



**CESAR<sup>2</sup>**

# **Annex**

## **Service Specifications**

**V 2.0 Rev 3.5 English**

**2016-02-01**

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# 1. INTRODUCTION

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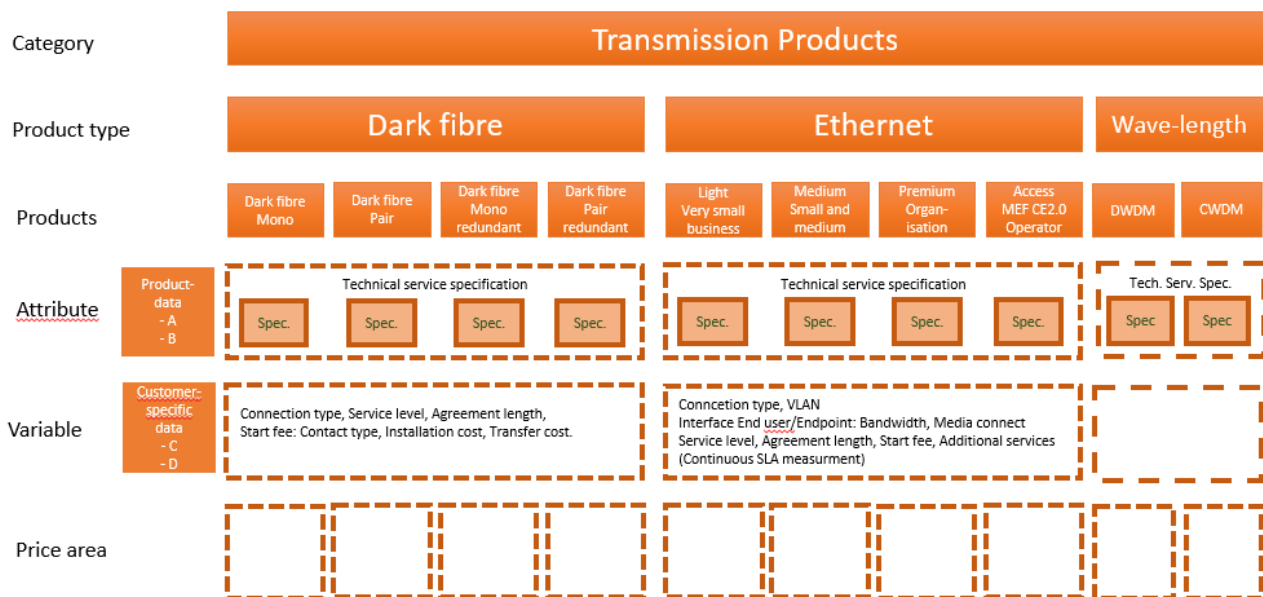
In connection to the development of CESAR2, identification of a need for common and agreed structure for capacity products has been identified. We have chosen to divide those products into three types of products. Black fibre, Ethernet and Wave-length products, and incorporate a joint service specification for the package and CESAR2.

These products should as far as possible be introduced on the city networks which joins CESAR2. If the product offering differs from the product specification, it shall be clear what or which products that are not provided.

## 2. PRODUCT OVERVIEW

In order to introduce standardized processes and data sheets for the connections that will be called off in CESAR2, a product structure has been developed, see below. The structure is based on a hierarchical chain where the categories are general and the attributes and variables are parts that form the content of the product.

**Picture:** Product and the structure



Attributes are the technical specification of the product. The Attributes are joint and cannot be changed. Variables are eligible qualities, which can change per business and link. Those shall be defined per link, to get a complete product specification, so that a service can be established with an accession treaty between buyer and seller.

### 2.1 Definitions of charges and areas

**Connection fees** = Fixed price of connectivity whether node exists or not. The price can vary from area to area

**Digging cost** = Price for digging that is not included in the connection charge.

In a **Fixed-price range**, all costs are predictable and priced with connection fees.

In the **Price area** the cost is predictable and monthly charged, digging cost may be added.

