

TLN WRO Specification type Document

< Specification and Certification BB and VOD IP
Interconnect >



Document Housekeeping

Document Category and type

CAT	TYPE	DOC ID	Comment
Broadband	SPEC	TLN_WRO_TA_B_S_PAAB	Specification type documents (-SPEC) are documents specifying logical / physical interfaces / protocols, etc..., to which AO equipment/systems need to comply

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List of Appendixes

This document may refer to further detailed documents that are added in Appendixes to this document.

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A. Appendix A, <APP_B_S_PAAB_A> contains:

- 1) Appendix A - <AO Network Interface>

The appendix (es) referred to in this section List of Appendixes, contain(s) detailed technical information which is only relevant when a Beneficiary enters in a concrete implementation project to become Beneficiary of the Telenet Reference Offer and/or Annex.

List of References

This document may refer to external documents or information sources.

A reference to an external document or information source is in this document highlighted with grey background.

The list of referred external documents or information sources in this document:

Reference 1: TLN_WRO_TA_G_C_PAAA - General Certification Procedures

Reference 2: TLN_WRO_TA_T_T_PAAA - Co-location and physical interconnect

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1 Abstract

This document provides the requirement specifications to which the physical and logical level backbone network interconnections must comply in order to provide an IP interconnect system between the AO and TLN IP networks carrying traffic in the data, control and OAM plane, supporting all services of the TLN WRO. It also specifies routing, geographical traffic aspects, redundancy and fail-over considerations.

Generic sections specifying certification procedures applicable to all AO CPE or network equipment that will be connected to the TLN network are described in General Certification Procedures Document [TLN_WRO_TA_G_C_PAAA - General Certification Procedures](#).

2 AO IP Interconnect Solution Functional Description

- (1) This section describes the physical and logical backbone network interconnections on a functional level to which the solution must comply in order to provide an IP interconnect system between the AO and TLN IP networks carrying traffic in the data, control and OAM plane, supporting all services of the TLN WRO. It also specifies routing, geographical traffic aspects, redundancy and fail-over considerations.
- (2) Further it also discusses traffic management policies on the interconnect links as well as handling regional aspects of AO end-user IP address allocation techniques.

3 AO IP Interconnect Solution Functional Requirements

3.1 General Architecture

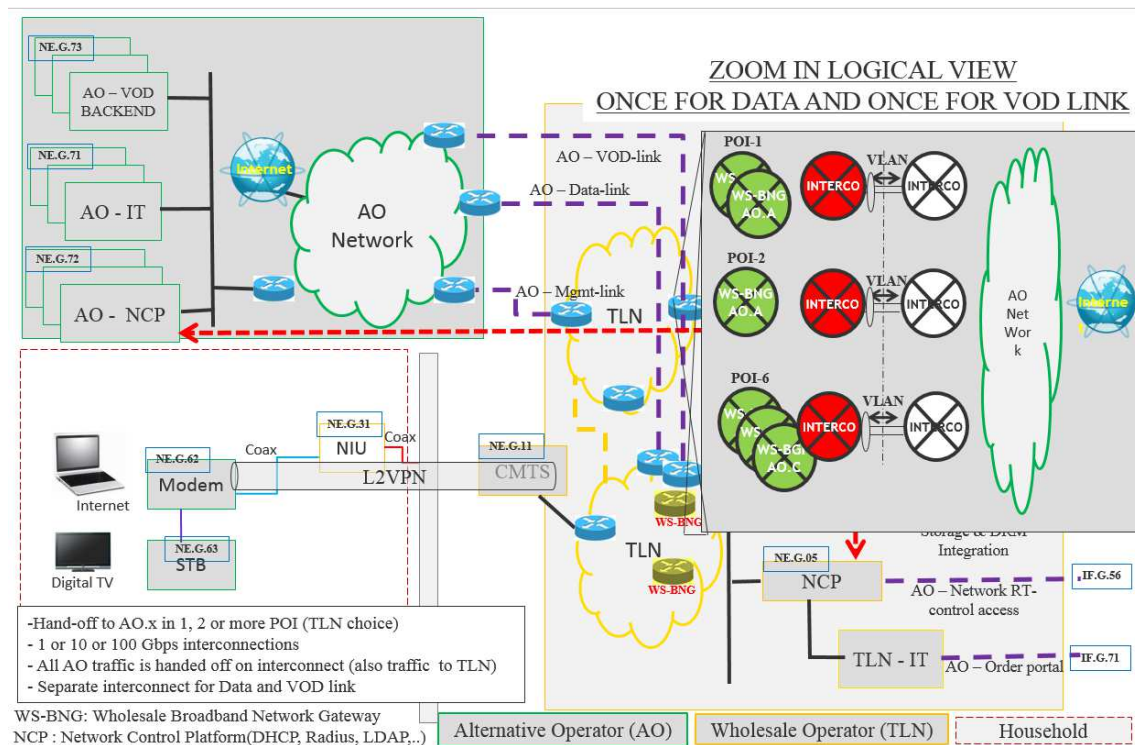


Figure 3-1: General Architecture

- (3) As shown in the figure above, AO CPE Traffic is transparently switched over the CMTS (L2VPN). From there the traffic is switched to a Wholesale Broadband Network Gateway (WS-BNG). The WS-BNG then routes traffic towards the correct AO interconnect link.
- (4) There are two interconnects. A Data link for BB and a VOD link for VOD IP.
- (5) From the WS-BNG all BB traffic is forced over that AO Data interconnect link. Traffic originating from the AO domain, and with as destination an end-user of the AO, will need to be routed towards the correct WS-BNG over the corresponding interconnect link. From the WS-BNG the traffic will be sent towards the AO end-user.
- (6) The “AO-Data link” is used to carry AO CPE’s US/DS data and control plane traffic. The “AO-Mgmt-link”, which will be realized as an IP-VPN or IPSec type connection is used to carry

management type of traffic like CDR file transfers, configuration file uploads, etc. between AO and TLN.

