



Proximus Reference Offer for Bitstream Access

## Annex 2B:

Technical Specifications of Bitstream services

Delivered by the IP-DSLAM platform

Covering the technologies ADSL, Reach Extended ADSL2 and ADSL2+

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Our reference: MSO & Servicing version

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# 1 Scope

The purpose of this document is to describe the technical specifications of the Bitstream (Re)ADSL(2+) over IP-DSLAM service “with Shared VLAN” and “with Dedicated VLAN” for ADSL(2+) and Re-ADSL2<sup>1</sup> from the ROP or from the IP-DSLAM in the LEX/LDC.

Note that the description of the above-mentioned service is available in the Bitstream Main Body.

To allow the Beneficiary to set up a service based on this service from Proximus, this document describes the interfaces.

All technical specifications as described in the present document are validated and supported by Proximus unless otherwise stated.

The Beneficiary willing to offer non-validated features which require other technical characteristics than those validated and supported by Proximus as described in the present reference offer can implement them but without commitment of Proximus on their correct functioning. Examples of such features are:

- Non tested protocols on the Proximus network,
- Burst sizes, delay or jitter requirements, beyond the QoS specifications as documented in the chapter “QoS specifications”.

The Beneficiary can request on a project mode basis for ad hoc testing to check the transparency of any specific protocol or the correct functioning of any specific feature in the context of the Bitstream (Re)ADSL(2+) over IP-DSLAM service.

Any enumeration of protocols or features listed in this document is not exhaustive and is based on the Proximus best knowledge available at this moment.

Regarding the non-validated features, Proximus assumes no liability for incomplete or incorrect information provided by its equipment suppliers or for protocols or features withdrawn or modified by the latter without any prior notice (whether in the frame of a correction or an upgrade of the equipment and/or a technology evolution).

<sup>1</sup> Planned launch date of Re-ADSL2 from the ROP: 22 October 2018. For the sake of readability (Re)ADSL(2+) in this Annex 2B shall be read as ADSL, ADSL2+ and Re-ADSL2 from the ROP or from the IP-DSLAM in the LEX/LDC.

## 2 Abbreviations

	Description
AAL	ATM Adaptation Layer
ADSL	Asymmetric Digital Subscriber Line
ARP	Address Resolution Protocol
ASC	ATM Service Class
ATM	Asynchronous Transfer Mode
BO	Building Outphasing
DHCP	Dynamic Host Configuration Protocol
DS	Downstream
DSLAM	Digital Subscriber Line Access Multiplexer
GE	Gigabit Ethernet
GE_NT	Gigabit Ethernet Network Termination
GUI	Graphical User Interface
IWF	Interworking Function
IPoE	Internet Protocol over Ethernet
ISAM	IP DSLAM
LACP	Link Aggregation Control Protocol
LAG	Link Aggregation
LAN	Local Access Network
LDC	Local Distribution Center
LEX	Local Exchange
MAC@	MAC address
MC- LAG	Multichassis LAG
MTU	Maximum Transmission Unit

OAL	<u>Q</u> LO (Ethernet) <u>A</u> ccess <u>L</u> ine
OLO	Other Licensed Operator (also mentioned in this document as “Beneficiary”)
p-bit	Priority bit
PoP	Point of Presence
PPP	Point to Point Protocol
PPPoA	Point to Point Protocol over ATM
PPPoE	Point to Point Protocol over Ethernet
PVC	Permanent Virtual Circuit
QoS	Quality of Service
ROP	Remote Optical Platform
SAR	Segmentation and Reassembly
SDSL	Symmetric Digital Subscriber Line
UNI	User Network Interface
US	Upstream
U2U	User to User (communication)
VC	Virtual Circuit
VDSL2	Very High Speed Digital Subscriber Line 2 (= Ethernet based, while VDSL1 is ATM based)
VP	Virtual Path
VLAN	Virtual LAN. It may refer to a “Shared VLAN” or to a “Dedicated VLAN”.
VLL	Virtual Leased Line
xDSL	ADSL, Re-ADSL2 (Reach Extended ADSL2), ADSL2+, SDSL and/or VDSL2

## 3 Overall Network Architecture for “Shared VLAN”

### 3.1 End-to-End View

#### 3.1.1 Architecture

The End-to-End Network Architecture for the “Shared VLAN” service is depicted below (an IP-DSLAM might also be located in a LEX/LDC):