### 3. Dark fibre products

#### 3.1 TECHNICAL SPECIFICATION (Attributes)

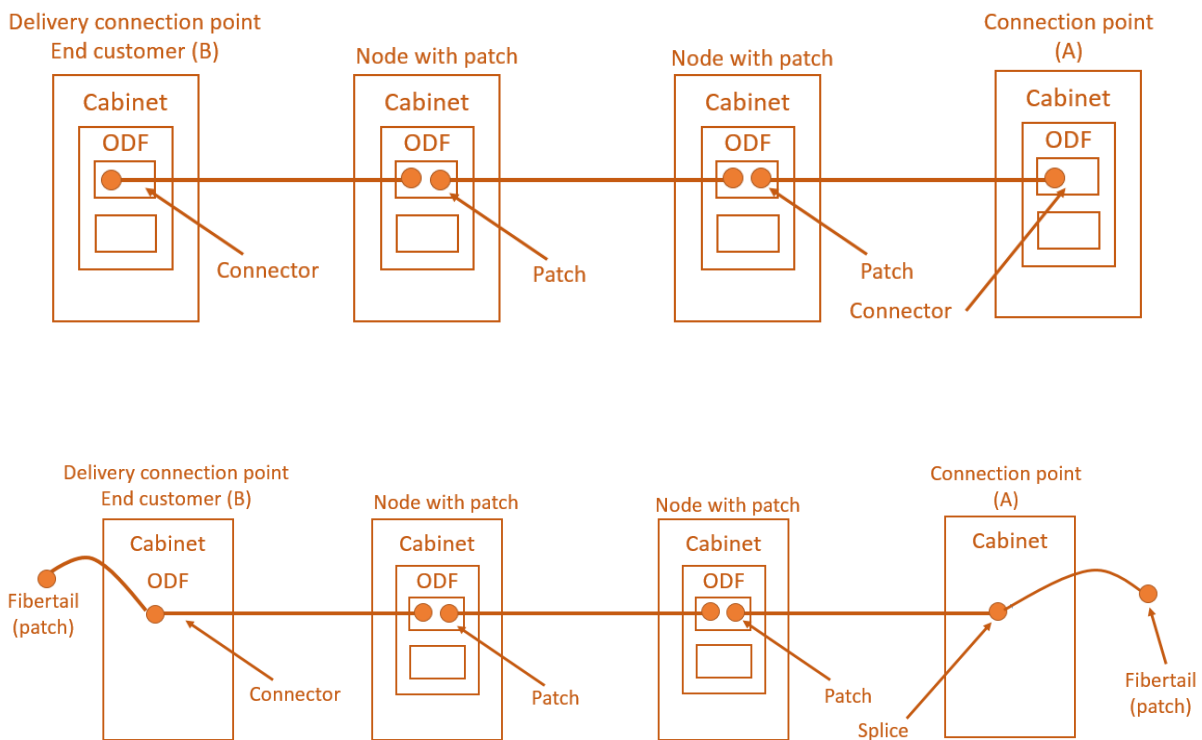
Product type Dark fibre comprises the following products:

Product type: DARK FIBRE				
ATTRIBUTES	PRODUCTS PRODUKTER			
	Dark Mono	Dark fibre Pair	Dark fibre Mono with redundance	Dark fibre Pair with redundance
<b>Interface</b> Singlemode fibre, 10/125µm. Connection interface consist of LC/SC-connections in ODF or in optical termination box or fibertail (patch).	X	X	X	X
<b>Type</b> Optical fibre according to the standard ITU-T Rec. G.652B or recent (G.652C or D) or ITU-T G.657 Category A	X	X	X	X
<b>Attenuation</b> At 1285-1330 nm, 0,40 dB/km maximum allowed attenuation and by 1530-1570 nm, maximum allowed attenuation is 0,28 dB/km.	X	X	X	X
<b>Reflexion</b> Maximum reflexion by arbitrary point is -50 dB. Reflexion measurement is measured in OTDR-measurement which can be ordered extra.	X	X	X	X
<b>Weld/splice</b> The medium attenuation on the splices shall be 0,1 dB, and the attenuation of a single splice may not exceed 0,2 dB.	X	X	X	X
<b>Fibre optic connector</b> Fibre optic connector SC, by ITU-T, type SS-EN 61754-4 Fibre optic connector LC, by ITU-T, type SS-EN 61754-20 Fibre optic connector FC, by ITU-T, type SS-EN 61754-13  with reflexion attenuation better than 40 dB. Contact attenuation shall be 0,3 dB maximum.	X	X	X	X
<b>Polarizationmode dispersion (PMD)</b> PMD is measured in a transmission channel at 1550 nm and shall be 0.5 ps/√km maximum. PMD is measured at region access (distance >250km).	X	X	X	X

