly:

```
> cd LANDevice_1_IPInterface_1
LANDevice_1_IPInterface_1 > set Enable 1
```

3.1.3 MODIFYING AN ARRAY

To create a set of parameters in an array, do the following.

First, list the current existing sets in the array:

```
WANConnectionDevice_1_Service > ls
[33] WANConnectionDevice_1_Service_List = [1]
[ 0] WANConnectionDevice_1_Service_1_Enable = [0]
[ 9] WANConnectionDevice_1_Service_1_RemotePort = []
[ 9] WANConnectionDevice_1_Service_1_Port = []
[ 2] WANConnectionDevice_1_Service_1_Protocol = []
[ 2] WANConnectionDevice_1_Service_1_UniqueKey = []
```

Then create the next set of parameters:

```
WANConnectionDevice_1_Service > mk 2
```

Set the parameters as expected:

```
WANConnectionDevice_1_Service_2 > set Port 80
WANConnectionDevice_1_Service_2 > set RemotePort 80
WANConnectionDevice_1_Service_2 > set Protocol tcp
WANConnectionDevice_1_Service_2 > set UniqueKey http
WANConnectionDevice_1_Service_2 > set Enable 1
```

List all the parameters to double-check:

```
WANConnectionDevice_1_Service_2 > cd ._
WANConnectionDevice_1_Service > ls
[33] WANConnectionDevice_1_Service_List = [1,2]
[ 0] WANConnectionDevice_1_Service_1_Enable = [0]
[ 9] WANConnectionDevice_1_Service_1_RemotePort = []
[ 9] WANConnectionDevice_1_Service_1_Port = []
[ 2] WANConnectionDevice_1_Service_1_Protocol = []
[ 2] WANConnectionDevice_1_Service_1_UniqueKey = []
[ 0] WANConnectionDevice_1_Service_2_Enable = [1]
[ 9] WANConnectionDevice_1_Service_2_RemotePort = [80]
[ 9] WANConnectionDevice_1_Service_2_Port = [80]
[ 2] WANConnectionDevice_1_Service_2_Protocol = [tcp]
[ 2] WANConnectionDevice_1_Service_2_UniqueKey = [http]
```

To remove a set of parameters:

```
WANConnectionDevice_1_Service > rm 2
WANConnectionDevice_1_Service > ls
[33] WANConnectionDevice_1_Service_List = [1]
[ 0] WANConnectionDevice_1_Service_1_Enable = [0]
[ 9] WANConnectionDevice_1_Service_1_RemotePort = []
[ 9] WANConnectionDevice_1_Service_1_Port = []
[ 2] WANConnectionDevice_1_Service_1_Protocol = []
[ 2] WANConnectionDevice_1_Service_1_UniqueKey = []
```

3.1.4 COMMITTING THE CHANGES

When all the changes are done, you must apply them with *`fcommit`* command:

```
 > fcommit
/etc/init.d/fwservices restart 1
/etc/init.d/firewall restart 1
/etc/init.d/iptables restart
```

3.2 SAVING AND RESTORING A CONFIGURATION

When many changes are made in the configuration, it should be a good idea to reproduce the configuration on another CPE or save the configuration in case of a factory reboot of the CPE.

3.2.1 SAVING

To save the configuration, you have to execute the *fdump diff* command, which displays the differences between the current configuration and the default one. Here is an example:

```
> fdump diff
- Voice_WANInterface=5
- LANDevice_2_Enable=1
+ WANConnectionDevice_1_Service_3_UniqueKey='sip'
+ WANConnectionDevice_1_Service_3_Protocol='udp'
+ WANConnectionDevice_1_Service_3_Port=5060
+ WANConnectionDevice_1_Service_3_Enable=1
- WANConnectionDevice_1_Service_List=1,2
+ WANConnectionDevice_1_Service_List=1,2,3
+ WANConnectionDevice_1_PhysicalInterface_VlanNumber=2
+ WANConnectionDevice_1_PhysicalInterface_List=
+ WANConnectionDevice_1_PhysicalInterface_Type='LANEthernetInterface'
```

3.2.2 RESTORING

If you have a text file with the content of the differences between the default configuration and a new one, you can apply them on a CPE with the *applydiff* command as following:

```
> applydiff
- Voice_WANInterface=5
- LANDevice_2_Enable=1
+ WANConnectionDevice_1_Service_3_UniqueKey='sip'
+ WANConnectionDevice_1_Service_3_Protocol='udp'
+ WANConnectionDevice_1_Service_3_Port=5060
+ WANConnectionDevice_1_Service_3_Enable=1
- WANConnectionDevice_1_Service_List=1,2
+ WANConnectionDevice_1_Service_List=1,2,3
+ WANConnectionDevice_1_PhysicalInterface_VlanNumber=2
+ WANConnectionDevice_1_PhysicalInterface_List=
+ WANConnectionDevice_1_PhysicalInterface_Type='LANEthernetInterface'

restore-config is done, please reboot to use new parameters
```

Note that you have to use the *applydiff* command and then to copy the file content.

Warning: All previous changes will be erased with this command, that's why it's important to type first *fdump diff* command before *applydiff*.

4 LOCAL AREA NETWORK (LAN)

In the CPE, you can have several defined LAN set in *LANDevice* menu.

The CPE has at least one IP address per LAN, but we can define several IP addresses in the same LAN. Here, we are configuring the first LAN:

```
LANDevice_1_IPInterface_1_Enable=1
LANDevice_1_IPInterface_1_IPAddress=192.168.1.1
LANDevice_1_IPInterface_1_SubnetMask=255.255.255.0
```

By default, the IP address is 192.168.1.1/24.

To enable the DHCP server on the LAN, the configuration is:

```
LANDevice_1_HostConfig_DHCPServerEnable=1
```

For setting the minimum and the maximum IP address of the range, from 192.168.1.2 to 192.168.1.200:

```
LANDevice_1_HostConfig_MinAddress=192.168.1.2
LANDevice_1_HostConfig_MaxAddress=192.168.1.200
```

The other parameters for the DHCP server (subnet mask, DNS servers, domain name, lease time) do not be required in a simple configuration, default values will be sent in the DHCP offer.

