Schweizerische Eidgenossenschaft
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Federal Department of the Environment, Transport, Energy and Communications DETEC

Federal Office of Communications

Technical Guidelines

concerning

FTTH Open Layer 2 Access

Phase 1: Interfaces (details)

Services (principles)

Processes (principles)

Edition 1.0: 6.10.2009

This standard was created by an industry working group under the aegis of the Federal Office of Communications. The document can be downloaded from www.bakom.ch .

Executive summary

The Communication Commission (Comcom) is making sure all industry players in Switzerland are working in harmony to deliver the next generation network to cover all Switzerland. This document contains the interfaces descriptions, the products types and the processes involved, in an active line access scenario (Open Access). It calls for an exchange platform that enforces a communication protocol between parties operated by a neutral actor.

Contents

1. Introduction

1.1 Objectives

Since 2007, several companies have begun to invest in the construction of fibre-to-the-home (FTTH) networks. Primarily, these companies are electricity undertakings in cities and Swisscom. In view of the substantial investment, it is necessary to discuss the different possibilities of cooperation and standardisation of these networks. This is why ComCom took the initiative to organise two round table discussions in 2008 and one in spring 2009. Conceived as forums for discussion, these round tables brought together the most important players in the market: the managers of the companies directly involved. At the end of the second round table organised by ComCom, it was agreed to set up several working groups with the industry. Placed under the aegis of OFCOM, these groups are in the process of drawing up solutions for better coordination in the deployment of fibre-optic networks in Switzerland. The first working group is handling the specification for internal wiring of buildings and the second is dealing with layer 2 access to the network. A third working group is looking at the legal aspects of the contracts binding building owners to operators, and a fourth group which was recently set up has the task of identifying adequate solutions for physically accessing FTTH networks.

The results featured in this document are the fruit of the collaboration between the various participants in the working group concerning layer 2 access to the network. The mandate of this working group can be found on the OFCOM website at the following page:
http://www.bakom.admin.ch/themen/technologie/01397/03044/03046/index.html?lang=fr .
The principal objective of this working group is to determine the relevant common points for the industry concerning access to services and to the layer 2 of networks owned by other FTTH operators, and to find consensus or solutions which allow a degree of uniformity in FTTH deployment in this regard, whether by using existing standards or those yet to be defined. The main content of the standard is expected to be the following:

- Definition of the network-network and user-network interfaces and of the network termination points (NTPs) which have to be provided by an FTTH network operator, so that open access at the transport level is possible for alternative operators and above all that it is uniform
- Definition of the service profiles at the layer 2 level (layer 2, parameters, performance. quality) provided as a minimum by an access network operator so that the most-used services (IPTV, VoD, VoIP, internet access, etc.) can be provided uniformly without modifications at the higher levels by service providers
- Functional standardisation of the access provision processes between network operators and service providers.

1.2 Participants

Alcatel-Lucent Schweiz AG
AEW Energie AG
Bakom/Ofcom
Broadband Networks AG
BSE Software GmbH
EBM
Colt Telecom AG
Energie Service Biel-Bienne
Ericsson AG
EWZ Telekom
Finecom Telecommunications AG
IWB Telekom
Openaxs (Stadtwerk Winterthur, Sankt Galler Stadtwerke)
Orange Communications SA
Raichle & De-Massari AG
Sierre Energie
Services Industriels de Genève – SIG
Sunrise
Swisscom
SymbioTec AG
Telekommunikation und Sicherheit
Teletrend AG
VTX