### 3.1.1 Connection specification

One (1) connection consist of one (1) fibre pair (two fibres) or one (1) fibre. One connection has one A-end and one B-end in two different Nodes, which are accessible for Buyers to connect to customer owned equipment or fibre. There can occur nodes where the patching is made along the connection. The Buyer has no access in those nodes. Delivery connection point is made in ODF or in patches.

**Picture:** Connection with patches and ends



### 3.1.2 PTS Ledningskollen

The net which the Buyer intend to deed or to put at the Buyer's disposal shall be reported in PTS ledningskollen if no other indication is made.

## 3.2 REDUNDANCE

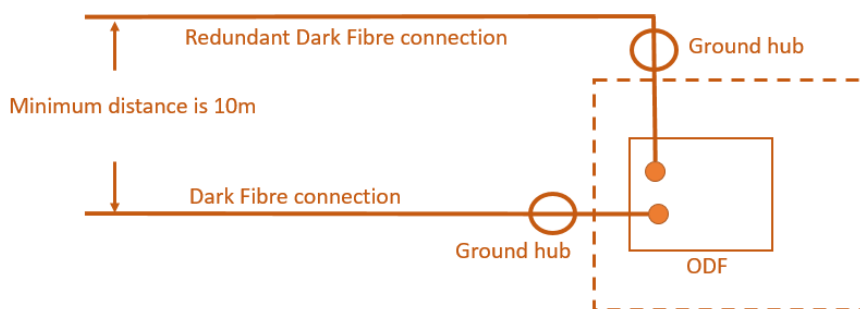
### Definition of Redundant Connection

A Redundant Connection shall by definition grant the following demands, see picture below.

- Fysically separated routes between connection points (A-and B-ends)

- Previous point implies that the Redundant Connections are physically separated up to delivery connection point in both A- and B-ends.
- Minimum distance between Connection and Redundant Connection must be at least 10 meters, except the last part up to delivery connection point. In case of lack of space inside a building, the Connection and Redundant Connection shall be laid in a separate room or corridor.
- Connection and Redundant Connection get to criss cross, but such crossing shall be made through a 90 degree angle, and +/- 1 meter from the crossing shall a specific mechanical cover be arranged between the two connections, if the distance is less than 2m. Special mechanical cover means some sort of digging security, e.g. a 10mm thick plate of steel or similar. Separate ground hubs can be required extra when ordering, see picture Redundance with ground hub.

**Picture:** Example: Redundance with ground hub



**Picture:** Example: Redundance without ground hub



Deviations from the Redundant Connection can be contracted with the Buyer. In this case the deviations from the definition above, shall be made clear.

### **3.3 Test/measurement protocol**

#### **3.3.1 Test of connection and measurement protocol**

Document what type of fibre that has been used and verify the termination points of the fibre.

Document that the executed moderation measures in all fibre links/rout units are terminated. Attenuation measurement shall be done with a calibrated instrument and the measurement should be executed in both directions, see SS-EN 61280-4.

#### **3.3.2 OTDR-measurement**

OTDR-measurement can be ordered and charged separately. The results of the OTDR measurement is delivered as a measurement report.

### **3.4 OBLIGATIONS OF THE BUYER**

If the Seller is to install equipment inside a property of the Buyer (technical space, ground hub, etc), the Buyer is responsible that the ODF space is accessible without any costs to the Seller.