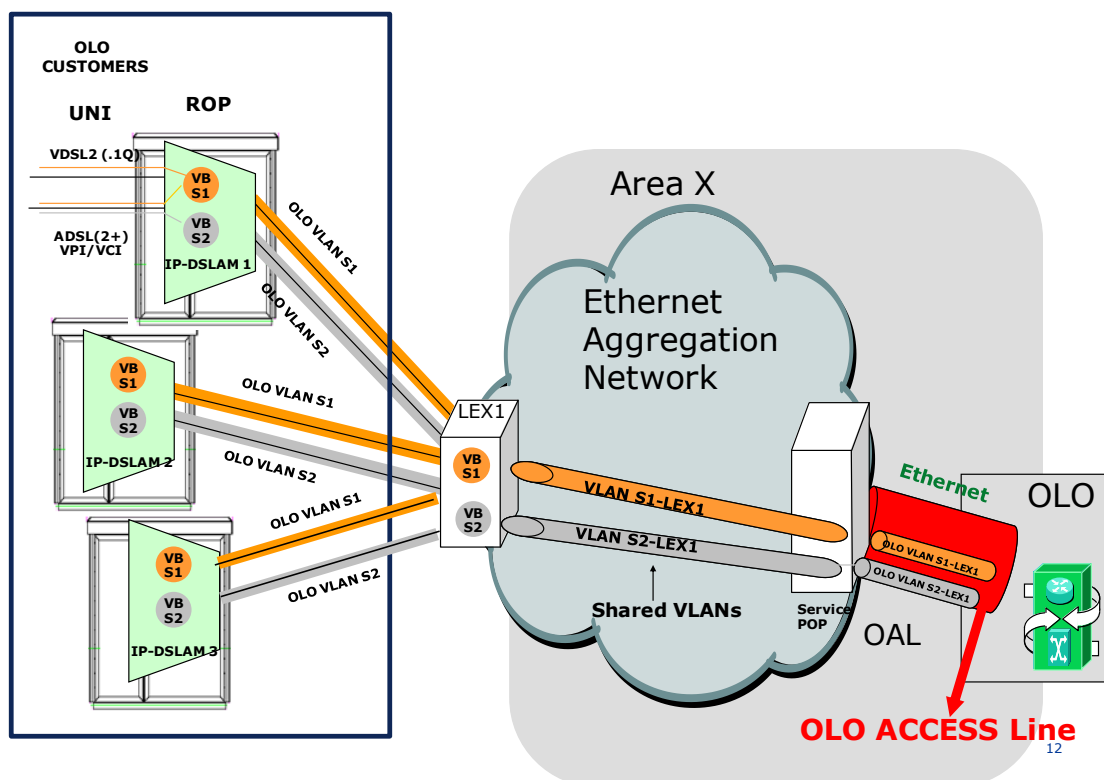


Figure 1: (Re)ADSL(2+) from ROP - Shared VLAN – E2E Architecture

This Bitstream (Re)ADSL(2+) over IP-DSLAM from ROP service offers an Ethernet connectivity between the OLO Access Line and the (Re)ADSL(2+) lines <sup>2</sup>. Within Building Outphasing (BO) networks but also on selected ROPs in non Building Outphasing networks, the (Re)ADSL(2+) lines are terminated on the Multi-DSL line card installed in the Remote Optical Platform (ROP). IP-DSLAMs in the LEX/LDC will also be activated for this service. The Multi-DSL line card provides multi-mode services (VDSL2, (Re)ADSL(2+)) over POTS. On the ATM based (Re)ADSL(2+) line, traffic segregation

<sup>2</sup> Since 01/07/2017 Bitstream ADSL2+ and since 01/02/2018 Bitstream ADSL are no longer sold for Living Units located in a copper distribution area of which all Living Units are in reach of VDSL2 from the ROP.

is performed via the support of multiple PVCs. Each PVC is translated to a “VLAN per service per OLO” at IP DSLAM and vice versa.

Eight VLAN services are defined in the Ethernet Aggregation Network, differentiated by a priority level, two VLANs for each priority:

- Best Effort (P0 & P0bis)
- Low priority (P1 & P1bis)
- Medium priority (P3 & P3bis)
- Highest priority (P5 & P5bis) and better performance for delay and jitter sensitive traffic.

The P0 & P0bis VLAN services:

-**transport downstream** in Best Effort QoS Ethernet frames that can be tagged p0 or p1 and hand them over to the IP-DSLAM, tagged with the p-bit (p0 or p1) as received from the OAL.

-**discard in downstream** Ethernet frames, tagged otherwise than p0 & p1, except small volumes<sup>3</sup> of control frames which are received from the OAL with a priority different from p0 or p1. These control frames are not discarded but retagged to p0.

-**retag in upstream** all Ethernet Frames to p0.

The P1 & P1bis, P3 & P3bis and P5 & P5bis VLAN services transport Ethernet frames tagged respectively with p1, p3 & p5 priority values. Ethernet frames not tagged with the corresponding priority values p1, p3 or p5 are retagged to respectively p1, p3 & p5.

Each (Re)ADSL(2+) line can offer to the End-User one or none of the two P0 services, one or none of the two P1 services, one or none of the two P3 services and one or none of the two P5 services.

The “Bitstream (Re)ADSL(2+) over IP-DSLAM – Shared VLAN” service shares the Aggregation Network described in Annex 2C – Technical Specifications, sections “Aggregation Network structure”, “Aggregation Areas” and “VLAN characteristics” with the other Bitstream services (Bitstream (Re)ADSL(2+) over ATM-DSLAM and VDSL2).

### 3.1.2 Encapsulation

For PPPoA, a VC-MUX/LLC encapsulation auto-detect functionality is implemented. For IPoE/PPPoE LLC-SNAP bridged encapsulation is supported.

<sup>3</sup> For security reasons, parameters will not be publicly shared. Beneficiary shall contact Proximus if he has the need to receive this information.