2. Definitions

2.1 Player definition

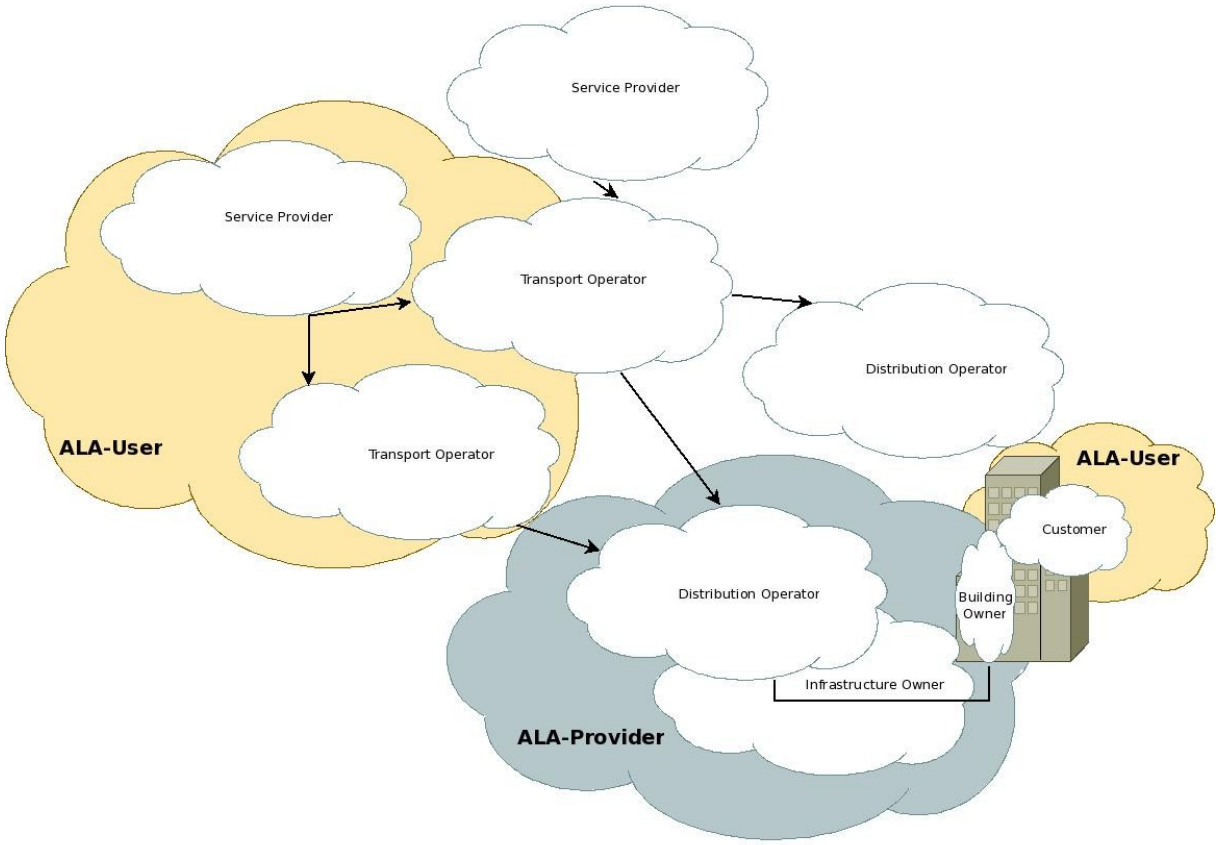


Figure 1: General Overview

In the general overview in Figure 1, the different players are:

Service Provider (ALA-User) provides Services to, supports and bills the end customer

Transport Operator provides interconnection facility to transport services from Service Provider to Distribution Provider across part of or all Switzerland

Distribution Operator (ALA-Provider) provides managed Last Mile connectivity (L2 services) from the interconnection points to the end customers

Infrastructure Owner provides L0, L1 horizontal infrastructure (tube, dark fiber, cabinet, rooms) that support the managed Last Mile network

Building Owner provides L0, L1 (connection boxes, dark fibre) vertical infrastructure that physically connects the horizontal infrastructure to the end customer

Customer requests services, consumes and pays for them. His ability to get access to the services (at least a defined minimum of them) should not be dependant on location within Switzerland, neither on the capability side, nor on the price side.

In this document, the main focus will be on the following three entities:

ALA-User Entity that makes use of the transport services to deliver end customer services to end customers

ALA-Provider Entity responsible to transport data for the services towards the end-customer premises

End Customer Entity that consumes services from ALA-User.