### 3.5 OPTIONS/Variables of Dark fibre

The following options/variables of Dark fibre products shall be available for the Buyer to order.

<b>OPTIONS DARK FIBRE (Variables)</b>				
	<b>Dark fibre Mono</b>	<b>Dark fibre Pair</b>	<b>Dark fibre Mono-redundant</b>	<b>Dark fibre Pair redundant</b>
Connection: Point to Point (P-P)	X	X	X*	X*
Quantity	X(mono)	X(pair)	X(mono)	X(pair)
* Black fibre mono/pair must be ordered together or in advance for the redundant connection with the main connection.				
<b>Service level</b>				
SN 0 - 99.5% Non holiday weekdays	X	X	X	X
SN 1 – 99.7%	X	X	X	X
SN 2 – 99.9%	X	X	X	X
<b>Contact type</b>				
SC/APC	X	X	X	X
SC/UPC	X	X	X	X
LC/APC	X	X	X	X
LC/UPC	X	X	X	X
FC/APC	X	X	X	X
FC/UPC	X	X	X	X
<b>One-time fee / Duration of agreement</b>				
<b>Connection fee (fixed fee for point connection)</b>	X	X	X	X
<b>Digging cost (digging etc. for point connection)</b>	X	X	X	X
<b>Duration of agreement</b>	X	X	X	X

## 4 Ethernet products

### 4.1 Overview of service specification Ethernet (Attributes)

The product type, Ethernet, comprises the following products.

Product type: ETHERNET				
Attributes	PRODUCTS			
	Ethernet Light	Ethernet Medium	Ethernet Premium	Ethernet Access MEF (EA-MEF)
Relevant standards	-	-	MEF 6.2, 10.3, 23.1	MEF 6.2, 10.3,23.1
Unicast Frame Delivery	Yes, unconditionally	Yes, unconditionally	Yes, unconditionally	Yes, unconditionally
Multicast Frame Delivery (read 4.5.1.13 if terms)	Yes, unconditionally	Yes, unconditionally	Yes, unconditionally	Yes, unconditionally
Broadcast Frame Delivery read 4.5.1.13 if terms)	Yes, unconditionally	Yes, unconditionally	Yes, unconditionally	Yes, unconditionally
Tunnel Ethertype 0x86DD (IPv6)	No	Yes, (4.5.1.5)	Yes, (4.5.1.5)	Yes, (4.5.1.5)
VLAN ID Preservation	No, no VLAN	Yes	EPL: always Yes EVPL: Yes or No (4.5.1.9)	EPL: always Yes EVPL: Yes or No (4.5.1.9)
VLAN CoS Preservation	No, no VLAN	Option Yes/No No =default (4.5.1.7)	EPL: always Yes EVPL: Yes/No (4.5.1.7)	EPL: always Yes EVPL: Yes/No (4.5.1.7)
DSCP preservation	No	Yes, (4.5.1.7)	Yes, (4.5.1.7)	Yes, (4.5.1.7)