Attach (1) or detach (0) a WiFi SSID to the LAN, here for example, we are attaching the SSID1 and are detaching SSID2 to the LAN1:

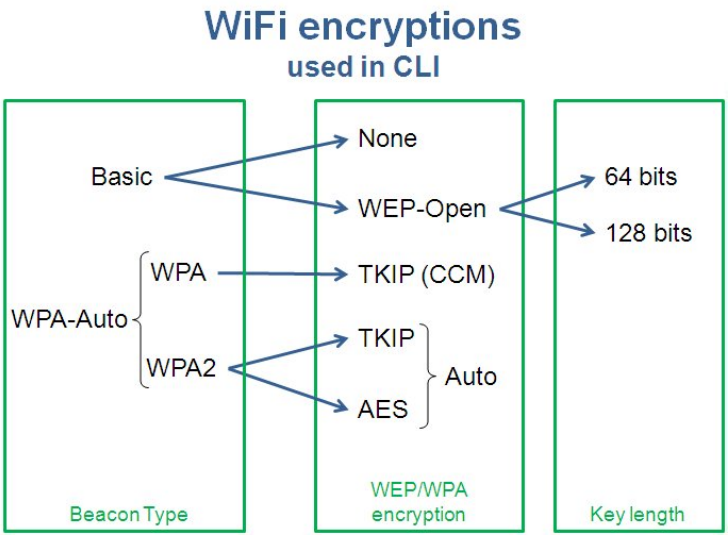
```
LANDevice_1_WLANInterface_1_Enable=1
LANDevice_1_WLANInterface_2_Enable=0
```

5 WIFI INTERFACE CONFIGURATION

Here, we are configuring the first SSID (`WLANInterface_1`). To configure another SSID, change the number after *`WLANInterface`*.

5.1 OVERVIEW OF WIFI ENCRYPTIONS

This drawing shows how the several WiFi encryptions are managed.



5.2 GENERAL SETTINGS

First, you have to enable the interface:

```
WLANInterface_1_Enable=1
```

Then, set the name of the SSID:

```
WLANInterface_1_Config_SSID=mySSID
```

Finally, you can hide the SSID in the wireless network discovery:

```
WLANInterface_1_Config_HideSSID=1
```

5.3 ENCRYPTION MODE

5.3.1 NO SECURITY ENABLED

```
WLANInterface_1_Config_BeaconType=Basic
WLANInterface_1_Config_WEPEncryption=None
```

5.3.2 WEP ENCRYPTION

```
WLANInterface_1_Config_BeaconType=Basic
WLANInterface_1_Config_WEPEncryption=WEP-Open
```

The WEP key must be entered in hexadecimal. To set an ASCII WEP key, it must be converted in hexadecimal before. For 64 bits WEP key, it is 5 ASCII characters long (here: myKey) and for 128 bits WEP key, it is 13 ASCII characters long (here: myLooonnngKey).

```
WLANInterface_1_Config_WEPKey1=6D794B6579
WLANInterface_1_Config_WEPKeyAscii1=1
```

5.3.3 WPA/WPA2 ENCRYPTION

For WPA encryption only:

```
WLANInterface_1_Config_BeaconType=WPA
WLANInterface_1_Config_WPAEncryption=Auto
WLANInterface_1_Config_WPADefaultKey=myWPAKey
```

For WPA2 encryption only:

```
WLANInterface_1_Config_BeaconType=WPA2
WLANInterface_1_Config_WPAEncryption=Auto
WLANInterface_1_Config_WPADefaultKey=myWPAKey
```

For WPA and WPA2 encryption both activated, which can be specifically selected by the WiFi client station:

```
WLANInterface_1_Config_BeaconType=WPA-Auto
WLANInterface_1_Config_WPAEncryption=Auto
WLANInterface_1_Config_WPADefaultKey=myWPAKey
```

In WPA2, to choose between TKIP encryption and AES encryption:

```
WLANInterface_1_Config_WPAEncryption=TKIP
WLANInterface_1_Config_WPAEncryption=AES
```

6 WIDE AREA NETWORK (WAN) – LAYER 2

We can have two types of WAN interfaces:

- Interfaces which used ADSL (ATM)
- Interfaces which used one Ethernet port as WAN with VLAN trunking (802.1q)

6.1 ATM CONFIGURATION

First, the ATM interface must be enabled:

```
ATMEthernetInterface_1_Enable=1
ATMEthernetInterface_1_ATMLinkConfig_Enable=1
```

Then you have to configure your ATM link with all of its parameters as:

- VPI/VCI:

```
ATMEthernetInterface_1_ATMLinkConfig_VC='8/35'
```

- The different values of the encapsulation type can be:

```
ATMEthernetInterface_1_ATMLinkConfig_ATMEncapsulation='LLC'
ATMEthernetInterface_1_ATMLinkConfig_ATMEncapsulation='VCMUX'
```

- Values of the class of service can be selected between ‘UBR’, ‘CBR’, ‘VBR-rt’, ‘VBR-nrt’

```
ATMEthernetInterface_1_ATMLinkConfig_ATMClass='UBR'
```

- If it is not UBR, you should precise these following fields:

```
ATMEthernetInterface_1_ATMLinkConfig_ATMPeakCellRate=
ATMEthernetInterface_1_ATMLinkConfig_ATMMaximumBurstSize=
ATMEthernetInterface_1_ATMLinkConfig_ATMSustainableCellRate=
```

- The different values of the link type can be ‘EoA’, ‘IPoA’, ‘PPPoE’, ‘PPPoA’

```
ATMEthernetInterface_1_ATMLinkConfig_LinkType='EoA'
```

When your ATM interface is configured, you can make it linked with a WAN interface:

```
WANConnectionDevice_1_PhysicalInterface_Type='ATMEthernetInterface'
WANConnectionDevice_1_PhysicalInterface_List=1
```

Note that you can link several ATM interfaces to only one WAN interface. In the following examples, we link the ATM interfaces 1, 2 and 4 to the WAN interface 1, using the following syntax:

```
WANConnectionDevice_1_PhysicalInterface_List=1,2,4
```

If you would have several WAN interfaces using the same ATM interface, you must set this parameter before to activate the interface sharing:

```
ATMEthernetInterface_1_Shared=1
```

7 WIDE AREA NETWORK (WAN) – LAYER 3

First, the WAN connection must be enabled:

```
WANConnectionDevice_1_Enable=1
```

7.1 PPP CONNECTION

To enable the PPP protocol on a WAN connection:

```
WANConnectionDevice_1_WANIPConnection_Enable=0
WANConnectionDevice_1_WANPPPConnection_Enable=1
WANConnectionDevice_1_WANPPPConnection_Username='user@isp.com'
WANConnectionDevice_1_WANPPPConnection_Password='userpassword'
```

On this PPP connection, the LCP settings can be changed, the default ones are the following:

```
WANConnectionDevice_1_WANPPPConnection_LcpRetranIntervalTimer=3
WANConnectionDevice_1_WANPPPConnection_LcpMaxRetranCount=10
WANConnectionDevice_1_WANPPPConnection_LcpEchoIntervalTimer=60
WANConnectionDevice_1_WANPPPConnection_LcpEchoFailureCount=4
```

To activate some debug logs level on the CPE about the PPP connection, set this parameter:

```
WANConnectionDevice_1_WANPPPConnection_Debug=1
```

7.2 IP CONNECTION (STATIC OR DHCP)

To enable the IP protocol on a WAN connection:

```
WANConnectionDevice_1_WANPPPConnection_Enable=0
WANConnectionDevice_1_WANIPConnection_Enable=1
```

You can assign dynamic IP address by DHCP:

```
WANConnectionDevice_1_WANIPConnection_AddressingType='DHCP'
```