### 3.1.2.1 IPoE protocol stacks at DSL side

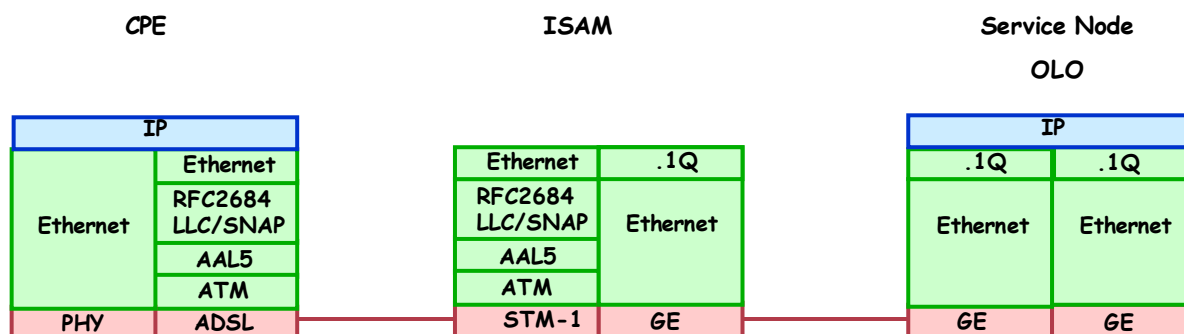


Figure 2: Bitstream (Re)ADSL(2+) over IP-DSLAM - from ROP - IPoE protocol stack

### 3.1.2.2 PPPoE and PPPoA protocol stacks at DSL side

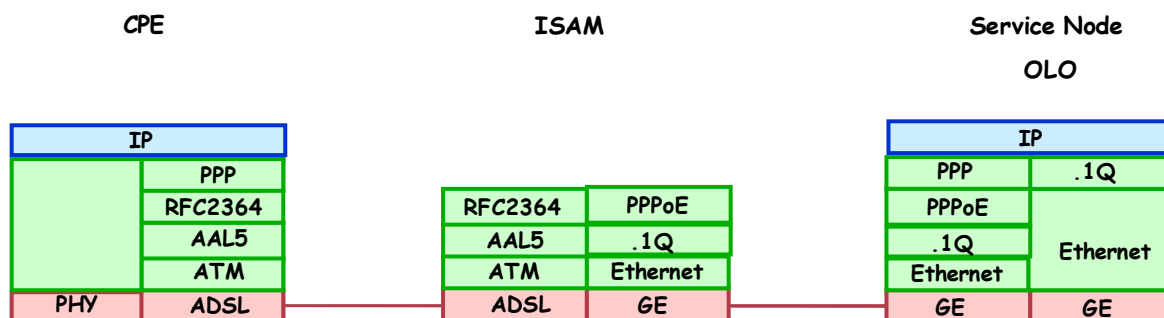


Figure 3: Bitstream (Re)ADSL(2+) over IP-DSLAM - from ROP - PPPoA protocol stack

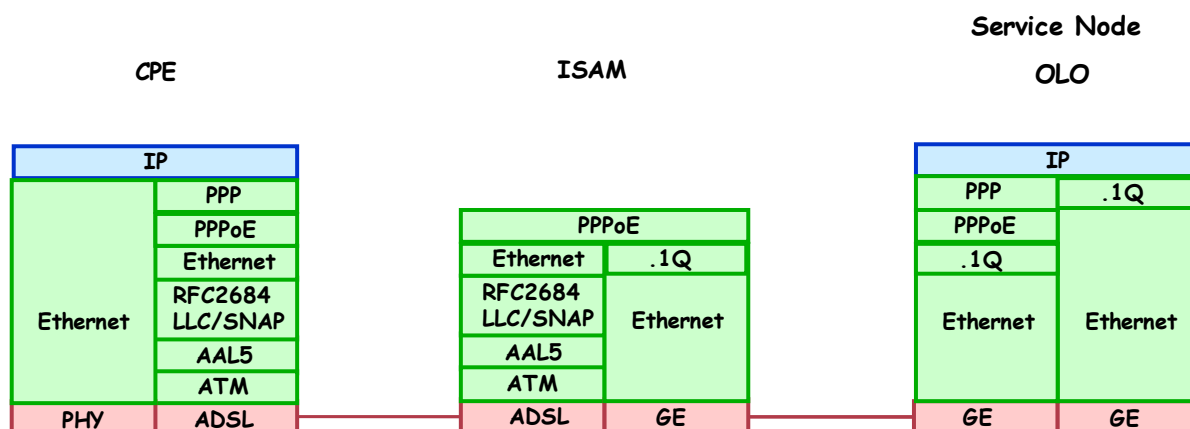


Figure 4: Bitstream (Re)ADSL(2+) over IP-DSLAM - from ROP - PPPoE protocol stack

### 3.1.2.3 Limitations

While Bitstream (Re)ADSL(2+) over ATM-DSLAM is transparent for higher layer protocols, Bitstream (Re)ADSL(2+) over IP-DSLAM is NOT.

The limitation in protocol stack makes that all other protocol stacks (than those listed above) are not supported, e.g. the following ATM applications:

- IP/AAL5 RFC2684 routed/ATM (IPOA),
- Circuit Emulation/AAL1/ATM,
- Voice on ATM/AAL2/ATM (used in UMTS),
- Signalling/SSCOP/AAL5/ATM (used in UMTS),
- Frame Relay/AAL5/ATM,
- OAM/ATM: use of OAM cells is not possible.

## 3.2 IP DSLAM

### 3.2.1 UNI

The maximum number of ATM VC connections on a Bitstream (Re)ADSL(2+) over IP-DSLAM line is 4.

VPI/VCI allocation: cf. Bitstream over ATM-DSLAM.

Cf. section 3.1.2 Encapsulation, AAL5 is used to transport frames over ATM PVCs. For bridged encapsulation (IPoE / PPPoE) native Ethernet framing is supported on the access loop.

### 3.2.2 Forwarding mechanism

For the “Bitstream (Re)ADSL(2+) over IP-DSLAM – Shared VLAN” service, PVCs of multiple End-User lines are merged into one service VLAN with ATM/Ethernet Interworking Functions. Each ATM PVC has 1 framer/deframer (AAL5 only). The following forwarding modes are supported:

- “PPP aware bridge” : Supports PPPoA / PPPoE autodetection
- “Residential Bridge” : Supports IPoE / PPPoE

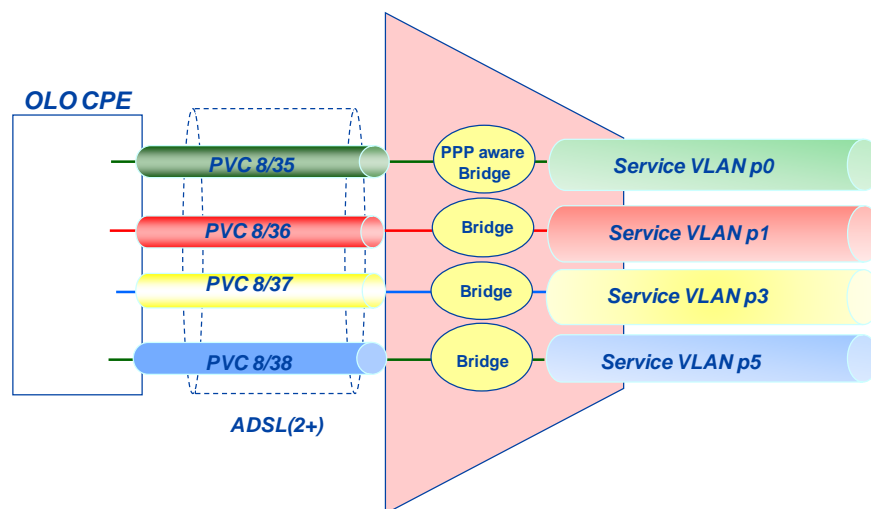


Figure 5: Example forwarding mechanism (Re)ADSL(2+) from ROP - Shared VLAN

#### PPP-aware bridge

In the “PPP-aware bridge” mode, PPP clients on DSL lines are supported with PPPoE / PPPoA auto-detection functionality.