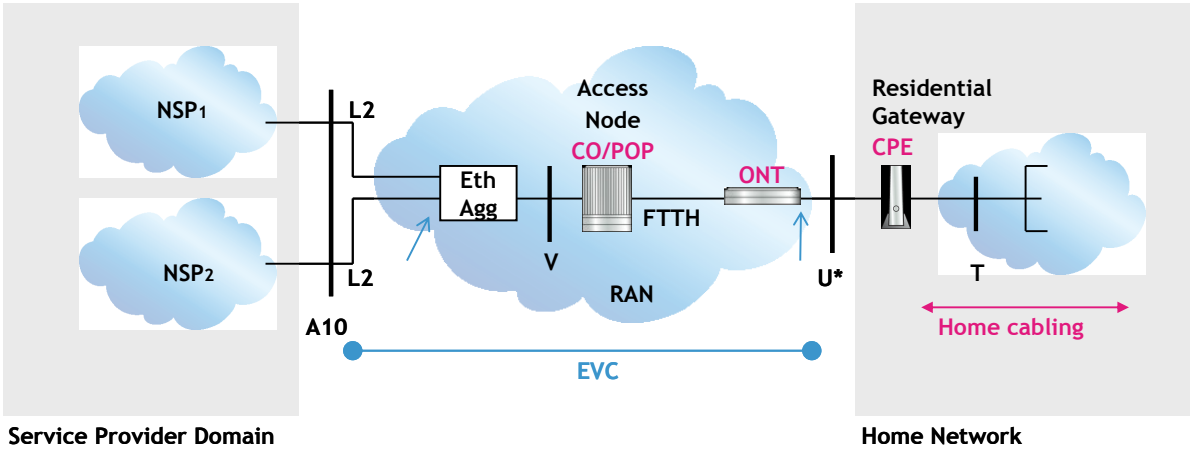
2.2 Assumptions

- The transport to the ALA-Provider network is under the responsibility of the ALA-User, even if outsourced, and hence not covered here
- The customer is already connected, all verticals have been ordered by the ALA-Provider. Hence this is not covered here, except that the covered area and endpoints have to be communicated
- The ALA-Provider and the ALA-User are already interconnected.

2.3 Reference Model

The global reference model is a combination of the definitions found in the Broadband Forum [2], the Metro Ethernet Forum [1] and the effort of OFCOM UK [3]. There is no will to replace existing standard by a "swiss version", but since some concept are still in early standardisation phases in the Gremium, we filled the gap in the mean time. We drew from TR144 [4], MEF4 [5] and the updated technical requirements for Ethernet Active Line Access [6].

In Figure 2 the global reference model is shown with the service provider (ALA-User) on the left side, then the interface A10 with the access network (ALA-Provider) and at the right side the U* interface with the home network. The interface between ALA-Provider and the home network is called U* and not U in order to demark from a notification that implies an xPON architecture specifically.



- Two Box Solution is shown
- Access Provider chooses protocol on fibre
- NSP is not involved if “RF overlay” is needed
- Access Provider is in charge to handle fibre/laser errors
- Multiple NSPs per fibre possible

Acronyms
CO = Central Office (L1)
EVC = Ethernet Virtual Connection (MEF)
NSP = Network Service Provider (TR-144)
ONT = Optical Network Termination (L1)
POP = Point Of Presence (L1)
RAN = Regional Access Network (TR-144)
UNI = User Network Interface (MEF)

Figure 2: Global reference model

The black acronyms in Figure 2 are taken from [4], the blue ones from [1] & [5] and the red ones from FTTH workgroup L1.

Figure 3 shows with more details the different solutions for the equipment and U* interface at the customer side. In any case, the responsibility of the ALA-Provider ends in the end customer after the OTO.