Or by static IP address:

```
WANConnectionDevice_1_WANIPConnection_IPAddress=80.80.80.80
WANConnectionDevice_1_WANIPConnection_SubnetMask=255.255.255.0
WANConnectionDevice_1_WANIPConnection_DefaultGateway=80.80.80.1
WANConnectionDevice_1_WANIPConnection_AddressingType='Static'
```

7.3 INCOMING OPEN PORTS

When an external application would like to access to the CPE with a specific port, the firewall should accept this request from the outside network. Several rules are applied to the firewall. In this example, we allow SSH connection on the port 2222 and TR-069 service on port 1901. Therefore, all requests received on the WAN interface 1 on the port 2222 will be transmit to port 22 internally.

```
WANConnectionDevice_1_Service_1_Enable=1
WANConnectionDevice_1_Service_1_RemotePort=2222
WANConnectionDevice_1_Service_1_Port=22
WANConnectionDevice_1_Service_1_Protocol='tcp'
WANConnectionDevice_1_Service_1_UniqueKey='ssh'
WANConnectionDevice_1_Service_2_Enable=1
WANConnectionDevice_1_Service_2_RemotePort=1901
WANConnectionDevice_1_Service_2_Port=1901
WANConnectionDevice_1_Service_2_Protocol='tcp'
WANConnectionDevice_1_Service_2_UniqueKey='tr069'
```

This service list is only used if the firewall is enabled on the WAN interface

```
WANConnectionDevice_1_Firewall_Enable=1
```

8 VOICE OVER IP (VOIP)

The VoIP service is composed by global settings under the *Voice* tree and by account settings under the *VoiceProfile* tree.

8.1 GLOBAL SETTINGS

First, to enable the VoIP service:

```
Voice_Enable=1
```

The VoIP service must be linked to a WAN interface. Here for example, all the VoIP streams (signalisation and media) are going through the WAN interface #2.

```
Voice_WANInterface=2
```

Note: If you are using the VoIP service on a WAN interface with firewall enabled, for instance the same WAN interface as the Internet service, you must open the port (5060 for SIP, 2427 for MGCP) in the firewall (§ 7.3 *Incoming open ports*).

Three signalisation types can be used for the VoIP: SIP, MGCP or H323. To specify the signalisation protocol, you can set this value with this parameter:

```
VoiceProfile_1_SignalingProtocol=<Voice_Signaling_Protocol>
```

For the media streams, RTP range ports can be configured, here from 7078 to 7088.

```
VoiceProfile_1_RTP_LocalPortMin=7078
VoiceProfile_1_RTP_LocalPortMax=7088
```

8.2 VOIP ACCOUNT

Each account is configured by a *VoiceProfile_X*, where X is the account number.

8.2.1 SETTINGS

First, the two main parameters must be set. For the signalling protocol, you can choose between SIP and MGCP protocols:

```
VoiceProfile_1_Name='Account1'
VoiceProfile_1_SignalingProtocol='SIP'
```

Then you can enable the account profile:

```
VoiceProfile_1_Enable=1
```

All the parameters for each signalling protocol are explicit. For SIP, you have these parameters:

```
VoiceProfile_1_SIP_ProxyServer=<proxy_server_domain_name_or_IP_address>
VoiceProfile_1_SIP_ProxyServerPort=5060
VoiceProfile_1_SIP_RegistrarServer=<proxy_server_domain_name_or_IP_address>
VoiceProfile_1_SIP_RegistrarServerPort=5060
VoiceProfile_1_SIP_UserAgentDomain=
VoiceProfile_1_SIP_OutboundProxy=<proxy_server_domain_name_or_IP_address>
VoiceProfile_1_SIP_OutboundProxyPort=5060
VoiceProfile_1_SIP_AuthUserName='0123456789'
```

```
VoiceProfile_1_SIP_AuthPassword='lsoebnrfbvcj'
VoiceProfile_1_SIP_URI=
VoiceProfile_1_SIP_EventSubscribe_List=
VoiceProfile_1_SIP_Status='Registered'
```

Please note that the Status parameter is read-only and is used to know the status of your SIP account.

8.2.2 FXS ALLOCATION

You can allocate one or two FXS to any VoIP account. For example, these two scenarios are possible:

1) Both FXS ports are connected to the first VoIP account:

```
VoiceProfile_1_NumberingPlan_FXSListIn='1,2'
VoiceProfile_1_NumberingPlan_FXSListOut='1,2'
```

2) Each FXS port is connected to one specific VoIP account:

```
VoiceProfile_1_NumberingPlan_FXSListIn='1'
VoiceProfile_1_NumberingPlan_FXSListOut='1'
VoiceProfile_2_NumberingPlan_FXSListIn='2'
VoiceProfile_2_NumberingPlan_FXSListOut='2'
```

8.2.3 DIAL PLAN

You can authorize a lot of combinations of dial plan. Several scenarios are possible:

1) Authorize the numbers beginning with 0 and with a length between 4 digits and 12 digits

```
VoiceProfile_1_NumberingPlan_PrefixInfo_1_PrefixRange='0'
VoiceProfile_1_NumberingPlan_PrefixInfo_1_PrefixMinNumberOfDigits=4
VoiceProfile_1_NumberingPlan_PrefixInfo_1_PrefixMaxNumberOfDigits=12
VoiceProfile_1_NumberingPlan_PrefixInfo_1_NumberOfDigitsToRemove=0
VoiceProfile_1_NumberingPlan_PrefixInfo_1_PrefixInsert=
VoiceProfile_1_NumberingPlan_PrefixInfo_1_PrefixAppend=
```

2) To forbid the numbers beginning with the prefix 00, for international calls, the prefix range must be changed to allow 01, 02, 03, …, 09:

```
VoiceProfile_1_NumberingPlan_PrefixInfo_1_PrefixRange='01-9'
```

8.3 ADDED-VALUE SERVICES

You can enable added-value services for the VoIP service like for example call forwarding, call waiting, etc. To enable one or several call forwarding types, for example:

```
VoiceProfile_1_Line_1_CallingFeatures_CallTransferEnable=1
VoiceProfile_1_Line_1_CallingFeatures_CallForwardOnBusyEnable=1
VoiceProfile_1_Line_1_CallingFeatures_CallForwardOnNoAnswerEnable=1
```

To reject the anonymous calls:

```
VoiceProfile_1_Line_1_CallingFeatures_AnonymousCallBlockEnable=1
```

To make private calls:

```
VoiceProfile_1_Line_1_CallingFeatures_CallerIDEnable=0
```

9 FIREWALL

By default, no firewall rule is configured. To enable firewall rules, you should create one and after enable it.

```
cd Firewall_Rules
Firewall_Rules> mk X
Firewall_Rules_X> set Enable 1
```

9.1 FILTERING BY LOGICAL INTERFACE

We should specify where the packets are going to or where they are coming from. Input is for packets coming in the CPE processor and Output is for packets going out. Here you have to write the number of the interface. For LAN interface, InputExt is set to 0 and for WAN interface InputExt is set to 1.

```
Firewall_Rules_X_Input
Firewall_Rules_X_InputExt
Firewall_Rules_X_InputNot
Firewall_Rules_X_Output
Firewall_Rules_X_OutputExt
Firewall_Rules_X_OutputNot
```