The PPPoA to PPPoE Interworking has the following characteristics:

- The IP DSLAM will set up / release the PPPoE session (with the OLO service node) which will encapsulate the user PPP packets.

- MAC address concentration – IP DSLAMs send PPPoE packets to the network using their own MAC address as source address.
- Subscriber identification (cf. section 8.1.1).

For PPPoE session setup:

- The PPPoE session is set up and released by the user himself and the IP DSLAM just relays it to the network side.
- Subscriber identification (cf. section 8.1.1).

The time-out value for the autonomous release of a PPP cross-connection / transaction that did not have carried upstream or downstream traffic is 300 s.

The PPP session can only be started by the customer PPP client, not by the OLO service node.

In order to be able to minimize fragmentation for PPPoA based CPEs, the IP DSLAM will send an additional 'PPP-Max-Payload' tag in both PADI & PADR messages, to define the max\_payload size of 1500 Bytes (instead of 1492 Bytes) in both the sending and receiving direction.

#### Residential Bridge:

The "Residential Bridge" forwarding mode can be considered as a L2 bridge with additional security features. In the upstream direction, frames are forwarded from a VPI/VCI at the user side to a VLAN ID at the network side, with a MAC learning process. In the downstream direction, the frames are forwarded based on the MAC address, with a check on the correctness of the VLAN ID/MAC address usage.

Main characteristics of the Residential Bridge model:

- Subscriber identification for PPPoE (PPPoE IA) and IPoE (DHCP Option 82).
- The PPPoE or DHCP session must be set up by the user CPE, in order to allow the bridge to learn the source MAC address. Sessions initiated via the network are not allowed by the Residential Bridge (as this would cause broadcast to all customers).
- Security mechanisms (cf. section 6.7).

### Mapping forwarding mode and QoS:

The IP DSLAM behaves as an Ethernet bridge for the services with p-bit = 1, 3 and 5 and as a PPP aware bridge for the services with p-bit = 0 (PPPoA/PPPoE traffic). A VLAN ID and corresponding p-bit is added by the IP DSLAM based on the service requested by the OLO.

Forwarding mode	p-bit in VLAN
Residential bridge	P5
Residential bridge	P3
Residential bridge	P1
PPP-aware bridge	P0

**Table 1: Fixed relation between forwarding mode and QoS**

### VLANs at Ethernet side

Eight VLANs per OLO are preconfigured in each IP DSLAM, conforming to the Bitstream VDSL2 with Shared VLANs service, differentiated by a priority level, two VLANs for each priority:

- Best Effort for p0 & p1-tagged Ethernet frames (two bridges: P0 & P0bis)
- Low priority for p1-tagged Ethernet frames (two bridges: P1 & P1bis)
- Medium priority for p3-tagged Ethernet frames (two bridges: P3 & P3bis)
- Highest priority for p5-tagged Ethernet frames, and better performance for jitter and delay sensitive traffic (two bridges: P5 & P5bis)

\* Note about P0 and P0bis VLAN:

*Downstream:* in the IP-DSLAM, P0 and P0bis VLANs contain the p0 and p1-tagged Ethernet frames, as sent by the Beneficiary. The p1-tagged Ethernet frames and their corresponding ATM cells are handled in the IP-DSLAM with the same QoS as the p1-tagged frames in "P1 & P1bis" VLANs.

*Upstream:* in P0 and P0bis VLANs, the IP-DSLAM tags all Ethernet frames to p0.

## 3.2.3 QoS

### ➤ Marking, Queuing & Scheduling

The QoS functions for Bitstream (Re)ADSL(2+) over IP-DSLAM are implemented on Ethernet frame level. ATM QoS as such is not supported (no ATM ASC, ATM profile ...). Although different PVCs can be

used on DSL UNI, prioritization in downstream is based upon the p-bit value in the VLAN header. On DSL ports, buffers distinguish between following types of traffic:

- Highest priority
- Medium priority
- Low priority
- Best Effort

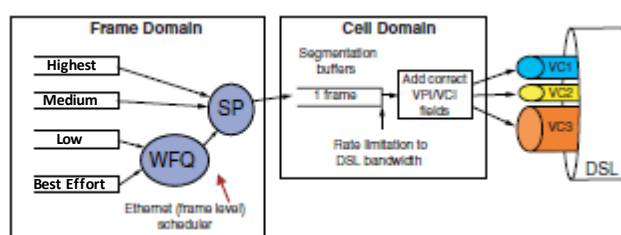
Note about “Best Effort”: PO and PObis VLANs (“Best Effort” VLANs) contain the p0 and p1-tagged Ethernet frames, as sent by the Beneficiary. The p1-tagged Ethernet frames and their corresponding ATM cells at UNI (although containing segmented untagged Ethernet in AAL5) are handled with the same QoS as the p1 tagged frames in “P1 & P1bis” VLANs in the IP DSLAM.

The association between the p-bit value and the traffic class/service is listed in the following table:

p-bit value in IP-DSLAM	Traffic Class in IP-DSLAM
5	Highest priority
3	Medium priority
1	Low priority
0	Best Effort

**Table 2: Association p-bit and traffic class**

The highest two priorities (highest priority and medium priority) are served by a Strict Priority (SP) mechanism, assuring that these – mostly – real-time applications do not suffer from too large delays. “Best effort” and “low priority” Ethernet frames compete for bandwidth in a fair manner. The weight of the “low priority” queue = 66%.



**Figure 6: Scheduling mechanism on DSL in downstream**

In upstream, a default p-bit marking per PVC at the IP DSLAM is performed according to the service requested by the OLO.

#### ➤ Policing/Shaping:

No policing of End-User data plane traffic in the upstream/downstream direction. In downstream, rate limitation is due to the DSL synchronisation rate.

### 3.3 Aggregation Network

The Bitstream (Re)ADSL(2+) over IP-DSLAM service shares the Aggregation Network defined in Annex 2C – Technical Specifications, sections “Aggregation Network structure”, “Aggregation Areas” and “VLAN characteristics” with the other Bitstream services ((Re)ADSL(2+) over ATM-DSLAM and VDSL2).