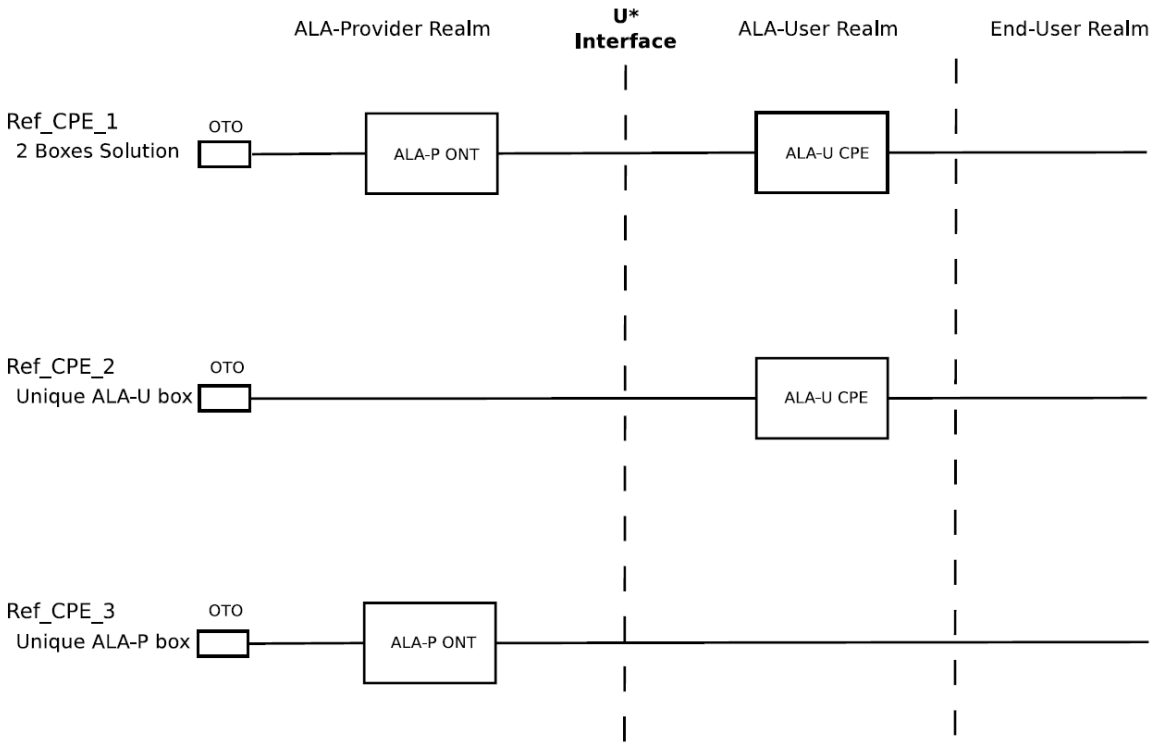


Figure 3: Different CPE positions, respective to their owner, with regards to the U* interface

3. Interfaces between ALA-User and ALA-Provider

3.1 Customer side

The interface at the customer site is called U* (see Figure 2). The relevant parameters of this interface are found in table 1.

Topic	Criteria	Interface Type (U*) non-Trunk	Priority-tagged	Trunk
General Criteria	# of ALA-Users per U* Interface	1	1	1
	Eth Services per U* Int.	1	1	1 or more
	TR-101	untagged	priority-tagged	VLAN-tagged
	Eth Service multiplexing	no MEF 10.1	no (id zero) MEF 10.1	Yes (VLAN-id) MEF 10.1
	Eth Service bundling	no	no	yes MEF 10.1
	Eth Service characteristics	MEF 13 type 1.1	MEF 13 type 1.1	MEF 13 type 1.2
PHY	Layer 1	Copper/Optical	Copper/Optical	Copper/Optical
	Layer 2	Ethernet	Ethernet	Ethernet
	MAC layer	IEEE 802.3	IEEE 802.3	IEEE 802.3
	Speed	10/100/1000	10/100/1000	10/100/1000
Frame	Frame Format	untagged	priority-tagged	VLAN-tagged
	Traffic Separation	none	none	Q-bit
	Tagging Support	none	802.1q	802.1q
	MTU Size	$\geq$ 1518	$\geq$ 1522	$\geq$ 1522
	VLAN ID	n/a	0	1-4094
	VLAN Transparency	n/a	n/a	Serv. dep. Req.
Service attributes	Class of Service Identifier Class of Service Identifier	DSCP port-based	DSCP p-bit	DSCP VLAN-ID
	Service Classes (MEF COS ID)	$\geq$ 3/1	$\geq$ 3	$\geq$ 3
	Latency/Jitter/Packet loss MEF guidelines	per service class	per service class	per service class
	Profile parameters	MEF 10.1	MEF 10.1	MEF 10.1
	Frame Delivery	unicast/multicast	unicast/multicast	unicast/multicast
	Traffic marking responsability	ALA-User	ALA-User	ALA-User
Mgmt	indicative			
	Link management	802.3ah	802.3ah	802.3ah
	Service management	802.1ag	802.1ag	802.1ag
Services	Topology	p2p, p2mp, mp2p, mp2mp		
	Traffic frame forwarding	transparent	transparent	transparent
	Bandwidth	different model (open pipe, asym/symm,set bandwidth		
	Delai/Jitter/Loss	per service class		

Table 1: U* Interface

3.2 Network side

The interface at the network side is called A10 (see Figure 2). We will not cover the case where the ALA-user is using a third party transporter to reach the ALA-Provider, as it is out of scope here. The A10 interface is described in table 2.