9.2 FILTERING BY IP ADDRESSES OR PORTS

You can filter regarding the IP addresses or ports. You can put a range of ports separated by a colon (:).

```
Firewall_Rules_X_SrcIPStart
Firewall_Rules_X_SrcIPEnd
Firewall_Rules_X_SrcIPNot
Firewall_Rules_X_SrcPorts
Firewall_Rules_X_SrcPortsNot
Firewall_Rules_X_DstIPStart
Firewall_Rules_X_DstIPEnd
Firewall_Rules_X_DstIPNot
Firewall_Rules_X_DstPorts
Firewall_Rules_X_DstPortsNot
```

9.3 FILTERING BY OTHER CRITERIA

You can filter packets by protocol, ICMP type, internal marking, IP precedence.

```
Firewall_Rules_X_Protos
Firewall_Rules_X_IcmpType
Firewall_Rules_X_Mark
Firewall_Rules_X_MarkNot
Firewall_Rules_X_IPPrec
Firewall_Rules_X_IPPrecNot
```

9.4 AFTER FILTERING

Once you have filtered the packets you wanted, you can apply several actions on them. For example, you can drop them, apply DSCP behaviour, and put them in QoS queues, and so on.

To change the DSCP field, to apply a class (as described in QoS chapter) or to apply an internal marking, change the following parameters:

```
Firewall_Rules_X_SetDSCP
Firewall_Rules_X_SetClass
Firewall_Rules_X_SetMark
```

10 QOS

Quality of Service allows efficient bandwidth allocation per queues, by prioritize:

- First: Voice traffic
- Second: Business applications (Videoconferencing for example) traffic
- Last: Best Effort traffic (Internet)

To activate QoS on the gateway, you should enable it:

```
QueueManagement_Enable=1
```

QoS queues can be configured depending on customer requirements, while respecting the maximum value of WAN architecture (for example, 8 queues available in case of VDSL or WAN Ethernet architecture):

```
QueueManagement_MaxQueues=8
```

Furthermore, to enable logs and debug when queues are created:

```
QueueManagement_Debug=1
```

10.1 LINUX CLASSES AND QUEUES

10.1.1 MAPPING CLASS VERSUS QUEUE

The mapping class algorithm depends on WAN interface and on hardware.

Linux Class	Queue	Priority
0	7	Best Effort
1	6	
2	5	
3	4	
4	3	
5	2	
6	1	
7	0	Strict Priority

The other queues should be configured depending on the customer traffic, in order to prioritize for example:

- Video conference traffic
- Business application
- Mail traffic
- Gaming traffic
- Management traffic

10.1.2 DEFAULT QUEUING PER DSCP VALUE

This array shows the link between DSCP field and ToS field.

	Diffserv field				**ToS Byte**		
	DSCP	DiffServ Byte			Precedence	T2;T1;T0	
af11	001010	00101000	0x28	40	001	010	Maximize Throughput (MT)
af12	001100	00110000	0x30	48	001	100	Minimize Delay (MD)
af13	001110	00111000	0x38	56	001	110	MT + MD
af21	010010	01001000	0x48	72	010	010	Maximize Throughput
af22	010100	01010000	0x50	80	010	100	Minimize Delay
af23	010110	01011000	0x58	88	010	110	MT + MD
af31	011010	01101000	0x68	104	011	010	Maximize Throughput
af32	011100	01110000	0x70	112	011	100	Minimize Delay
af33	011110	01111000	0x78	120	011	110	MT + MD
af41	100010	10001000	0x88	136	100	010	Maximize Throughput
af42	100100	10010000	0x90	144	100	100	Minimize Delay
af43	100110	10011000	0x98	152	100	110	MT + MD
cs1	001000	00100000	0x20	32	001	000	Normal Service
cs2	010000	01000000	0x40	64	010	000	Normal Service
cs3	011000	01100000	0x60	96	011	000	Normal Service
cs4	100000	10000000	0x80	128	100	000	Normal Service
cs5	101000	10100000	0xA0	160	101	000	Normal Service
cs6	110000	11000000	0xC0	192	110	000	Normal Service
cs7	111000	11100000	0xE0	224	111	000	Normal Service
default	000000	00000000	0x00	0	000	000	Normal Service
EF	101110	10111000	0xB8	184	101	110	MT + MD

10.2 CONFIGURE QOS

Two QoS algorithms are implemented in the software:

- Priority Queuing (PQ)
- Weighted Fair Queuing (PQ)

To activate one specified queue:

```
QueueManagement_Queue_1_Enable=1
```

One queue must be unique per interface, because one interface is defined by two parameters:

- InterfaceType
- InterfaceIndex

```
QueueManagement_Queue_1_QueueId=<queue_id_value>
```

To specify a scheduler algorithm to use:

```
QueueManagement_Queue_1_SchedulerAlgorithm=<PQ_or_WFQ>
```

To set a value for the queue weight:

```
QueueManagement_Queue_1_QueueWeight=<weight_value>
```

Example of 2 WFQ queues in case of Ethernet WAN architecture:

```
QueueManagement_Queue_1_Enable=1
QueueManagement_Queue_1_Description='Prio1'
QueueManagement_Queue_1_QueueId=0
QueueManagement_Queue_1_InterfaceType='LANEthernetInterface'
QueueManagement_Queue_1_InterfaceIndex=2
QueueManagement_Queue_1_SchedulerAlgorithm='WFQ'
QueueManagement_Queue_1_QueueWeight=100

QueueManagement_Queue_2_Enable=1
QueueManagement_Queue_2_Description='Prio2'
QueueManagement_Queue_2_QueueId=1
QueueManagement_Queue_2_InterfaceType='LANEthernetInterface'
QueueManagement_Queue_2_InterfaceIndex=2
QueueManagement_Queue_2_SchedulerAlgorithm='WFQ'
QueueManagement_Queue_2_QueueWeight=50
```

Note: If QueueWeight=100, PQ behavior is applied even if WFQ is set for SchedulerAlgorithm parameter.

10.3 VOIP TRAFFIC

The Pace Box allows marking on the Voice packets and on RTP packets, which come from FXS ports and Voice Processor.