Product type: ETHERNET					
ATTRIBUTES		PRODUCTS			
		Ethernet light	Ethernet Medium	Ethernet Premium	EA-MEF
<b>L2CP according to MEF 45, "Multi-CEN Layer 2 Control Protocol"</b>		No	No	Yes, (4.5.1.8)	Yes, (4.5.1.8)
<b>*1(1)Linktrace message (802.1ag Eth OAM) (4.5.1.12)</b>		No	No	Eligible yes/no Yes: Tunnel*1(1-4)	Eligible yes/no Yes: Tunnel*1(1-4)
<b>*1(2)Tunnel Connectivity Check messages (CCP)</b>		-	-	Yes	Yes
<b>*1(3)Tunnel Linktrace messages (LT)</b>		-	-	Yes	Yes
<b>*1(4)Tunnel uni/multicast Loopback messages (LB)</b>		-	-	Yes	Yes
*There shall be 2 Support for *1(1) Linktrace message (802.1ag eth OAM), *1(2) Tunnel connectivity Check message (CCP), *1(3) Tunnel Linktrace messages (LT) and *1(4) Tunnel uni/multicast Loopback message (LB).					
<b>EVC Performance</b>  <b>One CoS defined</b>	City (Metro) (<250km)	FLR<1% FD<100 ms FDV≤25ms	FLR 0.01% FD≤20 ms FDV≤15 ms	FLR 0.01% FD≤20 ms FDV≤8 ms	FLR 0.01%, FD≤10 ms FDV<3 ms
	Sweden (Regional) (<1200km)	FLR<1% FD≤100 ms FDV≤40ms	FLR≤0.01% FD≤75 ms FDV≤40 ms	FLR≤0.01% FD≤75 ms FDV≤40 ms	FLR≤0.01%, FD≤25 ms FDV≤8 ms
<b>Notice: FLR=Frame Loss Ratio (Packet loss) FD=Frame Delay FDV=Frame Delay Variation (jitter), read 4.5.2.2 -- 4</b>					
<b>Ethernet/EVC MTU size</b>		≤1518 (4.5.2.6)	≥1534 bytes eligible 1522 bytes (4.5.2.6)	≥1534 ≤ 9000 bytes (4.5.2.6)	≥1534 ≤ 9000 bytes (4.5.2.6)
<b>Number of MAC-adresses (MAC)</b>		5	≥5 *Part of a region connection ≥ 200	100 *Part of a region connection ≥ 200	100 *Part of a region connection ≥ 200
A regional connection is a connection which terminates with A-and B-points in different counties. E.g. region-cluster network. A connection which belong to a national backbone can also be called regional connection.					
<b>Duplex mode on interface (4.5.1.10 -- 11)</b>		auto-negotiation Default: Full	auto-negotiation Default: Full	Full	Full
<b>Classes of Service (CoS)</b>		-	-	One CoS defined	One CoS defined

Product type: ETHERNET				
ATTRIBUTES	PRODUCTS			
	Ethernet Light	Ethernet Medium	Ethernet Premium	EA-MEF
<b>Test (by 4.5.5)</b>	Yes	Yes, describe what is	Yes, full spec.	Yes, full spec.
<b>Testprotocol at delivery</b> (Service turn-up test suite)	No (4.5.5)	being tested Yes/No (4.5.5)	Yes (4.5.5)	Yes (4.5.5)

## 4.2 Service specification Ethernet Light

### Specification

This service is suitable for replacing xDSL services with a fibre based service to deliver ethernet service to a smaller business, e.g shops, workshops etc.

For technical functionality, read table 4.1 Overview of service specification Ethernet and for Options/Variables, read table 4.6

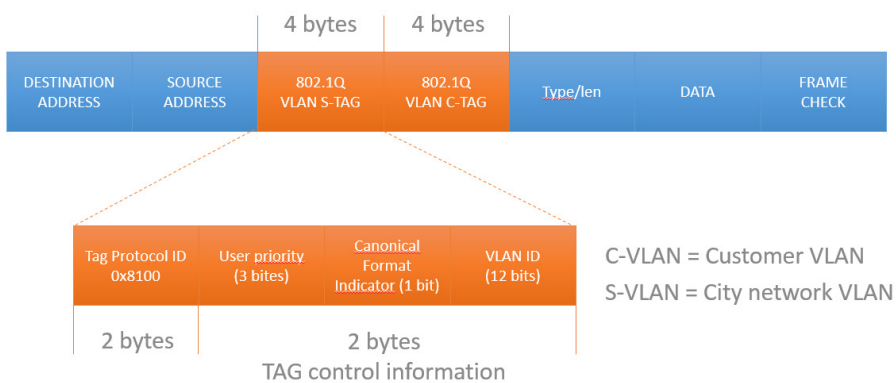
## 4.3 Service specification Ethernet Medium