		Interface Type (A10)		
Topic	Criteria	non-Trunk	Priority-tagged	Trunk
General Criteria	# of ALA-Users per A10 Interface	1	1	1
	Eth Services per A10 Int.	1	1	1 or more
	TR-101	untagged	priority-tagged	VLAN-tagged
	Eth Service multiplexing	no MEF 10.1	no (id zero) MEF 10.1	Yes (VLAN-id) MEF 10.1
	Eth Service bundling	no	no	yes MEF 10.1
	Eth Service characteristics	MEF 13 type 1.1	MEF 13 type 1.1	MEF 13 type 1.2
PHY	Layer 1	Copper/Optical	Copper/Optical	Copper/Optical
	Layer 2	Ethernet	Ethernet	Ethernet
	MAC layer	IEEE 802.3	IEEE 802.3	IEEE 802.3
	Speed	10/100/1G/10G	10/100/1G/10G	10/100/1G/10G
Frame	Frame Format	untagged	priority-tagged	VLAN-tagged
	Traffic Separation	none	none	Q-bit
	Tagging Support	none	802.1q	802.1q
	MTU Size	$\geq$ 1518	$\geq$ 1522	$\geq$ 1522
	VLAN ID	n/a	0	1-4094
	VLAN Transparency	n/a	n/a	Serv. dep. Req.
Service attributes	Class of Service Identifier	DSCP	DSCP	DSCP
	Class of Service Identifier	port-based	p-bit	VLAN-ID
	Service Classes (MEF COS ID)	$\geq$ 3/1	$\geq$ 3	$\geq$ 3
	Latency/Jitter/Packet loss MEF guidelines	per service class	per service class	per service class
	Profile parameters	MEF 10.1	MEF 10.1	MEF 10.1
	Frame Delivery	unicast/multicast	unicast/multicast	unicast/multicast
	Traffic marking responsability	ALA-User	ALA-User	ALA-User
Mgmt	indicative			
	Link management	802.3ah	802.3ah	802.3ah
	Service management	802.1ag	802.1ag	802.1ag
Services	Topology	p2p, p2mp, mp2p, mp2mp		
	Traffic frame forwarding	transparent	transparent	transparent
	Bandwidth	different model (open pipe, asym/symm,set bandwidth		
	Delai/Jitter/Loss	per service class		

Table 2: A10 Interface

4. Transport services catalogue

4.1 Products

The transport service relies basically on the 3 MEF type:

- E-Lan Private LAN services for enterprises
- E-Line Private Line services between enterprises
- E-Tree Point to Multipoint ideally suited for distribution of consumer services.

Most consumer services are based on E-Tree, where the Tree itself implies the creation of the A10 interfaces based upon a common agreement between the ALA-User and the ALA-Provider. This typically involves a project and a contract. This (root) Tree is then referenced each time a Leaf is created, modified or deleted. The Leafs are created when a consumer requests a services in its location. The Leaf holds the reference to the Tree, the OTO and the U* interface. The available Leaf Type and Tree Type on a given network are published by the ALA-Provider. They form the base for distinctive transport services operations.

5. Control Plane Processes

To be able to serve the end customer, some interaction has to take place between ALA-Users and ALA-Providers. This section explains the atomic messages and their parameters needed to build a successful interaction.

By following the process of delivering a customer subscription, the steps and corresponding messages are displayed here as an example of such an exchange:

1. Customer asks for a product at the ALA-user desk

2. ALA-User checks availability of capable line and gets the owner of such a line

3. ALA-User informs customer and lets him sign a contract

4. ALA-User orders a transport service (most likely an additional leaf on an E-Tree) with the corresponding parameters

5. ALA-Provider confirms the date of delivery

6. ALA-Provider makes it happen and updates the line status

7. ALA-User wishes the customer installation

The steps 2, 4, 5, 7 involve some communications between ALA-User and ALA-Provider and hence are of interest here, while the others remain in the realm of their particular owner.

5.1 Types of control messages

The following drawing (Figure 4) shows the minimal amount of messages that have to take place between ALA-User and ALA-Provider. The list is not exhaustive.

The messages to be exchanged should cover the questions and answer parts. Topics that should be present are:

- Inventory
  Availability of transport services, status and delivery time of U* interfaces

- Order management:
  e.g. order service instance at A10, respond to order, add/remove/update leaf connecting with U*

- Fulfilment Assurance:
  e.g. get status of a connection order, return status

- Service Assurance:
  Open trouble ticket, solve it / report status of it, close trouble ticket

The messages must have a defined and open format to be successfully implemented. Their parameters are of type mandatory or optional. The mandatory parameters must be defined.The following data objects are part of the transfer protocol (L1 objects and their status are defined by AG L1):

- Structure (Building according to AG L1)
  - ID to be defined by group AG L1
  - Status (to be defined by AG L1)

- Flat
  - ID (to be defined by AG L1)
  - Status (to be defined by AG L1)

- OTO
  - ID (to be defined by AG L1)
  - Status (to be defined by AG L1)

- Services Root Type
  - Name
  - ID

- Service Instance
  - ID
  - U* (referred to OTO, to Flat, to Building)
  - Service root ID