For example: With a class equals to Expedited Forwarding (EF):

IP Precedence 5 = 101 <=> DiffservByte = 101110(00) = 184

Step 1: Mark the traffic

```
VoiceProfile_1_SIP_DSCPMark=46
VoiceProfile_1_RTP_DSCPMark=46
```

Step 2: Forward the traffic

```
Firewall_Rules_X_Enable=1
Firewall_Rules_X_User=0
Firewall_Rules_X_Description='IP precedence 5 to High Priority Queue'
Firewall_Rules_X_IPPrec=5
Firewall_Rules_X_SetClass=7
Firewall_Rules_X_Chain='Postrouting'
```

10.4 OTHER TRAFFIC

For example: With a class equals for RTCP with DSCP = 24

DSCP= 24 ⇔ DiffservByte = 011000(00) = 96 ⇔ IP precedence = 3

First rule to mark the VoIP traffic

```
Firewall_Rules_5_Enable=1
Firewall_Rules_5_Description="mark RTCP traffic with DSCP 24"
```

Enter the UDP ports used by RTC. p1:p2 is a range

```
Firewall_Rules_5_Protos='udp'
Firewall_Rules_5_DstPorts=p1:p2
```

Set the DSCP value:

```
Firewall_Rules_5_SetDSCP=96
```

Second rule to forward the traffic in a medium priority queue

```
Firewall_Rules_6_Enable=1
Firewall_Rules_6_Description="Forward the traffic to the a medium priority queue"
```

Sort the traffic by IP precedence:

```
Firewall_Rules_6_IPPrec=3
```

Forward the traffic in a medium priority queue:

```
Firewall_Rules_6_SetClass=4
```

11 PROVISIONING & REMOTE MANAGEMENT

There are two ways of enabling the provisioning and the firmware upgrade. You can either do it with TR-069 or with FTP/HTTP. Both are described here.

11.1 TR-069

To initiate the first connectivity with a TR-069 ACS, these parameters must be set:

- URL of the ACS
- Login/Password of the ACS HTTP server
- Login/Password of the CPE HTTP server used for Connection Requests

Then you can configure the TR-069 server as following:

```
Services_TR069_Enable=1
Services_TR069_ACSUrl='your-acs-url'
Services_TR069_ACSLogin='your-acs-login'
Services_TR069_ACSPassword='your-acs-password'
Services_TR069_SrvLogin='the-cpe-login'
Services_TR069_SrvPassword='the-cpe-password'
```

These are the basic parameters in order to make TR-069 work. The first parameter is to enable the checking and the second parameter is for entering the certificate to compare.

```
Services_TR069_VerifyCert=1
Services_TR069_ACSCertPem='-----BEGIN CERTIFICATE-----
MIIDjzCCAvigAwIBAgIEPII/2zANBgkqhkiG9w0BAQUFADA2MQswCQYDVQQGEwJF
UzENMAsGA1UEChMERk5NVDEYMBYGA1UECxMPRk5NVCBDbGFzZSAyIENBMB4XDTA1
MDUyMzEzMzY1MloXDTA5MDUyMzEzMzY1MlowczELMAkGA1UEBhMCRVMxDTALBgNV
MA0GCSqGSIb3DQEBBQUAA4GBAHlFBM4DuIaCSVAIYuZz7VtUe+2oTNi6TFZCzHCF
bGljb3MxEjAQBgNVBAsTCTUwMDA3MDAxNTEUMBIGA1UEAxMLVzEuUkVORkUuRVMw
gZ8wDQYJKoZIhvcNAQEBBQADgY0AMIGJAoGBAOEK/TzlOqjk0vlZW6VHpxScs2kG
Nm3zSEIBPnNPFkgaDXANlQseBmaSf9s2XFe7YWkXkGFBfOtscdb+RmL7SXWxk2fE
osGxTKR7g4mdYVR1b1H6KB7nOfhduSL6vWHA5heVVBQVpnNGE+Bh7NesAjIS6X2o
y3vB5AzQ9gyUBcBjAgMBAAGjggFrMIIBZzBwBgNVHREEaTBnpFgwVjEYMBYGCSsG
AQQBrGYBDxMJRzg0MTQ0MTYxMR4wHAYJKwYBBAGsZgEOEw9SRU5GRSBPUEVSQURP
UkExGjAYBgkrBgEEAaxmAQgTC1cxLlJFTkZFLkVTggtXMS5SRU5GRS5FUzAJBgNV
HRMEAjAAMCsGA1UdEAQkMCKADzIwMDUwNTIzMTMzNjUyWoEPMjAwOTA1MjMxMzM2
NTJaMAsGA1UdDwQEAwIFoDARBglghkgBhvhCAQEEBAMCBkAwHQYDVR0OBBYEFAFs
mb270FNdSCdOQKg7giVVDA9UMB8GA1UdIwQYMBaAFECadkSXdAfErBTLHo1POkV8
MNdhMFsGA1UdHwRUMFIwUKBOoEykSjBIMQswCQYDVQQGEwJFUzENMAsGA1UEChME
Rk5NVDEYMBYGA1UECxMPRk5NVCBDbGFzZSAyIENBMRAwDgYDVQQDEwdDUkwyMDAx
MA0GCSqGSIb3DQEBBQUAA4GBAHlFBM4DuIaCSVAIYuZz7VtUe+2oTNi6TFZCzHCF
PNAemuBF1ZiUZ7ceNg6BH6hveakeZ4uClBRULMxDQYlu3h8NzgQbv3G6+xf0Xw+F
HWmuA5EX15CnhkzGhFyUeeFfj1LjrfTacxaE4gWhDdOEznvszFH7pRrQBJWEZjq+
QiHn
-----END CERTIFICATE-----'
```

When the CPE is upgraded via TR-069, the CPE must reboot. When there is no longer significant traffic, the CPE can be set in order to reboot at this moment. It avoids the end-customers to have an interruption of service (voice or TV for example). This functionality can be enabled as followed:

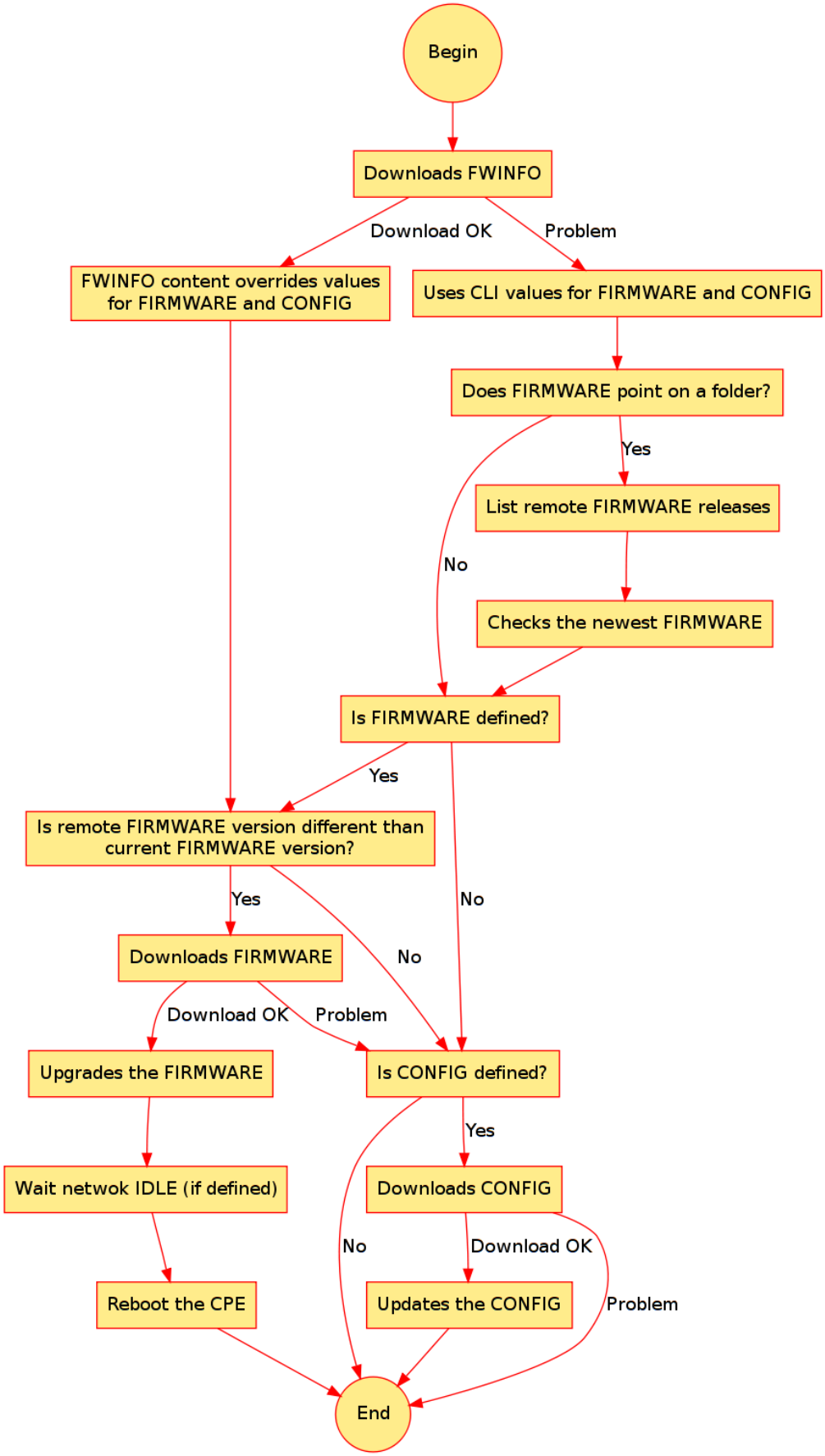
```
Services_TR069_RebootNoTraffic=1
```

If this value is set to 1, reboot will only take place when no traffic is detected during an amount of time in the WAN interface.

If set to 0, the reboot needs to be manual.

11.2 FTP OR HTTP PROVISIONING

This is a diagram of ftp or http provisioning steps, when the CPE starts:



11.2.1 CONFIGURATION PARAMETERS

In order to activate the FTP Provisioning, these CLI parameters should be configured:

- **Services_FtpProvisioning** *(obj)*
- **Services_FtpProvisioning_Enable** *(bool)* -- enable or disable the service
- **Services_FtpProvisioning_FtpInformationServer** *(string)* – IP address or domain name of the Information file server
- **Services_FtpProvisioning_InformationLogin** *(string)* -- login for the Information file server
- **Services_FtpProvisioning_InformationPassword** *(string)* -- password for the Information file server
- **Services_FtpProvisioning_InformationFilename** *(string)* -- filename to download from the Information file server
- **Services_FtpProvisioning_InformationServerProtocol** *[ftp|http]* -- the protocol needed to connect on the information server

11.2.2 INFORMATION FILES

All information of FTP provisioning can be listed in a file (also called FWINFO) formatted like this:

```
FIRMWARE_FILENAME=path/to/firmware.bin
FIRMWARE_SERVER=example.com
FIRMWARE_SERVER_PROTOCOL=ftp
FIRMWARE_USER=foo
FIRMWARE_PASSWORD=bar

CONFIGURATION_FILENAME=path/to/cli-script.conf
CONFIGURATION_SERVER=example.com
CONFIGURATION_SERVER_PROTOCOL=ftp
CONFIGURATION_USER=foo
CONFIGURATION_PASSWORD=bar
```

11.2.3 ABOUT VARIABLES CONTENT

In the CLI values and FWINFO files, the following *magic patterns* can be used to be automatically replaced with the correct value:

%MAC -- the MAC address of the CPE

%SN -- the serial number

%KEEPSERVER -- the name of the FWINFO server

%KEEPUSER -- the login of the FWINFO server

%KEEPPASSWORD -- the password of the FWINFO server

%KEEPSERVERPROTOCOL -- the password of the FWINFO server

Therefore, the configuration will be easier, by removing all redundant information. Example (FWINFO file):

```
FIRMWARE_NAME=path/to/firmware.bin
FIRMWARE_SERVER=%KEEPSERVER
FIRMWARE_SERVER_PROTOCOL=%KEEPSERVERPROTOCOL
FIRMWARE_USER=%KEEPUSER
FIRMWARE_PASSWORD=%KEEPPASSWORD

CONFIGURATION_FILENAME=path/to/the-specific-cli-script-for-%MAC.conf
CONFIGURATION_SERVER_PROTOCOL=%KEEPSERVERPROTOCOL
CONFIGURATION_SERVER=%KEEPSERVER
CONFIGURATION_USER=%KEEPUSER
CONFIGURATION_PASSWORD=%KEEPPASSWORD
```

12 IGMP MANAGEMENT

IGMP snooping and IGMP proxy are two different ways of managing the IGMP messages.

- The IGMP snooping (RFC 4541) can be used only in layer 2 network design. In our case, it is when we have a bridge configuration between a WAN interface and an Ethernet interface.
- The IGMP proxy can be used only in layer 3 network design. That means the network design must be full routed between the different interfaces.

12.1 IGMP SNOOPING

In the Pace Box, there are two types of IGMP snooping, one based on hardware layer and another one based on software layer (bridge Linux, with ebtables library).

To clarify both IGMP snooping:

- The software snooping is the snooping between the Linux interfaces (eth0.2 and wan2, in a configuration where the wan2 is bridged on the eth0.2)
- The hardware snooping is the snooping managed directly by the Ethernet switch.

```
Layer2Bridging_Enable=1
Layer2Bridging_InputPolicy=1
Layer2Bridging_OutputPolicy=1
Layer2Bridging_ForwardPolicy=1
Layer2Bridging_IGMPSnooping_Enable=1
Layer2Bridging_IGMPSnooping_Output_List=1
Layer2Bridging_IGMPSnooping_Exclude_List=1
Layer2Bridging_IGMPSnoopingTable_Interface_Count=1
```

To activate IGMP Snooping on LAN interface, you should configure this line:

```
LANEthernetInterface_1_SwitchIGMPEnable=1
```

Below this option, you can configure all multicast group you would like:

```
LANEthernetInterface_1_IGMPMulticastTable_MulticastGroup_1_Group=<IGMP_group_address>
LANEthernetInterface_1_IGMPMulticastTable_MulticastGroup_1_ForwardPort_1_Port=<IGMP_port>
LANEthernetInterface_1_IGMPMulticastTable_MulticastGroup_1_ForwardPort_1_Age=0
LANEthernetInterface_1_IGMPMulticastTable_MulticastGroup_1_ForwardPort_1_SourceFilteringMod
e=1
LANEthernetInterface_1_IGMPMulticastTable_MulticastGroup_1_ForwardPort_Count=1
```