Most important characteristics:

- Max 8 bridges (p0, p1, p3, p5, p0bis, p1bis, p3bis, p5bis) in the Ethernet node in the LEX, for all Bitstream services.
- Proximus connects the bridges in the “access nodes” to corresponding bridges in the IP DSLAMs.
- VLAN connectivity per bridge, up to an OAL, ordered by the OLO.
- P1, P1bis, P3, P3bis, P5, P5bis: each VLAN transports 1 service (=p-bit) to 1 Access node (1 per LEX).
- The P0 & P0bis VLAN services :
  - transport **downstream** in Best Effort QoS Ethernet frames that can be tagged p0 or p1 and hand them over to the IP-DSLAM, tagged with the p-bit (p0 or p1) as received from the OAL.
  - discard in downstream Ethernet frames, tagged otherwise than p0 & p1, except small volumes<sup>4</sup> of control frames which are received from the OAL with a priority different from p0 or p1. These control frames are not discarded but retagged to p0.
  - retag **in upstream** all Ethernet Frames to p0.

<sup>4</sup> For security reasons, parameters will not be publicly shared. Beneficiary shall contact Proximus if he has the need to receive this information.

## 4 Overall Network Architecture for “Dedicated VLAN”

### 4.1 End-to-End View

#### 4.1.1 Architecture

The End-to-End Network Architecture for the “Dedicated VLAN” service is depicted below:

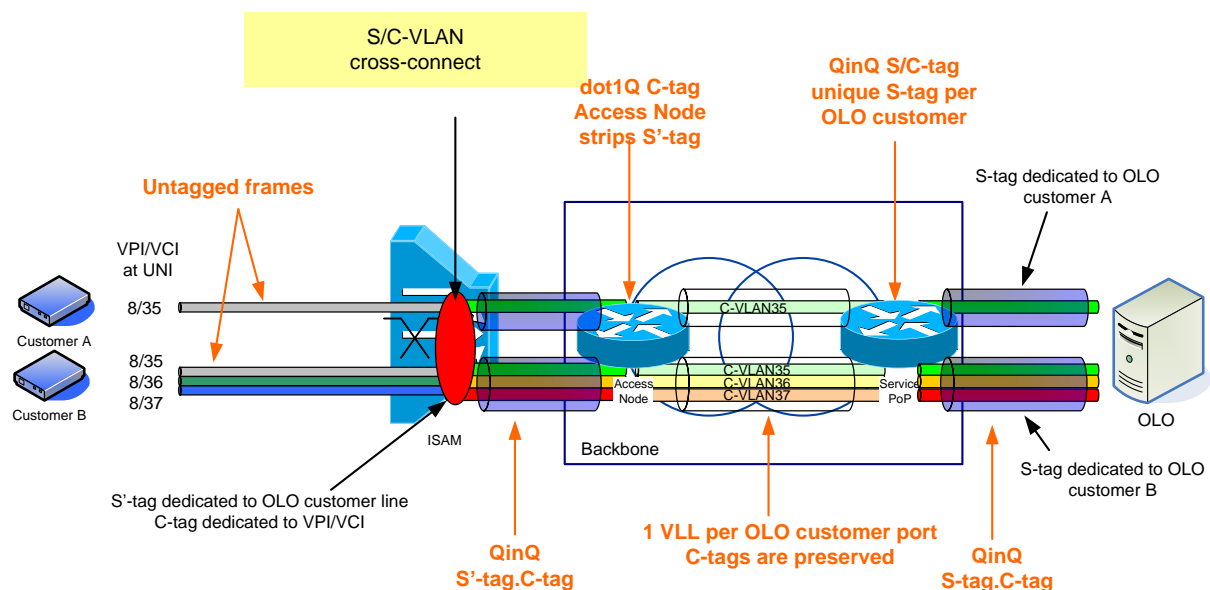


Figure 7: (Re)ADSL(2+) from ROP - Dedicated VLAN – E2E Architecture

On the ATM based DSL line, traffic segregation is performed via the support of multiple PVCs.

In upstream, VLAN allocation and priority marking is PVC based with support of native Ethernet on UNI PVC. Each ATM PVC is mapped to a unique S'/C-tag. The traffic of each ATM PVC is identified by the C-Tag. A unique S'-tag is applied per DSL port. The “Dedicated VLAN (all PVC' with the same S'-tag) per End-User” is mapped in a VLL in the Aggregation Network. At the ingress of the Aggregation Network the S'-tag is removed. The VLL (Dedicated VLAN) ends on 1 OLO Access Line, connected to a Service PoP of the Area to which the End-User line belongs. At the egress interface of the Aggregation Network (Service PoP), the C-tags are preserved and an S-tag per End-User is added.

In downstream, at the OLO service node S/C-tagged frames are sent and the OLO is shaping the traffic covered by a S-tag to the bandwidth & QoS identified by the VLAN profile, ordered for the “Dedicated VLAN”. At the ingress of the Aggregation Network (Service PoP), the S-tags are removed. At the egress of the Aggregation Network (Access Node), an S'-tag is added. In the IP DSLAM each C-VLAN is mapped to 1 ATM VPI/VCI at UNI.

Note - since the S'-tag envelops all PVCs of one End-User line, all PVCs are transported to one single OAL in the Service Area to which the End-User belongs and indicated in the OLO order.



#### 4.1.2 QoS

The OLO shall associate 1 VLAN profile to every (Re)ADSL(2+) line, for the Ethernet transport in the backbone:

- A Bitstream MonoQoS VLAN profile shall be used if the End-User (Re)ADSL(2+) line is bearing only 1 ATM VC connection or if more ATM VCs of the same QoS are connected. This type of VLAN profile is defined in Annex 2A “Bitstream services delivered by the ATM-DSLAM” of this reference offer, where it is related to 1 ATM VC, but here it is allocated to all Ethernet traffic in all ATM VCs on one End-User (Re)ADSL(2+) line.
- A Bitstream VDSL2 VLAN profile shall be used if the End-User (Re)ADSL(2+) line is bearing 2 or more ATM VC connections of different QoS. This type of VLAN profile is defined in the Bitstream VDSL2 offer, where it is also related to all traffic on one End-User (V-)DSL line.