- (7) For VOD IP traffic between TLN and the AO, the “AO-VOD link” is used. As described in the ROTV and AIDTV Architecture document.

3.2 Regional Interconnect Zones

- (8) There are 5 Regional Interconnect Zones (RIZ) which correspond to the location of the 5 TLN switching Offices (SO). Those RIZ are identified by a list of HE which together constitutes a RIZ. Each HE serves a number of communities.

3.2.1 Regional Interconnect Zones General Requirements

- (9) Telenet operates in 5 Regional Interconnect Zones (RIZ) and can provide services to the end users in each zone. An AO must have interconnection to at least one of the five RPOI’s.

3.2.2 Regional Interconnect Zones Geographical View

- (10) An approximate Geographical coverage is view for the 5 TLN RIZ can be seen in below figure.

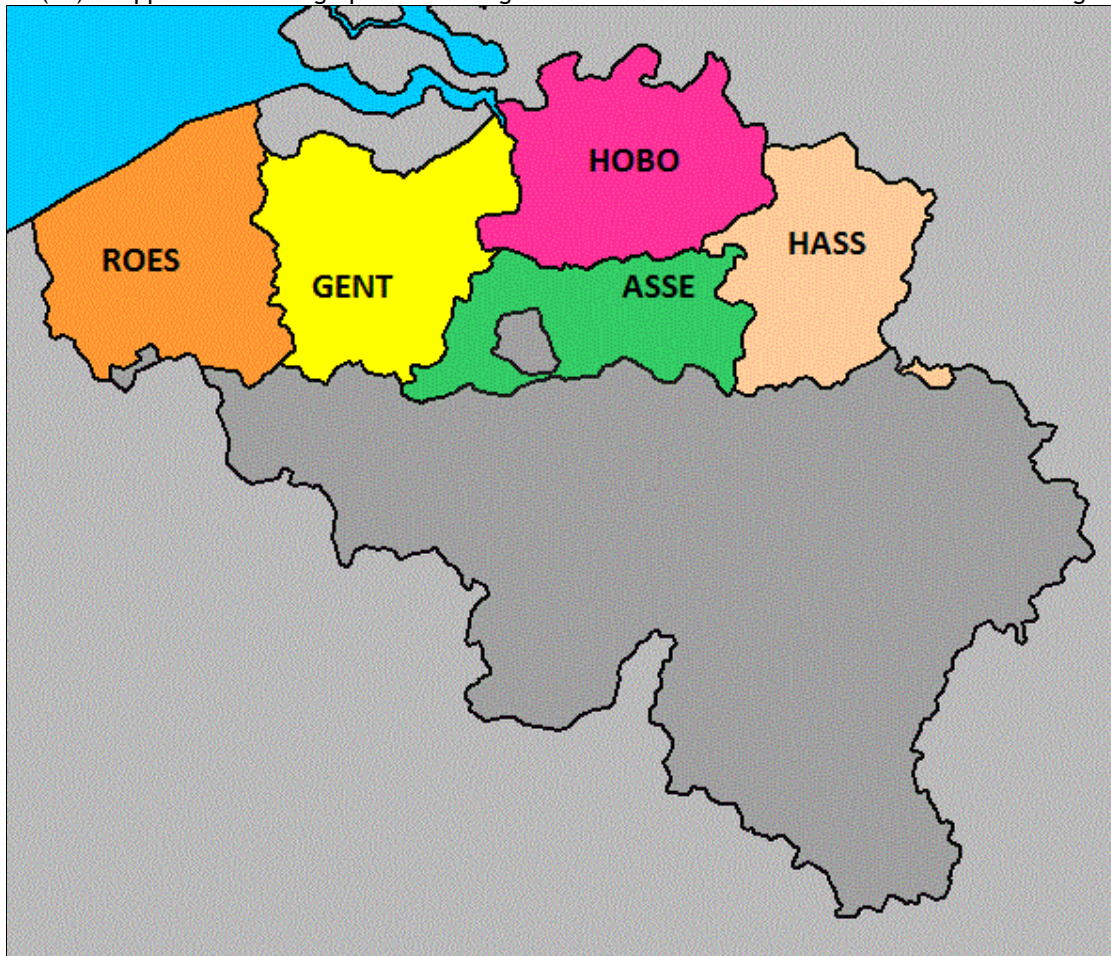


Figure 3-2: Regional Interconnect Zones

- (11) Also the physical Locations for 5 the RPOI can be seen in below figure.