### Specification

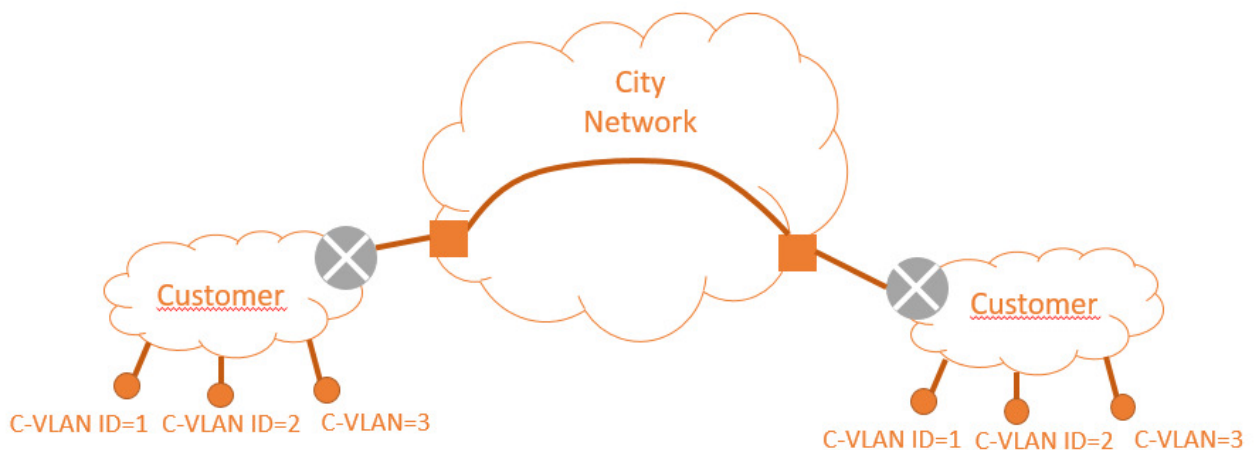
This service is suitable for offering Ethernet transport to small- and medium sized business.

For technical functionality, read table 4.1 Overview of service specification Ethernet and Options/Variables, read table 4.6

**Picture:** Specification of VLAN-tag function for Ethernet Medium



**Figure:** Example of configuration



## 4.4 Service specification Ethernet Premium

### Description

This service is suitable as an alternative to leased Dark fibre connections. Specifications are almost equal Ethernet Access MEF, read 4.5

What differs from the Ethernet Access MEF are the EVC-value, i.e.

- FLR, Frame Loss Ration (Packet loss)
- FD, Frame Delay
- FDV, Frame Delay variation

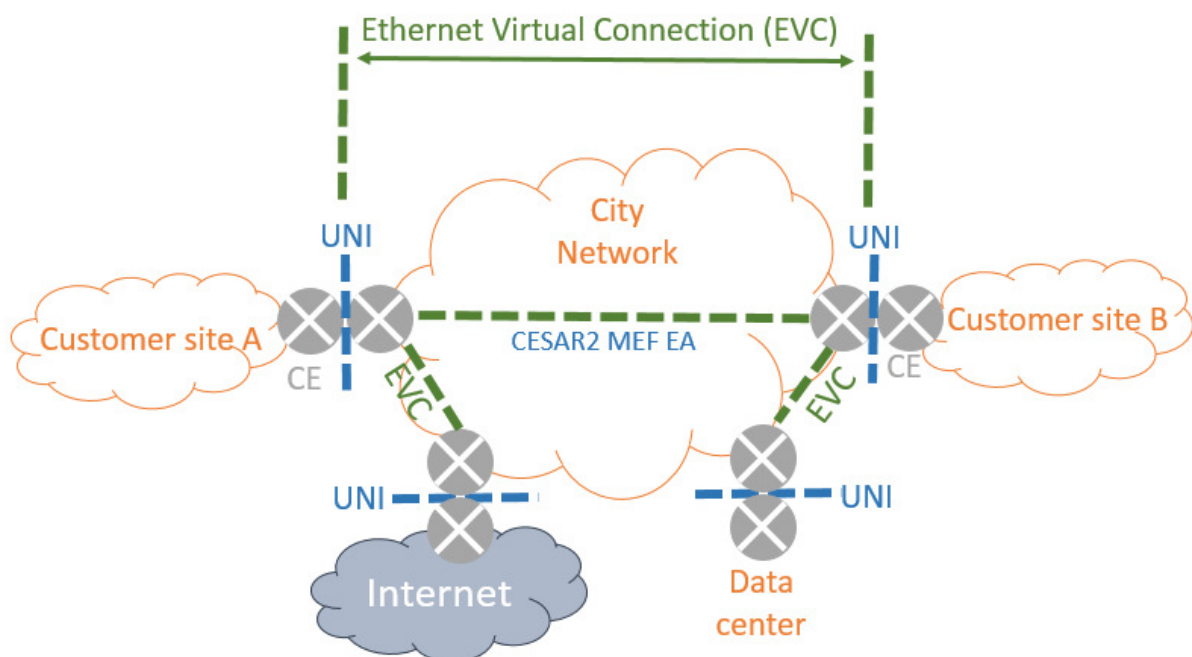
Premium does not have as high demands as of a service product according to 4.5. There is no demand for Management-VLAN.