##### Marking & policing:

In upstream, a default p-bit marking per PVC at the IP DSLAM is performed according to the service requested by the OLO. Although there is no ATM QoS on the IP DSLAM, for ordering “Bitstream (Re)ADSL(2+) over IP-DSLAM - Dedicated VLAN” services, the p-bit associated to each PVC will be based upon the following ATM Service Class to p-bit association table:

ASC	Traffic type	p-bit
UBR	Best Effort	P0
NRT-VBR	Low priority	P1
RT-VBR	Medium priority	P3
CBR	High priority	P5

**Table 3: Fixed relation between ASC and p-bit**

In downstream a mapping to the correct forwarding class (defined by the VLAN profile & S/C VLAN) is done at the OAL.

The upstream and downstream Ethernet flows are policed following the VLAN profiles.

The service primarily offers a layer 2 QoS, but in order to accommodate customer equipment that is not able to set p-bits, a one-to-one mapping between each p-bit value (0, 1, 3 & 5) and one corresponding Layer 3 “IP-precedence” value is established upon agreement between the OLO and Proximus about the “VLAN profile”. The following table shows the baseline of the equivalence:

	Layer 2 QoS (p-bits)	Layer 3 QoS (IP-precedence bits)
Best effort	0	0
Low priority	1	1
Medium priority	3	3
Highest priority	5	5

Table 4: Equivalence of Layer 2 QoS / Layer 3 QoS

### 4.1.3 Encapsulation

#### 4.1.3.1 IPoE protocol stacks at DSL side

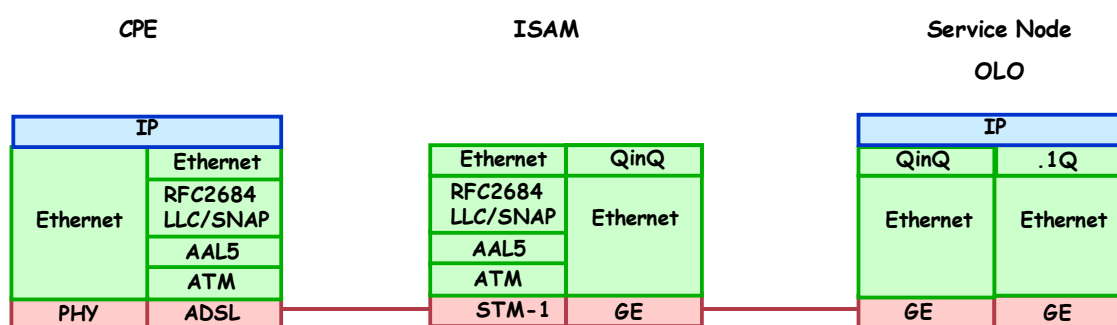


Figure 8: Bitstream (Re)ADSL(2+) over IP-DSLAM - IPoE protocol stack

#### 4.1.3.2 Limitations

Cf. section 3.1.2.3.

## 4.2 IP DSLAM

### 4.2.1 UNI

The maximum number of ATM VC connections on a Bitstream (Re)ADSL(2+) over IP-DSLAM line is 4.

VPI/VCI allocation: cf. Bitstream over ATM-DSLAM.

Cf. section 4.1.3 Encapsulation, only ATM AAL5 based services are supported on UNI. For IPoE/PPPoE only native Ethernet framing is supported on the access loop.

### 4.2.2 Forwarding mechanism

For the “Bitstream (Re)ADSL(2+) over IP-DSLAM – Dedicated VLAN” service, an S/C VLAN cross-connect model is implemented. PVCs of one End-User line are cross-connected into stacked S’/C –VLANs. Each ATM PVC has 1 framer/deframer (AAL5 only). The forwarding mode is depicted below:

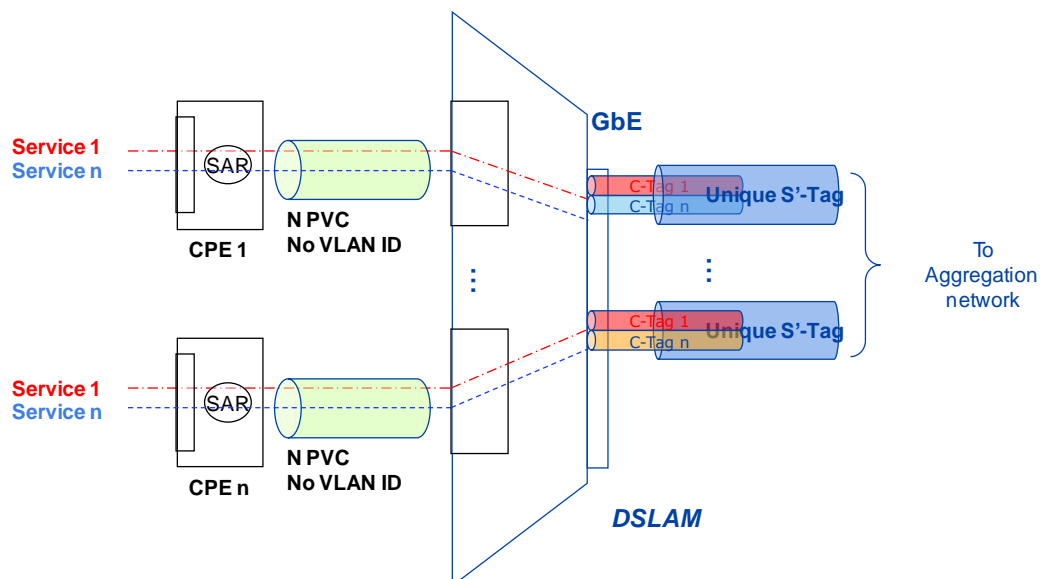


Figure 9: Forwarding mechanism for Dedicated VLAN

VLAN allocation:

- S’/C VLAN allocation with Unique (S’-tag / C-tag) pair per PVC
  - C-Tag = Service (PVC)
  - S’-Tag = DSL port

### 4.2.3 QoS

Cf. section 3.2.3.