- (12) The addresses of the RPOI’s are respectively:

- Hoboken: Boombekelaan 14, 2660 Hoboken
- Asse: Brusselsesteenweg 464, 1730 Asse
- Gent: Bomastraat 11, 9000 Gent
- Hasselt: Gouverneur Verwilghensingel 32, 3500 Hasselt
- Roeselare: Hof ter Weze 10, 8800 Roeselare



Figure 3-3: Physical Locations RPOI

3.2.3 Regional Interconnect Zones List of Head-Ends

(13) The lists of Head-Ends for each of the five Regional Interconnect Zones (ASSE, GENT, HASS, HOBOKEN and ROES) are as shown below.

Postcode	Name	Site Type	SO	Postcode	Name	Site Type	SO	Postcode	Name	Site Type	SO	Postcode	Name	Site Type	SO
1730	ASSE	HE	ASSE	9000	GENT	HE	GENT	3350	WOMMERSOM	HE	HASS	8900	IEPER	HE	ROES
1650	BEERSEL	HE	ASSE	9080	LOCHRISTI	HE	GENT	2340	BEERSE	HE	HOBOKEN	8680	KOEKELARE	HE	ROES
1785	BRUSSEGEM	HE	ASSE	9100	SINT-NIKLAAS	HE	GENT	2440	GEEL	HE	HOBOKEN	8500	KORTRIJK	HE	ROES
1000	BRUSSEL	HE	ASSE	9620	ZOTTEGEM	HE	GENT	2270	HERENTHOUT	HE	HOBOKEN	9090	MELLE	HE	ROES
3080	DUIJBURG	HE	ASSE	3200	AARSCHOT	HE	HASS	2660	HOBOKEN	HE	HOBOKEN	8930	MENEN	HE	ROES
1540	HERFELINGEN	HE	ASSE	3580	BERINGEN	HE	HASS	2540	HOVE	HE	HOBOKEN	8430	MIDDELKERKE	HE	ROES
1750	LENNIK	HE	ASSE	3740	BILZEN	HE	HASS	2800	MECHELEN	HE	HOBOKEN	9700	OUDENAARDE	HE	ROES
3000	LEUVEN	HE	ASSE	3600	GENK	HE	HASS	2900	SCHOTEN	HE	HOBOKEN	8800	ROESELARE	HE	ROES
1820	PERK	HE	ASSE	3500	HASSELT	HE	HASS	2940	STABROEK	HE	HOBOKEN	8460	ROKSEM	HE	ROES
6470	RANCE	HE	ASSE	3680	MAASEIK	HE	HASS	2300	TURNHOUT	HE	HOBOKEN	8880	SINT-ELOOIS-WINKEL	HE	ROES
1030	SCHAARBEEK	HE	ASSE	3900	OVERPELT	HE	HASS	2980	ZOERSEL	HE	HOBOKEN	8630	VEURNE	HE	ROES
3000	UPC-LEUVEN	HE	ASSE	3390	SINT-JORIS-WINGE	HE	HASS	8000	BRUGGE	HE	ROES	8790	WAREGEM	HE	ROES
9200	DENDERMONDE	HE	GENT	3800	SINT-TRUIDEN	HE	HASS	9900	EKKLO	HE	ROES				

Figure 3-4: List of Head-ends

(14)Postal zip codes of communities belonging to the service area for each Head-End are shown below.

HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC
Aalst	1730	Aarschot	3202	Beringen	2430	Bilzen	3740	Brussegem	1730	Duisburg	1560	Eeklo	9910	Geel	2470	Gent	9830
Aalst	1790	Aarschot	3270	Beringen	2431	Bilzen	3742	Brussegem	1731	Duisburg	1930	Eeklo	9920	Geel	2480	Gent	9831
Aalst	9280	Aarschot	3271	Beringen	3510	Bilzen	3746	Brussegem	1745	Duisburg	1932	Eeklo	9921	Geel	2490	Gent	9840
Aalst	9300	Aarschot	3272	Beringen	3530	Bilzen	3770	Brussegem	1785	Duisburg	1933	Eeklo	9930	Geel	2491	Hasselt	3500
Aalst	9308	Beerse	2340	Beringen	3540	Brugge	8000	Brussegem	1850	Duisburg	1950	Eeklo	9931	Geel	2800	Hasselt	3501
Aalst	9310	Beerse	2350	Beringen	3545	Brugge	8020	Brussegem	1851	Duisburg	1970	Eeklo	9932	Geel	3530	Hasselt	3510
Aalst	9320	Beersel	1500	Beringen	3550	Brugge	8200	Brussegem	1852	Duisburg	2800	Eeklo	9940	Geel	3600	Hasselt	3511
Aalst	9340	Beersel	1501	Beringen	3560	Brugge	8210	Brussegem	1853	Duisburg	3040	Eeklo	9950	Geel	3665	Hasselt	3512
Aalst	9400	Beersel	1502	Beringen	3580	Brugge	8211	Brussegem	1860	Duisburg	3060	Eeklo	9960	Geel	3668	Hasselt	3520
Aalst	9401	Beersel	1600	Beringen	3581	Brugge	8300	Brussegem	1861	Duisburg	3061	Eeklo	9961	Geel	3960	Hasselt	3530
Aalst	9402	Beersel	1601	Beringen	3582	Brugge	8301	Dendermonde	1745	Duisburg	3070	Eeklo	9968	Gent	9000	Hasselt	3550
Aalst	9403	Beersel	1602	Beringen	3583	Brugge	8310	Dendermonde	1785	Duisburg	3071	Eeklo	9970	Gent	9030	Hasselt	3570
Aalst	9404	Beersel	1620	Beringen	3945	Brugge	8340	Dendermonde	1840	Duisburg	3078	Eeklo	9971	Gent	9031	Hasselt	3590
Aalst	9406	Beersel	1630	Beringen	3970	Brugge	8370	Dendermonde	1861	Duisburg	3080	Eeklo	9980	Gent	9032	Hasselt	3600
Aalst	9420	Beersel	1640	Beringen	3971	Brugge	8377	Dendermonde	2830	Duisburg	3090	Eeklo	9981	Gent	9040	Hasselt	3720
Aalst	9450	Beersel	1650	Beringen	3980	Brugge	8380	Dendermonde	2870	Eeklo	8340	Eeklo	9982	Gent	9041	Hasselt	3721
Aalst	9451	Beersel	1651	Bilzen	3590	Brugge	8400	Dendermonde	2880	Eeklo	9000	Eeklo	9988	Gent	9042	Hasselt	3722
Aalst	9470	Beersel	1652	Bilzen	3620	Brugge	8420	Dendermonde	2890	Eeklo	9042	Eeklo	9990	Gent	9050	Hasselt	3723
Aalst	9472	Beersel	1653	Bilzen	3621	Brugge	8421	Dendermonde	9200	Eeklo	9060	Eeklo	9991	Gent	9051	Hasselt	3724
Aalst	9473	Beersel	1654	Bilzen	3690	Brugge	8450	Dendermonde	9220	Eeklo	9800	Eeklo	9992	Gent	9052	Hasselt	3730
Aarschot	2230	Beersel	1730	Bilzen	3700	Brugge	8730	Dendermonde	9250	Eeklo	9850	Geel	2260	Gent	9060	Hasselt	3740
Aarschot	2800	Beersel	1740	Bilzen	3717	Brugge	9990	Dendermonde	9255	Eeklo	9880	Geel	2400	Gent	9080		
Aarschot	3200	Beersel	1741	Bilzen	3730	Brussegem	1082	Dendermonde	9280	Eeklo	9881	Geel	2440	Gent	9090		
Aarschot	3201	Beersel	1742	Bilzen	3732	Brussegem	1702	Dendermonde	9310	Eeklo	9900	Geel	2450	Gent	9820		

Figure 3-5: Postal codes for Head-Ends

HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC
Herenthout	2200	Herfelingen	1760	Hove	2500	Ieper	8908	Kortrijk	8511	Lennik	1770	Lochristi	9180	Mechelen	2570	Melle	9420
Herenthout	2220	Hoboken	2000	Hove	2520	Ieper	8920	Kortrijk	8520	Leuven	3000	Lochristi	9185	Mechelen	2580	Melle	9520
Herenthout	2221	Hoboken	2018	Hove	2530	Ieper	8950	Kortrijk	8540	Leuven	3001	Lochristi	9230	Mechelen	2650	Melle	9521
Herenthout	2222	Hoboken	2020	Hove	2531	Ieper	8951	Kortrijk	8550	Leuven	3010	Lochristi	9240	Mechelen	2800	Melle	9820
Herenthout	2223	Hoboken	2030	Hove	2540	Ieper	8952	Kortrijk	8551	Leuven	3012	Lochristi	9260	Mechelen	2801	Melle	9860
Herenthout	2230	Hoboken	2040	Hove	2547	Ieper	8953	Kortrijk	8552	Leuven	3018	Lochristi	9270	Mechelen	2811	Menen	8501
Herenthout	2235	Hoboken	2050	Hove	2550	Ieper	8954	Kortrijk	8553	Leuven	3020	Lochristi	9290	Mechelen	2812	Menen	8560
Herenthout	2250	Hoboken	2060	Hove	2560	Ieper	8956	Kortrijk	8554	Leuven	3078	Maaseik	3630	Mechelen	2820	Menen	8930
Herenthout	2260	Hoboken	2550	Hove	2570	Ieper	8957	Kortrijk	8572	Leuven	3110	Maaseik	3631	Mechelen	2830	Menen	8940
Herenthout	2270	Hoboken	2600	Hove	2600	Ieper	8958	Kortrijk	8580	Leuven	3111	Maaseik	3640	Mechelen	2860	Middelkerke	8430
Herenthout	2275	Hoboken	2620	Hove	2610	Ieper	8970	Kortrijk	8581	Leuven	3118	Maaseik	3650	Mechelen	2861	Middelkerke	8431
Herenthout	2460	Hoboken	2627	Hove	2630	Ieper	8972	Kortrijk	8582	Leuven	3150	Maaseik	3660	Mechelen	3020	Middelkerke	8432
Herenthout	2580	Hoboken	2640	Hove	2640	Ieper	8978	Kortrijk	8583	Leuven	3300	Maaseik	3670	Mechelen	3120	Middelkerke	8433
Herenthout	2590	Hoboken	2660	Hove	2650	Ieper	8980	Kortrijk	8587	Leuven	3320	Maaseik	3680	Mechelen	3140	Middelkerke	8434
Herenthout	3120	Hoboken	2830	Hove	2840	Koekelare	8470	Lennik	1602	Leuven	3321	Maaseik	3960	Mechelen	3150	Middelkerke	8600
Herenthout	3140	Hoboken	2840	Hove	2850	Koekelare	8600	Lennik	1700	Leuven	3360	Mechelen	1840	Mechelen	3190	Middelkerke	8620
Herfelingen	1540	Hoboken	2845	Hove	9100	Koekelare	8610	Lennik	1701	Leuven	3370	Mechelen	1850	Mechelen	3191	Oudenaarde	9600
Herfelingen	1541	Hoboken	2850	Ieper	8640	Koekelare	8680	Lennik	1702	Lochristi	9040	Mechelen	1880	Melle	9032	Oudenaarde	9630
Herfelingen	1570	Hove	2018	Ieper	8647	Koekelare	8810	Lennik	1703	Lochristi	9041	Mechelen	1910	Melle	9050	Oudenaarde	9636
Herfelingen	1670	Hove	2150	Ieper	8650	Koekelare	8820	Lennik	1730	Lochristi	9042	Mechelen	1980	Melle	9070	Oudenaarde	9660
Herfelingen	1671	Hove	2160	Ieper	8900	Koekelare	8830	Lennik	1740	Lochristi	9060	Mechelen	1981	Melle	9090	Oudenaarde	9667
Herfelingen	1673	Hove	2170	Ieper	8902	Kortrijk	8500	Lennik	1750	Lochristi	9070	Mechelen	1982	Melle	9230	Oudenaarde	9680
Herfelingen	1674	Hove	2280	Ieper	8904	Kortrijk	8501	Lennik	1760	Lochristi	9080	Mechelen	2223	Melle	9260	Oudenaarde	9681
Herfelingen	1755	Hove	2288	Ieper	8906	Kortrijk	8510	Lennik	1761	Lochristi	9160	Mechelen	2500	Melle	9340	Oudenaarde	9688