- Order
  - Service Instance
  - OTO or Flat or Building

- Service Assurance Report
  - ID
  - Service instance

- Trouble Tickets
  - ID

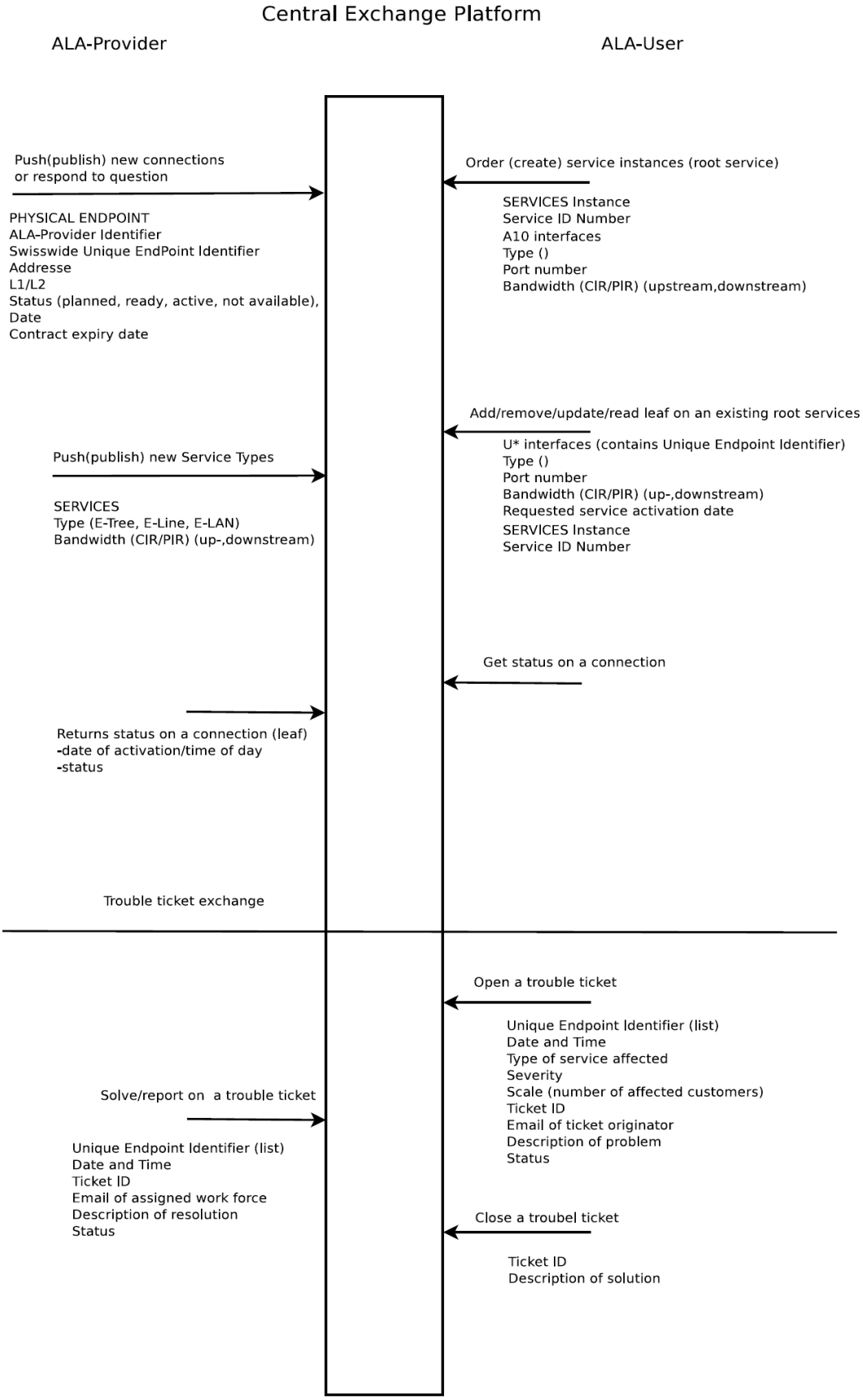


Figure 4: Central exchange platform and control plane messages

5.2 Recommendations for the exchange platform

The group is recommending the usage of a common central platform able to dispatch messages between the different actors (ALA-Users and ALA-Providers).

R1. The experience gained by Teldas in this field could serve as the foundation to develop and efficiently operate such a platform.

R2. The exchange platform must be able to store and keep in synchronization some data (mostly line related), and at the same time be able to dispatch (reroute) some messages towards their final destination (for most orders or status messages). This must ensure access rapidity, data dynamism and data privacy and accuracy. The platform must allow the availability check of a line for a given address at a given date.

R3. The transport service must be held in a defined format. It must be referenced by a unique identifier.

R4. At least in a second step, the platform should also dispatch orders, without taking any responsibility in the execution of the order except the timely delivery of it.