## 4.3 Aggregation Network

The Bitstream (Re)ADSL(2+) over IP-DSLAM service “with Dedicated VLAN” is deployed in the Aggregation Network defined in Annex 2C – Technical Specifications, sections “Aggregation Network structure” and “Aggregation Areas”.

## 5 QoS specifications

The QoS specifications as set out hereafter are applicable to both Shared VLAN and Dedicated VLAN. They are to be considered indicative values which serve only for reference purposes.

Service quality	Type	ADSL (iFEC)
p5	Delay	< 24 ms
	Jitter	< 9 ms
p3	Delay	< 26 ms
	Jitter	/
p1	Delay	< 31 ms
	Jitter	/
p0	Delay	/
	Jitter	/

### Maximum Burst Size:

The P5 and P5bis VLAN services have the highest priority in the network and are also designed to offer better performance for jitter and delay sensitive traffic (e.g. voice and real-time traffic). This performance is obtained with a reduced size of the buffers compared to other service qualities. The traffic sent on VLANs P5 and P5bis should take into account that this service is less tolerant to bursts of data. It is advised to send traffic with an appropriate shaping to avoid packet losses. An appropriate shaping can be implemented as follows: for traffic with priority value p5 the shaper shall be configured slightly below the ordered P5 (resp. P5bis) transport bandwidth and the traffic shall be sent with a constant bitrate to avoid packet loss. For p5-tagged traffic on a Shared P5 (resp. P5bis) VLAN the sum of the shaped bandwidths shall stay slightly below the ordered P5 (resp. P5bis) transport bandwidth.

For the other VLAN services, the Maximum Burst Size is equal to the VLAN bandwidth multiplied by the maximum delay (10 ms). Max 80% load on the DSL line.

Main assumptions:

- Averages over 5 min.
- Frame sizes:

p5 service quality	128 octets
p3 service quality	512 octets
p1 service quality	1400 octets

- Ethernet Service speed of 2Mbps.
- Ethernet traffic aligned with VLAN profile.
- Outside saturation, max 80% load on OAL and DSL line. Max 50% p5 service quality.

## 6 UNI

Unless specified otherwise, this section equally refers to the two types of service: with Shared and with Dedicated VLANs.

### 6.1 Physical Transport (Layer 0)

#### With and without voice products

- “With voice” means: data service offered in combination with a Proximus PSTN/ISDN line.
- “Without voice” means: data service offered without combination with a Proximus PSTN/ISDN line.

### 6.2 NTP & Splitters

Reference is made to the chapter “Network Termination Point for ADSL, Re-ADSL2, ADSL2+ and SDSL” in the Main Body.

### 6.3 DSL profiles at UNI (Layer 1)

The (Re)ADSL(2+) line profiles are documented in the chapter “Activation of ADSL, Reach Extended ADSL2, ADSL2+ or SDSL on a specific End-User line” in the Main Body.

### 6.4 ATM profiles at UNI (Layer 2)

No ATM profiles are implemented in case of Bitstream over IP-DSLAM.

VPI/VCI allocation: same as for Bitstream over ATM-DSLAM.

Number of VCs: max 4 VCs.

E2E ATM OAM (I.610): not supported.

CLP bit: not supported in downstream, can be set in upstream, without any effect.

### 6.5 AAL (ATM Adaptation Layer)

Cf. section 3.1.2 and section 4.1.3 of this document.

AAL 5 only.

RFC 2684 bridged mode & PPPoE.

RFC2364 in case of PPPoA.

## 6.6 Ethernet

Native Ethernet only. MTU size: the maximum length of the Data – Field is 1500 octets.

MAC address uniqueness is required.

## 6.7 Security

This chapter documents the known limitations based on tests performed on the IP-DSLAM firmware R.5.6.02x. Planned IP-DSLAM firmware upgrades will be preceded with tests which validate whether the limitations remain unchanged or not :

- The currently documented known limitations remain valid after IP-DSLAM firmware upgrades if the tests confirmed they remain unchanged.
- The currently documented known limitations will be adapted if a planned IP-DSLAM firmware upgrade adds, changes or removes limitations.
- Would new limitations be discovered on the active IP-DSLAM firmware then the Beneficiaries will be immediately informed of it and the currently documented known limitations will be adapted accordingly afterwards.

### 6.7.1 Limitations

Known limitations on the IP-DSLAM firmware are:

(see also chapter “Security” - section “Limitations” in Annex 2C “Technical Specifications” of the present reference offer).

Protocol	Shared VLAN	Dedicated VLAN
802.1x	Blocked	Transparent



ARP	Policed <sup>(5)</sup>	Policed <sup>(5)</sup>
RIP	Policed <sup>(5)</sup>	Policed <sup>(5)</sup>
CFM	Policed <sup>(5)</sup>	Transparent
ICMP	Policed <sup>(5)</sup>	Transparent
DHCP	Policed <sup>(5)</sup>	Transparent
IGMP	Policed <sup>(5)</sup>	Transparent
PPPoEDiscovery	Policed <sup>(5)</sup>	Transparent
PPP LCP	Transparent	Transparent
PPP control	Transparent	Transparent
PPP LCP termination ack	Transparent	Transparent

- Shared VLAN refers to the residential bridge forwarding mode.
- Dedicated VLAN refers to S/C-VLAN CC.

L2CP (Layer 2 Control Protocol) PAUSE frames are blocked.

## 6.7.2 Shared VLAN

### No user-to-user communication

- Frames received from a user will always be sent towards the network and never to another user.

### Prevention of Broadcast storms

- Downstream:
  - All broadcast frames are dropped including specific control protocol, e.g. ARP Requests
  - Ethernet frames with unknown destination MAC@ are dropped and not flooded as within a standard L2 bridge. Ageing timer bridge = 900s (=> application shall send a message upstream at startup and every x sec, x<900, in order to remain joinable from the network)
- Upstream:
  - Rate limiting control plane (DHCP, IGMP, ARP...)