Figure 3-6: Postal codes for Head-Ends

HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC
Oudenaarde	9690	Perk	1831	Schoten	2060	Sint-Joris-Winge	3128	Sint-Niklaas	9170	Turnhout	2321	Waregem	8700	Wommersom	3450	Zottegem	9506
Oudenaarde	9700	Perk	1850	Schoten	2100	Sint-Joris-Winge	3130	Sint-Niklaas	9190	Turnhout	2322	Waregem	8710	Wommersom	3454	Zottegem	9550
Oudenaarde	9750	Perk	1910	Schoten	2110	Sint-Joris-Winge	3200	Sint-Niklaas	9250	Turnhout	2323	Waregem	8720	Wommersom	3460	Zottegem	9551
Oudenaarde	9770	Roeselare	8480	Schoten	2140	Sint-Joris-Winge	3210	Sint-Truiden	3540	Turnhout	2328	Waregem	8740	Wommersom	3470	Zottegem	9552
Oudenaarde	9771	Roeselare	8740	Schoten	2520	Sint-Joris-Winge	3211	Sint-Truiden	3700	Turnhout	2330	Waregem	8755	Wommersom	3471	Zottegem	9570
Oudenaarde	9772	Roeselare	8750	Schoten	2600	Sint-Joris-Winge	3212	Sint-Truiden	3720	Turnhout	2360	Waregem	8760	Wommersom	3472	Zottegem	9571
Oudenaarde	9790	Roeselare	8755	Schoten	2900	Sint-Joris-Winge	3220	Sint-Truiden	3800	Turnhout	2370	Waregem	8770	Wommersom	3473	Zottegem	9572
Oudenaarde	9800	Roeselare	8800	Schoten	2910	Sint-Joris-Winge	3221	Sint-Truiden	3803	Turnhout	2380	Waregem	8780	Zoersel	2240	Zottegem	9620
Oudenaarde	9810	Roeselare	8810	Schoten	2930	Sint-Joris-Winge	3290	Sint-Truiden	3806	Turnhout	2381	Waregem	8790	Zoersel	2242	Zottegem	9660
Oudenaarde	9870	Roeselare	8840	Schoten	2950	Sint-Joris-Winge	3293	Sint-Truiden	3830	Turnhout	2382	Waregem	8791	Zoersel	2243	Zottegem	9661
Oudenaarde	9890	Roeselare	8850	Schoten	2960	Sint-Joris-Winge	3294	Sint-Truiden	3832	Turnhout	2387	Waregem	8792	Zoersel	2280		
Overpelt	3900	Roeselare	8851	Schoten	2970	Sint-Joris-Winge	3390	Sint-Truiden	3840	Turnhout	2470	Waregem	8793	Zoersel	2288		
Overpelt	3910	Roeselare	8870	Schoten	9111	Sint-Joris-Winge	3391	Sint-Truiden	3850	Turnhout	2990	Waregem	8850	Zoersel	2290		
Overpelt	3920	Roeselare	8890	Sint-Eloois-Winkel	8500	Sint-Joris-Winge	3460	Sint-Truiden	3870	Veurne	8630	Waregem	9790	Zoersel	2310		
Overpelt	3930	Roksem	8400	Sint-Eloois-Winkel	8530	Sint-Joris-Winge	3461	Sint-Truiden	3890	Veurne	8647	Waregem	9800	Zoersel	2390		
Overpelt	3940	Roksem	8420	Sint-Eloois-Winkel	8531	Sint-Joris-Winge	3560	Sint-Truiden	3891	Veurne	8660	Waregem	9870	Zoersel	2520		
Overpelt	3950	Roksem	8460	Sint-Eloois-Winkel	8560	Sint-Niklaas	2070	Stabroek	2180	Veurne	8670	Wommersom	3350	Zoersel	2531		
Overpelt	3990	Roksem	8470	Sint-Eloois-Winkel	8860	Sint-Niklaas	9100	Stabroek	2920	Veurne	8690	Wommersom	3380	Zoersel	2550		
Perk	1702	Roksem	8490	Sint-Eloois-Winkel	8880	Sint-Niklaas	9111	Stabroek	2940	Veurne	8691	Wommersom	3381	Zoersel	2960		
Perk	1785	Roksem	8680	Sint-Joris-Winge	3050	Sint-Niklaas	9112	Stabroek	2950	Waregem	8540	Wommersom	3384	Zoersel	2970		
Perk	1800	Schoten	2000	Sint-Joris-Winge	3051	Sint-Niklaas	9120	Stabroek	2990	Waregem	8570	Wommersom	3400	Zoersel	2980		
Perk	1818	Schoten	2018	Sint-Joris-Winge	3052	Sint-Niklaas	9130	Turnhout	2300	Waregem	8572	Wommersom	3401	Zoersel	2990		
Perk	1820	Schoten	2030	Sint-Joris-Winge	3053	Sint-Niklaas	9140	Turnhout	2310	Waregem	8573	Wommersom	3404	Zottegem	9404		
Perk	1830	Schoten	2040	Sint-Joris-Winge	3054	Sint-Niklaas	9150	Turnhout	2320	Waregem	8581	Wommersom	3440	Zottegem	9500		