12.2 IGMP PROXY

In order to make IGMP proxy work, few parameters have to be filled. Two types of interfaces exist:

- the upstream interface which is the interface from where you send the IGMP reports
- the downstream interface from where you receive the multicast streams

It is enabled by default, but the IGMP proxy parameters must be enabled with *`UpstreamInterface`* at an empty value in order to let the IGMP snooping work.

```
Services_IgmpProxy_Enable=1
Services_IgmpProxy_LogLevel=1
Services_IgmpProxy_QuickLeave=1
Services_IgmpProxy_HostTracking=0
Services_IgmpProxy_UpstreamInterface=<WANConnectionDevice_Index>
Services_IgmpProxy_DownstreamInterfaces=<LANEthernetInterface_Index>
```

13 ANNEX: CONFIGURATION EXAMPLES

A.1 BRIDGING AN ETHERNET PORT ON A WAN INTERFACE

In order to isolate Ethernet ports, we should create internal VLANs. Here, we will use the Ethernet port 4 as the bridge port. We create two VLANs: VLAN #1 for the classic LAN #1 (used for ports 1, 2 and 3) and the VLAN #2 for the LAN #2 (used for port 4) which is the bridge between the Ethernet port and the WAN interface. To assign VLANs to Ethernet ports:

```
LANEthernetInterface_1_SwitchVLANEnable=1
LANEthernetInterface_1_VLANInterface_1_VID=1
LANEthernetInterface_1_VLANInterface_1_Enable=1
LANEthernetInterface_1_VLANInterface_2_VID=2
LANEthernetInterface_1_VLANInterface_2_Enable=1
LANEthernetInterface_1_Port_1_VLANInterface=1
LANEthernetInterface_1_Port_2_VLANInterface=1
LANEthernetInterface_1_Port_3_VLANInterface=1
LANEthernetInterface_1_Port_4_VLANInterface=2
```

To link the VLAN #1 to the LAN #1:

```
LANDevice_1_LANEthernetInterface_1_Enable=0
LANDevice_1_LANEthernetInterface_1_VLANInterface_1_Enable=1
```

To link the VLAN #2 to the LAN #2 and creating the LAN #2:

```
LANDevice_2_Enable=1
LANDevice_2_IPInterface_1_IPAddress=192.168.2.1
LANDevice_2_IPInterface_1_SubnetMask=255.255.255.0
LANDevice_2_HostConfig_DHCPServerEnable=0
LANDevice_2_LANEthernetInterface_1_Enable=0
LANDevice_2_LANEthernetInterface_1_VLANInterface_2_Enable=1
```

To create the bridge between the Ethernet port and the WAN interface, we must activate the ‘passthrough’ mode on the LAN #2. Here we are bridging with the WAN #2.

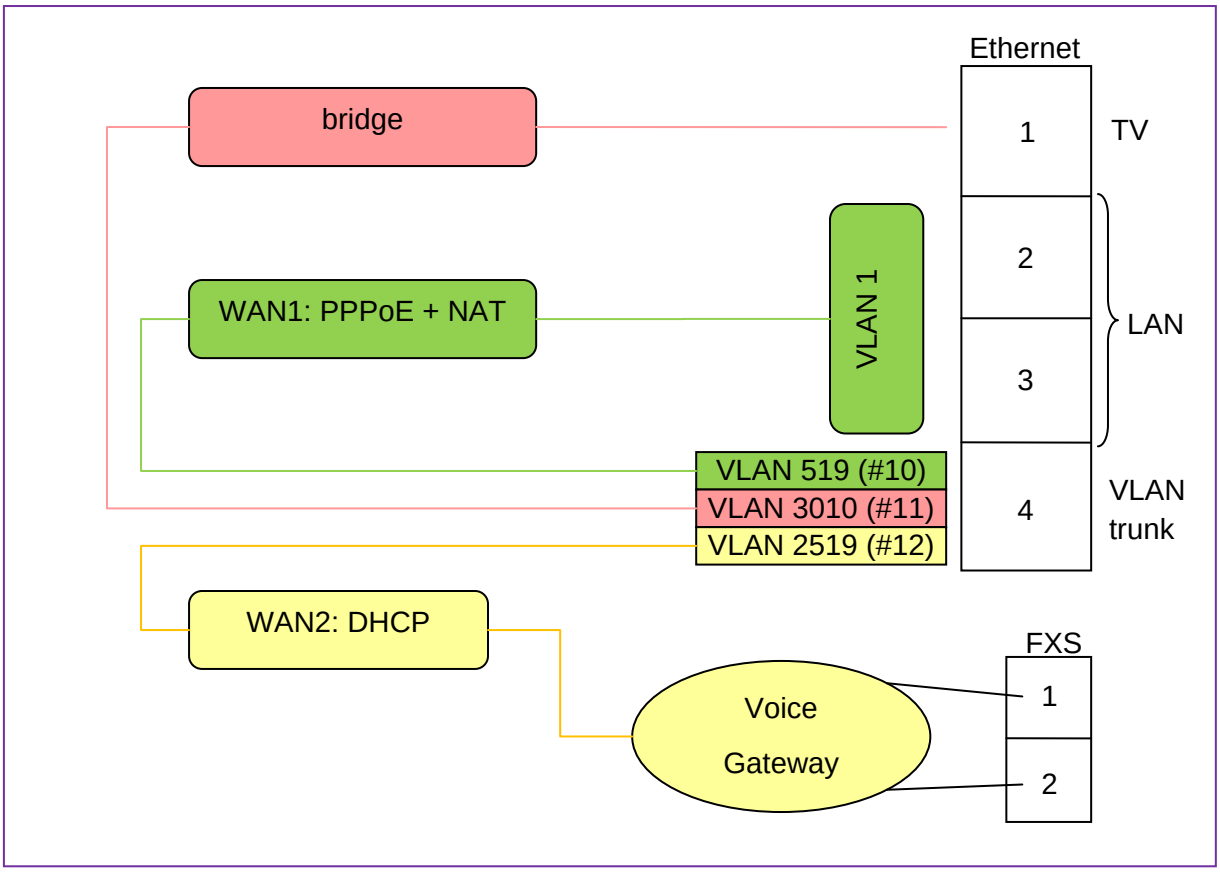
```
LANDevice_2_HostConfig_UseAllocatedWAN='Passthrough'
LANDevice_2_HostConfig_AssociatedConnection=2
```

The WAN #2 must have the following parameters set to be bridged.

```
WANConnectionDevice_2_Enable=1
WANConnectionDevice_2_WANPPPConnection_Enable=0
WANConnectionDevice_2_WANIPConnection_Enable=0
```

A.2 TRUNKING CONFIGURATION

Here is an example of configuration for the VLAN trunking. Below is the architecture scheme.