<sup>5</sup> For security reasons, parameters will not be publicly shared. Beneficiary shall contact Proximus if he has the need to receive the information.

- Discard L2CP control frames (STP, Pause frames...)
- Multicast blocking

Limit of the number of MAC@ per PVC (Residential Bridge): max 4

Limit of the number of PPP sessions per PVC (PPP aware Bridge): for PPPoA 1 session per PVC; for PPPoE the max number of MAC@ (4) per PVC needs to be taken into account if PPPoE clients with different MAC@ are used.

MAC anti-spoofing (Residential Bridge)

It prevents duplicate MAC addresses within the same VLAN during a certain session. The traffic of the duplicate MAC address is blocked. The bridge port of the End-User is blocked.

The MAC anti spoofing feature cannot be disabled. The duplicate MAC is removed after ageing timer.

### 6.7.3 Dedicated VLAN

- Control frames (ARP, RIP, DHCP DISCOVER/REQUEST, PPP PADI/PADR) are rate limited in the upstream direction.
- L2CP (Layer 2 Control Protocol) PAUSE frames are blocked.

This behavior is subject to change due e.g. to CPE, IP-DSLAM or aggregation network software upgrade.

## 7 Modem

### 7.1 Required modem

The OLO user can keep on using the Bitstream (Re)ADSL(2+) over ATM-DSLAM modems as far as this supports the UNI specifications, especially the protocol stack.

### 7.2 ATM OAM pings

Interworking between I.610 F5 loopback end-to-end to IEEE 802.1ag (CFM) is not supported by the IP DSLAM.

### 7.3 CPE non compliance (non exhaustive)

The following CPEs are not compatible with the Bitstream (Re)ADSL(2+) over IP-DSLAM implementation:

- All modems configured to use ATM OAM (ATM OAM is not supported),
- USB modem with PC equipped with the operating system "Windows 98" or "Windows Millennium".

The latest version of the "white list" of tested and compatible CPEs is published on the secured part of the Proximus wholesale website.

## 8 OLO Access line

The OLO access Line (OAL) is the OAL defined in Annex 2C – Technical Specifications, section “OLO Access Line”.

### 8.1 “Shared VLAN”

A VLAN @ OAL can carry a mix of Bitstream (Re)ADSL(2+) over IP-DSLAM traffic and other Bitstream xDSL traffic ((Re)ADSL(2+) over ATM-DSLAM and VDSL2).

Reference is made to the document “Bitstream VDSL2, Annex 2C – Technical Specifications”, section “VLAN characteristics” for the offered VLAN bandwidths and granularities.

#### 8.1.1 Line identification

Line identification will be enabled for both PPPoE / PPPoA and IPoE (DHCP) on each service VLAN of the OLO.

##### IPoE:

For IPoE access, per service VLAN a layer 2 DHCP relay function is implemented on the DSLAM as described within DSL Forum TR-101. The DHCP packet format is specified in RFC 2131. The DHCP Relay Agent Information option (option 82) format is specified in RFC 3046.

In upstream, the access loop identification will be encoded within the “Agent Circuit ID” sub-option 1 of DHCP Option 82 during the DHCP session setup.

In downstream, the DSLAM will remove DHCP option 82.

##### PPPOE:

For PPPoE access, per service VLAN the PPPoE Intermediate Agent function is implemented on the DSLAM as described within DSL Forum TR-101.

In upstream, the access loop identification will be encoded within the “Agent Circuit ID” sub-option 1 of the PPPoE vendor specific tag in the discovery messages (PADI, PADR, PADT) of the PPPoE protocol.

Format agent circuit ID for IPoE and PPPoE:

"<Access-Node-Identifier> atm <rack>/<shelf>/<slot>/<dsl-line>:<VPI>.<VCI>"

Example:

- H02NOR00001 atm 3/2/01/06:8.35
- L02NOR00001 atm 1/1/03/01:8.36

## 8.2 “Dedicated VLAN”

### 8.2.1 VLAN ID range

Per OAL, the S-VLAN ID is unique per OAL and allocated by Proximus per increasing order in the range [800, 4094], for all Dedicated VLANs (same range as Bitstream VDSL2 Dedicated VLAN).

The C-VLAN ID identifies the PVC on the End-User line. The C-VLAN ID allocation is based upon the VCI value. Example: VPI/VCI 8.36 => C-tag 36.

### 8.2.2 Line identification

The end customer line is identified via the S-tag ID + OAL ID.

### 8.2.3 VLAN profile (QoS)

The OLO shall associate 1 MonoQoS VLAN profile to every Bitstream (Re)ADSL(2+) over IP-DSLAM line, each corresponding to one S-VLAN ID at OAL.

This VLAN profile can be either a MonoQoS VLAN profile or a VDSL2 VLAN profile, as specified in the present reference offer. Both lists contain the common (pool) profiles and optionally also the VLAN profiles that the alternative operator has defined or can define.

The different possible cases are summarized in the table below:

Criteria	VLAN profile to use
1 ATM VC or more ATM VCs of same QoS on the (Re)ADSL(2+) End-User line	MonoQoS VLAN profile
2 or more ATM VCs with different QoS on the (Re)ADSL(2+) End-User line	VDSL2 VLAN profile

No new VLAN profile pools have been defined for Bitstream (Re)ADSL(2+) over IP-DSLAM. The VLAN profiles are defined in the Bitstream VDSL2 offer (see Annex 2C), respectively Bitstream (Re)ADSL(2+) over ATM-DSLAM offer (see Annex 2A).

The upstream and downstream Ethernet flows are policed following the VLAN profiles.

It is the responsibility of the Beneficiary to underbook, match or overbook the instantaneous available physical bandwidth on the xDSL line (upstream and downstream). It is recommended not to overbook higher QoS bandwidths (P5, P3, P1).

Shaping at Beneficiary's network in the downstream direction towards the End-User shall take into account:

- The ordered VLAN profile of the VLAN.
- The DSL line service profile, taking into account the ATM overhead of about 20% !

Shaping at the End-User's CPE in the upstream direction shall take into account the DSL line profile and the bandwidth of the VLAN profile.

◆◆◆◆◆ End of document ◆◆◆◆◆