Figure 3-7: Postal codes for Head-Ends

3.2.4 Regional Interconnect Zones Traffic Routing Rules

AO modems (or STB's) will be unable to get service, if they are moved in another location than where they were initially installed. In case of a move for AO end-user Modem (or STB), the CM (or STB) needs to be re-registered in the TLN NCP for the new specific region.

3.3 AO Interconnect Links

3.3.1 AO Interconnect Links General Requirements

- (15) Telenet delivers all aggregated BB and/or VOD IP traffic of AO end-users towards AO via TLN to AO interconnect link, distributed over 5 RPOI's based on geographic origin of traffic.
- (16) The interconnect for the aggregated BB and VOD IP traffic cannot be the same. The location for the interconnect for the aggregated BB and VOD IP traffic can, but must not be the same, selected by Telenet.
- (17) Details over the interface are documented in [Appendix A - <AO Network Interface>](#).

3.3.2 AO Interconnect Links Physical Connections

- (18) AO to TLN interconnectivity is established in minimum 1 of the 5 regional POI's (AO-RPOI) which are physically based in the Telenet switching office locations (Asse, Hoboken, Gent, Roeselare, Hasselt), where the WS-BNG will be located. Telenet offers single or multiple 1Gbps, 10 Gbps or 100 Gbps link connections. If the link between AO and TLN is a combination of multiple physical links, LAG support is required with LACP.
- (19) The first RPOI the AO needs to connect to the RPOI in one of the regions to be selected by Telenet.
- (20) Initially, there might be a single WS-BNG (possibly redundant) that will be used for all five regions. There will be a logical separation per region on the WS-BNG and the interconnect link.

There will be a restriction for the aggregated bandwidth of logical RPOI links. If the bandwidth for an interconnect exceed 10Gbps, Telenet reserves the right to request the

AO to interconnect to additional RPOI's. The order in which the RPOI's need to be added will be defined by Telenet taking into account the characteristics of the AO traffic resulting from the AO end-users. The purpose of adding RPOI's should be to have the traffic spread out evenly throughout the Telenet network bearing in mind that offload of the AO traffic should be done as close to the source as possible.

- (21)The different possibilities to realize the required physical link for the interconnect is described in the document [TLN_WRO_TA_T_T_PAAA Co-location and physical interconnect](#).

3.3.3 AO Interconnect Links Traffic Routing

- (22)AO BB Traffic will be routed towards the AO backbone through TLN to AO BB interconnect link. All traffic is forced over the AO interconnect link. A router redundancy protocol must be used for redundant interconnect links.
- (23) Even if the destination of traffic is in the TLN network, the BB traffic will always be routed to the AO network primarily and it will be the responsibility of the AO network to route it back to destination which is in TLN network in this case.
- (24)AO VOD IP traffic will be routed towards the AO backbone through TLN to AO VOD interconnect link. Not all traffic is forced over the AO interconnect link. Refer to the ROTV and AIDTV Architecture document for the details of the traffic flows.

3.3.4 AO Interconnect Links Redundancy

- (25)Telenet offers link redundancy, based on redundant interface cards for AO interconnections to ensure that networks continue to function in the presence of single points of link failure.