For technical functionality, read table 4.1. Overview of service specification Ethernet and Options/Variables, read table 4.6

## 4.5 Service description Ethernet Access MEF

Both parties strive that the leased connections deliver according to the Metro Ethernet Forum's standards MEF6.2 and MEF10.3 for Ethernet Virtual Private Line (EVPL) and Ethernet Private Line (EPL). The reason for this position is to achieve as correct probability as possible of how a leased ethernet connection works when it comes down to functionality and performance. In this document different parts of the MEF6.2 and MEF10.3 are referred to consistently where relevant.

Figure: Basic terms



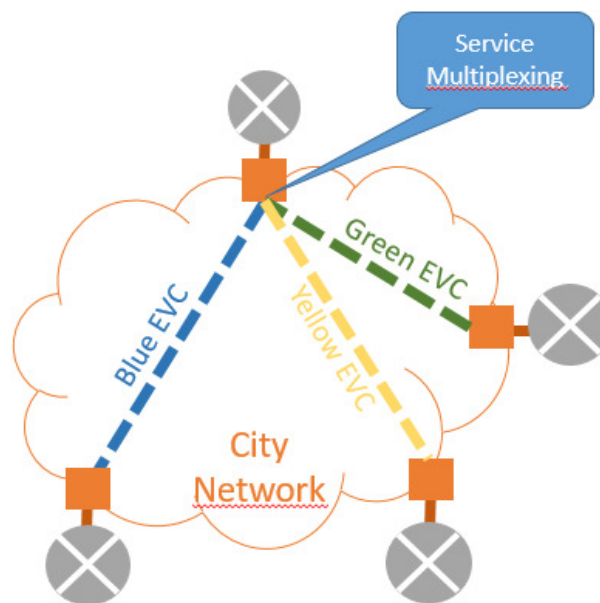


Two technical solutions are accepted:

1. **E-line EPL** are being delivered with separate ethernet interface in both ends of the Connection. One or several EVC:s are established above the EPL by agreement between the Buyer and the Seller.
2. **E-line EPL** are being delivered with ethernet interface at the end-customer, but with joint ethernet interface towards the Buyer. Several end-customers connects to the Buyer's net through a joint ethernet connection and are separated on the VLAN.

The Seller shall support Q-in-Q per EVC (so the Buyer are able to deliver a Layer2-end-to-end solution in the end).

**Figure:** Examples of configuration of EVPL



The figure shows three EVC:s, established through a joint transfer point. The EVC:s multiplexes based on VLAN. This equals solution 2, E-line EVLP and is preferred to the buyer.