First, we configure the WAN interfaces like this:

- the WAN #1 is for the Internet service
- the WAN #2 is for the VoIP service

```
WANConnectionDevice_1_Enable=1
WANConnectionDevice_1_PhysicalInterface_Type='LANEthernetInterface'
WANConnectionDevice_1_PhysicalInterface_VlanNumber=10
WANConnectionDevice_1_WANPPPConnection_Enable=1
WANConnectionDevice_1_WANPPPConnection_Username='login@pppserver.com'
WANConnectionDevice_1_WANPPPConnection_Password='pppPassword'
WANConnectionDevice_1_DNSEnable=1
WANConnectionDevice_1_NATEnable=1

WANConnectionDevice_2_Enable=1
WANConnectionDevice_2_PhysicalInterface_Type='LANEthernetInterface'
WANConnectionDevice_2_PhysicalInterface_VlanNumber=12
WANConnectionDevice_2_WANIPConnection_Enable=1
WANConnectionDevice_2_WANIPConnection_AddressingType='DHCP'
WANConnectionDevice_2_DNSEnable=1
WANConnectionDevice_2_NATEnable=0
```

Then we configure the VLANs for the LAN and for the VLAN trunking, according to the previous scheme.

```
LANEthernetInterface_1_Port_1_VLANInterface=11
LANEthernetInterface_1_Port_2_VLANInterface=1
LANEthernetInterface_1_Port_3_VLANInterface=1
LANEthernetInterface_1_Port_4_VLANInterface=2
LANEthernetInterface_1_Port_4_VLANTrunk=10,11,12

LANEthernetInterface_1_VLANInterface_1_VID=1
LANEthernetInterface_1_VLANInterface_1_Enable=1
```

```
LANEthernetInterface_1_VLANInterface_2_VID=2
LANEthernetInterface_1_VLANInterface_2_Enable=1
LANEthernetInterface_1_VLANInterface_10_VID=519
LANEthernetInterface_1_VLANInterface_10_Enable=1
LANEthernetInterface_1_VLANInterface_11_VID=3010
LANEthernetInterface_1_VLANInterface_11_Enable=1
LANEthernetInterface_1_VLANInterface_12_VID=2519
LANEthernetInterface_1_VLANInterface_12_Enable=1
LANEthernetInterface_1_SwitchVLANEnable=1
```

To link VLAN #1 to LAN #1:

```
LANDevice_1_Enable=1
LANDevice_1_LANEthernetInterface_1_Enable=0
LANDevice_1_LANEthernetInterface_1_VLANInterface_1_Enable=1
```

To changing the WAN interface for the VoIP service:

```
Voice_Enable=1
Voice_WANInterface=2
```

14 ANNEX: TROUBLESHOOTING

Once your configuration done, depending on its complexity level, it is important to remind some configuration lines. Thus, some commands are described here and can be used to troubleshooting the CPE. All these commands are available when you access on the CPE by telnet using the credentials *root/hemingway* and then execute the command `diag`.

A.3 "LOGREAD -F"

With "*logread -f*" command, all logs generated by the CPE may be displayed, included the name of the process and the realized action by the process.

```
Jan  1 02:07:22 pppd[881]: Timeout waiting for PADO packets
Jan  1 02:07:22 pppd[881]: Unable to complete PPPoE Discovery
```

Here, for example, we see some logs from 'pppd' (process which manages the PPP connections). You can precise debug level in order to get more information for some processes:

A.3.1 MORE DEBUG ON PPP CONNECTIONS

To improve debug level for PPP connections, you must enable a parameter in the CLI regarding to the WAN interface you would like to debug. For WAN1, you should set the following parameter:

```
WANConnectionDevice_1_WANPPPConnection_Debug=1
```

A.3.2 MORE DEBUG ON VOIP

To obtain detailed debug logs, you must open a Telnet session using a root account and configure the following commands:

```
cd Voice
set Debug 3
set Trace 1
fcommit
```

Note that debug levels 3 and 4 allow logs on application layer and on phone library layer. Moreover, with Trace activated, it's possible to investigate on SIP incoming and outgoing packets body.

A.4 TCPDUMP

This command allows a deep diagnosis inside L2 frames included TCP handshake, errors and so on. This trace can be captured in a ".pcap" format file and be opened with Wireshark. You can save this capture in a USB device connected to the gateway, using this command:

```
tcpdump –i <interface> -pn –s 0 –w /var/mnt/<filesystem>/<filename>.pcap
```

<interface> -- interface from which you want to capture logs

<filesystem> -- stands for the filesystem of the USB device

<filename> -- the file name to give

A.5 COMMAND "IFCONFIG"

By typing this command, you can see all the network interfaces and their status. For example, you can see if your ATM interface has been well declared and if the IP addresses are well assigned for all interfaces.

```
atm4      Link encap:Ethernet  HWaddr 00:0C:C3:73:04:1D
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:100
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

eth0      Link encap:Ethernet  HWaddr 00:0C:C3:73:04:1D
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:663 errors:0 dropped:0 overruns:0 frame:0
          TX packets:16870 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:100
          RX bytes:63082 (61.6 KiB)  TX bytes:1136858 (1.0 MiB)

lan1      Link encap:Ethernet  HWaddr 00:0C:C3:73:04:1D
          inet addr:192.168.1.1  Bcast:192.168.1.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:663 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1709 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:51148 (49.9 KiB)  TX bytes:205999 (201.1 KiB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:1638 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1638 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:98274 (95.9 KiB)  TX bytes:98274 (95.9 KiB)

wan1      Link encap:Ethernet  HWaddr 00:0C:C3:73:04:1D
          UP BROADCAST RUNNING  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:758 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 B)  TX bytes:24256 (23.6 KiB)
```

A.6 COMMAND "ADSLINFO"

By typing this command, you will see all information related to the ADSL synchronisation status:

```
DSP version    : 5.3.3.11.1.1
line state     : Full On
modulation     : G.992.5 A (ADSL2+)
time connected : 00:00:32

up occupation   (%) : 0
down occupation (%) : 100

up max rate   (kbps) : 1623242
down max rate (kbps) : 22884

up actual rate   (kbps) : 1021
down actual rate (kbps) : 22884

up interleaved rate    (kbps) : 1021
down interleaved rate  (kbps) : 22884
```

```
up fast channel rate   (kbps) : 0
down fast channel rate (kbps) : 0

up interleaved delay   (ms) : 5
down interleaved delay (ms) : 5

up noise margin   (dB)  : 2476.8
down noise margin (dB)  : 6.0
up attenuation    (dB)  : 2476.8
down attenuation  (dB)  : 8.4
up output power   (dBm) : 0.0
down output power (dBm) : 11.2

local FECs  : 0
remote FECs : 0
local HECs  : 0
remote HECs : 0
local CRCs  : 1
remote CRCs : 0

ATUC provider : GSPN
ATUR provider : AWRE
```