3.4 AO IP Range/Address Space

3.4.1 AO IP Range/Address Space General Requirements

- (26)Telenet does not offer IP address ranges for AO end-users. The AO has to provide sufficient IP address ranges for each of 5 RPOIs. TLN needs to be informed about IP address ranges for each specific region. Telenet will request the required ranges the AO has to provide. The ranges need to contain sufficient IP addresses and be communicated upfront by the AO to Telenet and subject to appropriate change management as described in the relevant procedures in the TLN WRO.
- (27)For each update the AO has to provide minimum a /22 per required subnet for IPv4 ranges, and minimum a /64 per CPE subnet and a /40 for prefix delegation subnets for IPv6 ranges. There can only be a maximum of 4 updates per year. Each update can contain new subnets for multiple regions. The AO needs to request the implementation of new subnets at least 2 weeks in advance.
- (*) Sufficient means the number of IP addresses per region that are needed to cover the AO end-users growth for minimal the next 6 months in order to limit the impact on the Telenet network and changes can be initiated in time.
- (28)The AO will be required to have its own IP address range and IP address pools of sufficient size will have to be provided upfront to TLN to allow proper routing set-up configuration in each of the connected RPOI's, for the components detailed in the VOD IP section of the ROTV and AIDTV Architecture. The IP address ranges need to be uniquely aggregatable in one supernet for IPv4 and one for IPv6 over all the RPOI's. For IPv4 it must be a public address range and for IPv6 a global unicast address range.
- (29)On the AO customer's premise, the STB must receive an IP address out of the same subnet as provided to that customer for the broadband offering, effectively making the STB part of the

LAN. In order to both classify the VOD IP traffic and route it appropriately, to respect the PEP for VOD IP, the previous single IPv4 and IPv6 supernet requirement must be met. Also, the AO STB must use public IPv4 or a IPv6 global unicast address to connect to the components detailed in the VOD IP section of the ROTV and AIDTV Architecture. In case the AO uses Carrier Grade NAT, the STB should use IPv6.

3.4.2 AO IP Pool Management

- (30) TLN participates in IP pool management and IP address assignment services for AO end-users. The effective dynamic IP address assignment to individual AO end-users customers is the responsibility of the AO NCP. The AO uses its own IP address range for each of the 5 RPOIs and Telenet configures these ranges in the appropriate NE on a per RPOI basis. Multiple ranges are required per RPOI. The AO needs to assign “dynamic” IP addresses to its individual end-user devices that are selected via a dynamic algorithm (e.g. round robin) from the AO IP ranges configured for a particular RPOI. The address “lease-time” needs to be of limited duration (maximum 24H). In addition the “lease-time” should not be lower than 2 hours to avoid excessive network overhead. The AO dynamic IP address selection algorithm should in at least 95% of the cases, select a different address for two consecutive leases of the same modem.

3.5 Wholesale Broadband Network Gateway (WS-BNG)

3.5.1 WS-BNG General Requirements

- (31) The Gateway (WS-BNG) terminates AO end-user traffic which is sent over the TLN access network using L2VPN BSoD technology.
- (32) The L2VPN configuration for an AO modem is implemented via the modem configuration file.

3.5.2 WS-BNG Functions and Protocols

- (33) The Gateway (WS-BNG) functions as a transit router. It receives IP data packets from the AO end-user devices and routes them to the AO network and vice versa.

3.5.3 WS-BNG Accounting

- (34) Telenet provides CDR type info about traffic usage of AO end-users for billing purpose. Implementing specific volume limits for individual end-users is the responsibility of AO.

3.6 AO Data and Management Links

3.6.1 AO Data Link

- (35) The “AO Data Link” Interface between AO and TLN is used to carry all the traffic originated from / destined to AO end-users.

3.6.2 AO Management Link

- (36) This interface is used for management purposes applications between AO and TLN. Since the link carries sensitive traffic, it is secured by using IP-VPN or IPsec type connections.

3.6.3 AO VOD Link

- (37) This interface is used for connecting the Telenet provided services and components with the AO VOD Backend.

3.7 AO Traffic Management

3.7.1 AO Traffic Management General Description

(38) In order to guarantee a fair use of the available bandwidth in the network among all end-users Telenet performs traffic management to ensure that also in peak load situations end-users will have a good broadband service experience.