R5. The platform must allow the tracking of an order status (Fulfilment Assurance).

R6. The platform must allow the tracking of a service status (Service Assurance).

R7. The format of all reference keys must be defined Swiss wide.

R8. The format of Order messages must be defined and open.

R9. The format of Trouble Ticket messages must be defined and open.

R10. To correctly and completely specify and then implement this platform, some entities should be formed and mandated. They should be placed under the umbrella of Round Table. The existing system used for Number Portability could be extended in such a way.

R11. The three following aspects should be taken into account:

- Legal aspects (general conditions applicable to this platform, its creation and its operation)
- Economic aspects (financial, economic and pricing conditions applicable to this platform its creation and its operation, usage and development)
- Technical aspects (Specifications to collect, proof of concept, implementation and monitoring of evolution)

5.3 Known limitations

The ALA-User deals with end-customer records (the commercial entity), while the ALA-Provider deals with Delivery Endpoints (the physical site). The customer may not know his Delivery Endpoint at the time of subscriptions.

Some work has been done in EWZ environment to solve this issue. This result should be reused and enhanced.

6. Recommended next steps

The following next steps are suggested by the work group:

R1. Creation of a group mandated to specify completely the Platform based on current state of activities

R2. Creation of a group mandated to develop the complete business model

R3. Creation of a control organism in charge of controlling the development and operation of the Platform against the initial goals in particular of non-discriminatory usage of the Platform.

6.1 General conditions

Some bilateral work in that direction has already started between different providers. We urgently suggest a merge of those tracks.

The work towards the Platform should not be queued behind the existing work in the ULL (copper) world, but instead, adequate new working groups should be mandated concurrently.

The ground problematic being different from the one that was solved by the Number Portability System, care should be used to get a representative population when forming the new groups.

6.2 Data confidentiality, security, integrity

Care should be taken to ensure that the data exchanged do not infringe privacy laws, are not prow to corruption or loss. Systematic acceptance test should be in order.

6.3 Protocol definition and implementation

A pragmatic approach would suggest to define and to implement small successful steps towards the final goals.

At the beginning, only the protocol of the exchange could be specified and implemented, with very basic messages and parameters.

6.4 Individual statements of participants

6.4.1 Sunrise

Sunrise intends to deliver customers nationally homogeneous fiber-based services at one national price.

Our extensive experience with ULL has shown that customers expect seamless handover of retail services between retail service providers. Since each retail service provider may use services from differing ALA providers, switching between networks must also be coordinated with the seamless handover of the retail services.

With ULL coordination must be done between a limited set of players. With having multiple ALA-

Providers the situation becomes more complex than today. Complex transactions can include several donor ALA-Providers, several donor ALA-Users, one recipient ALA-User and one recipient ALA-Provider with different network technologies.

Fiber-based offerings over open access networks will only be adopted by the market if the retail customers can trust in the ability of the industry to provide such coordination.
Therefore Sunrise believes that only a strong framework between all players putting the end-customer into the middle will lead to a success in this market.

Hence, Sunrise sees following requirements as key:

- A nationwide broker platform similar to the INET-Server for ONP today.
- This platform shall handle complex transactions with multiple ALA-Providers and multiple ALA-Users.
- Every ALA-User and every ALA-Provider can implement optionally one machine-to-machine interface. The platform shall also offer normal Web-screens for players that do not want to implement a machine-to-machine interface.
- This platform shall monitor a common SLA between all players to make sure all orders are done on time.
- This platform shall support all type of networks (cable, copper, fibre). Mixed implementations with e.g. additional interface calls to WSG of Swisscom for ULL can be considered.

The following functionality shall be supported by the broker platform:

- Network pre-qualification shall show availability of networks for a customer site. It shall include all conditions necessary to order this access. It shall as well show all existing access networks and their contractual binding obligations.
- Service pre-qualification shall show all existing services of the customer and their contractual binding obligations. Only with this information the customer can be consulted appropriately at the point of sales.
- Handling of the switching transaction including all ceases of services, ceases of existing networks and the order of the new network.
- Central monitoring of these transactions and measurement of a common SLA.
- Central routing and monitoring of Trouble Tickets.
- Similar functionality as the switching transactions for relocations and network profile modifications.

6.4.2 Swisscom

Swisscom basically agrees with the idea to standardize and harmonize the relevant communication between the different actors using or providing a FTTH L2 Open access service. Swisscom agrees that we have to define a common language and if needed to centralize some basic information exchange functionalities (e.g. Line ID). But we see no need to implement all functionalities in “one centralized national IT-platform”. To integrate processes like Service Fulfilment and Service Assurance etc. will be too complex, too slow and will hinder innovation and competition.

6.4.3 Ewz

ewz supports the idea of a central FTTH inventory platform based on the needs of the market. The implementation of the platform should be realised stepwise.

Concepts which are already implemented and are operative should be reused. ewz is willing to contribute with the know-how of the ewz.zürinet implementation which is already up and running to define the standards.

ewz proposes that the first Step should the specification of the platform, (data objects and interfaces, transactions). In a second phase the evaluation of the organization which develops and operates the platform could be done.

If there will be a central, independent organization is hosting and operating the solution, the Utilities should be able to contribute and have a right to say. The financing of the implementation need also to be defined in a way that smaller providers can afford to participate.

Access to information and contribution should be possible for all participants without discrimination.

7. Acronyms

AG L1/L2	Arbeitsgruppe L1/L2, FTTH workgroup L1/L2
ALA	Active Line Access, see the OFCOM UK references [3]
A10	A10 reference point, Interface between the service provider point of presence and regional broadband network (Broadband Forum)
BNG	Broadband Network Gateway
CIR	Committed Information Rate, Average bandwidth guaranteed to work under normal conditions
CoS	Class of Service, Parameter which specifies a priority value (IEEE 802)
CPE	Customer Premises / Provided Equipment
EVC	Ethernet Virtual Connection, An association or two or more Ethernet NUIs for a private line or a private network (MEF)
E-LAN	Ethernet LAN Service Type, Multipoint EVC service type (MEF), useful for extending a private LAN over several locations
E-Line	Ethernet Line Service Type, Point-to-point EVC service type (MEF), similar to a leased line
E-Tree	Ethernet Tree Service Type, Rooted-multipoint EVC service type (MEF), useful for serving private end-customer of a broadband service
MEF	Metro Ethernet Forum, see the chapter references [1]
NSP	Network Service Provider, Provides Internet access, telephony (P2P communication), media distribution, corporate networks, etc. (Broadband Forum)
ONT	Optical Network Termination, see AG L1
OTO	Optical Telecom Outlet, See AG L1
PIR	Peak Information Rate, Peak rate for a burst of limited size, which exceeds CIR
POP	Point of Presence
QoS	Quality of Service
SLA	Service Level Agreement, relates to business agreement
SLS	Service Level Specification, relates to the technical specification (MEF)
U*	Interface between broadband access network (ALA-provider) and home network
UNI	User Network Interface, interface to Ethernet service (can be at A10 or U*)

8. References

[1] http://metroethernetforum.org/page_loader.php?p_id=29 Metro Ethernet Forum

[2] http://www.broadband-forum.org/technical/trlist.php Broadband Forum's list of recommendations

[3] http://www.ofcom.org.uk OFCOM UK

[4] http://www.broadband-forum.org/technical/download/TR-144.pdf TR 144 recommendation Broadband Multi-Services Architecture & Framework Requirements

[5] http://metroethernetforum.org/MSWord_Documents/MEF4.doc MEF4 is the description of the global architecture

[6] http://www.ofcom.org.uk/telecoms/discussnga/ OFCOM UK recommendations on Active Line Access

[7] http://metroethernetforum.org/PDF_Documents/MEF6-1.pdf MEF6.1 is the description of services

All texts of laws with SR references are published in the systematic collection of federal law and can be consulted on the www.bk.admin.ch website. They can also be obtained from the Federal Office for Construction and Logistics (BBL), CH-3003 Berne.

The technical and administrative regulations as well as the numbering plans can be consulted on the www.bakom.admin.ch website. They can also be obtained from the Federal Office of Communications OFCOM, 44, Postfach, CH-2501 Biel-Bienne.

The ITU-T Recommendations can be obtained from the ITU, Place des Nations, 1211 Geneva 20 (www.itu.int).

The ETSI standards can be obtained from the European Telecommunications Standardisation Institute, 650 route des Lucioles, 06921 Sophia Antipolis, France, (www.etsi.org).

The ISO standards can be obtained from the central secretariat of the International Organisation for Standardisation, 1, rue de Varembé, 1211 Geneva, (www.iso.ch).

The IEC standards can be obtained from the IEC Central Office, 3, rue de Varembé, CH-1211 Geneva 20, Email: inmail@iec.ch, (www.iec.ch).

The Swiss standards (SN) can be obtained from Swiss Association for Standardisation, Bürglistrasse 29, 8400 Winterthur, (www.snv.ch).

The W3C Recommendations are available at www.w3c.org.

The IAB's RFCs are available at www.ietf.org.