3.7.2 AO Traffic Management General Architecture

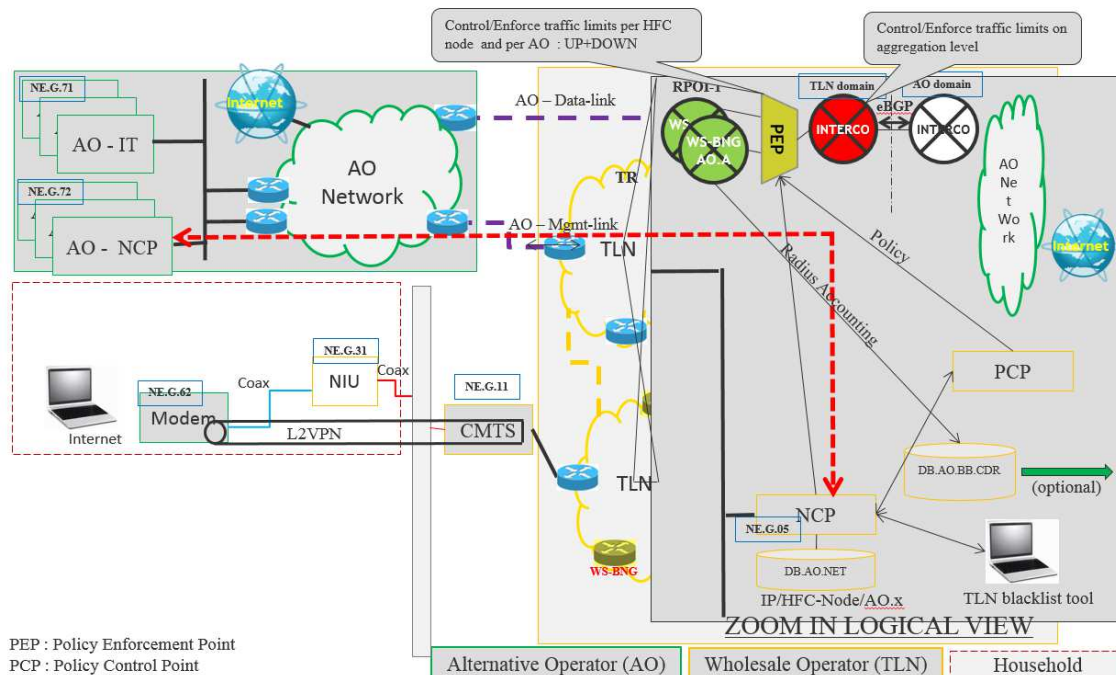


Figure 3-8: Traffic Management Architecture

(39) Telenet will apply bandwidth management to both AO and TLN end-users and potential other users equally. Bandwidth limitations can be applicable on three levels: HFC node level, aggregation level and optionally end-user level.

(40) HFC node level restrictions can be implemented on the PEP. PEP is the logical entity or place in the TLN network that enforces policies for admission and bandwidth control. Practically it is implemented in different network elements. This type of traffic management is performed to avoid congestion and depends on the specific broadband product tier.

(41) Besides HFC node level traffic management, also aggregation level restrictions can be applicable. For traffic related to AO end-users this aggregation level based traffic management will be performed on the interconnection links between the AO and TLN Networks.

(42) Optionally, Telenet can apply bandwidth restriction on individual end-users based on their specific broadband product tier.

3.8 Restrictions

(43) The broadband interconnection service explicitly excluded below listed services that belong to the AO domain as the ROBB service offered by Telenet is restricted to the delivery / pick-up of the traffic from/ to the interconnect links at the RPOI:

- Value added services like (but not limited to): E-mail, Web space hosting, Virus scan, Personal firewalling, TLN Hot-spot access, TLN Home-spot access, Network based backup
- My Telenet type subscription management functionality
- Telemeter service
- Re-direction towards landing page, offering volume block up-sell or choice for continue in narrowband services
- AO end-user e-mail notification services on network events (e.g. high usage, ...)

3.9 Operational Procedures

(44) Telenet will execute from time to time operational changes on the IP interconnect infrastructure. An AO making use of the TLN WRO part should be prepared at all time to adapt its infrastructure, devices and systems, as well as its operational procedures to handle those changes. In addition it is strongly recommended by TLN that AO will take this into account in the design of its solution, so that impact of future changes will be limited. Below a non exhaustive list is given, showing some examples of operational changes that TLN has executed in the past and which will be repeated likely in the future:

- Creation of new RIZ, or re-organisation of existing ones
- Updates and changes to the routing protocols and routing policies
- Updated and changes to the IP address allocation and sub-netting requirements

4 Certification for interconnection between AO IP backbone network and the TLN network

4.1 Introduction

(45)The tests will cover all of the requirements specified by this document.

4.2 Test score card

CONFORMANCE TEST SCORE CARD					
Conformance Test Score Card Number	TLN-WRO-TA-TSC-%-P%%%				
Test Identification					
Test Execution Date					
Test Run Type	Full / Reduced(without OOS cases)				
Device / Equipment / Interface Name					
Device / Equipment / Interface Type / Class					
AO Device / Equipment / Interface Identification					
Software Version					
Tested by					
Overall Result Status	Pass / Fail				
Applicability	Select 1 or more: ROTV / ROBB / AIDTV				
CONFORMANCE TEST ITEM LIST					
Test Cases Summary	FORMAT	IN SCOPE	MAN	PASS/FAIL	REM
			"Y/N"	"P/F"	(*xy)
3. AO IP Interconnect Solution Functional Requirements	HO				
3.1. General Architecture			Y		
3.2. Regional Interconnect Zones			Y		
3.3 AO Interconnect Links			Y		
3.4 AO IP Range / Address Space			Y		
3.5 Wholesale Broadband Network Gateway (WS-BNG)			Y		
3.6 AO Data and Management Links			Y		
3.7 AO Traffic Management			Y		
3.8 Restrictions			Y		
3.9 Operational Procedures			Y		
Remarks					
(*xy) : "Remark explanation comes here"					