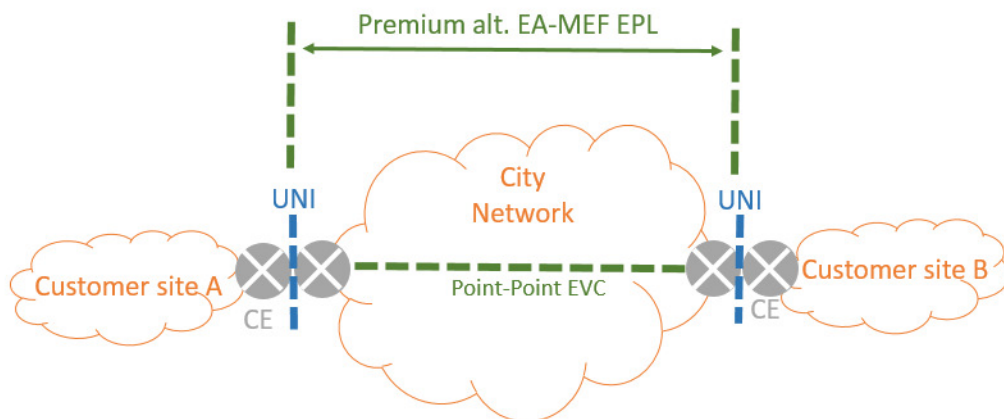
## 4.5.1 TECHNICAL SPECIFICATION, PERFORMANCE REQUIREMENTS

### 4.5.1.1 Outline of solution

The Seller should be able to present an outline of the net construction. The outline shall contain information of which underlying technique that has been used to implement the service.

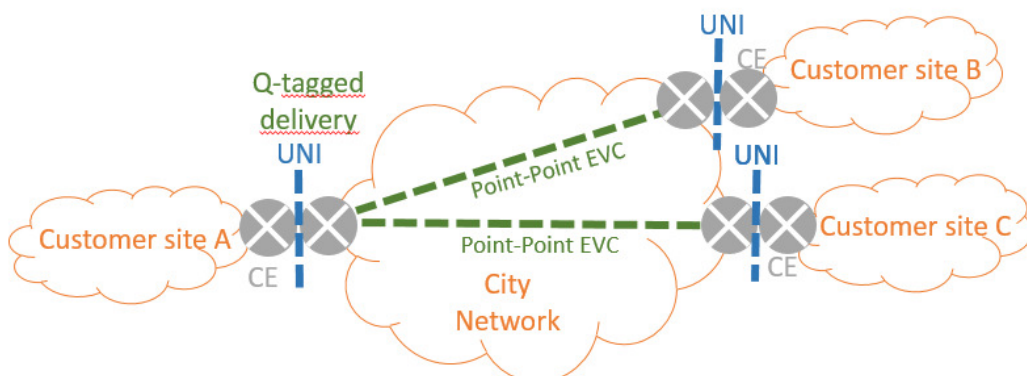
### 4.5.1.2 E-line EPL

A Connection of type EPL shall follow specification MEF6.2. The figure below shows how the Buyer wants different specified parameters to work.



### 4.5.1.3 E-line EVPL

An EVPL connection shall follow the specification of MEF6.2. There is a specification below of how the Buyer intend different specific parameters to function.



#### **4.5.1.4 Operation and maintenance**

It shall be possible for the Buyer to establish a separate EVPL/EPL for operation and maintenance of the set equipment. This requires a separate order.

#### **4.5.1.5 Ethertype**

Possible limitations of which ethertypes are supported by the Connection shall be specified by the Seller. The Ethertype 0x86DD for Ipv6 over the Ethernet, shall be supported by the Connection (read RFC2464).

#### **4.5.1.6 Bandwidth**

Possible Ingress Bandwidth Profile which is applied by the Connection, shall apply per EVC and not per CoS ID. If an Ingress Bandwidth Profile is applied on the Connection, following parameters shall be specified as <CIR, CBS, EIR, EBS, CM, CF> (the parameters are specified in paragraph 7.11.1 i MEF10.2).

Practically this means that CIR == EIR to achieve the demand in chapter 4.5.2.1.

It also means that it is not necessary to support priority on the Connection since all frames being sent above it, shall be guaranteed through the net of the Seller, according to the performance requirements in chapter 4.5.2.1

#### **4.5.1.7 CoS and DSCP-value**

Preservation of CE-VLAN CoS and DSCP shall be made, i.e. the value may not be changed by the Seller if Yes is specified.

#### **4.5.1.8 Layer-2 control protocol**

The management of the layer-2 control protocol shall be operated according to MEF 45. This means that STP/RSTP/MSTP normally should be discarded.

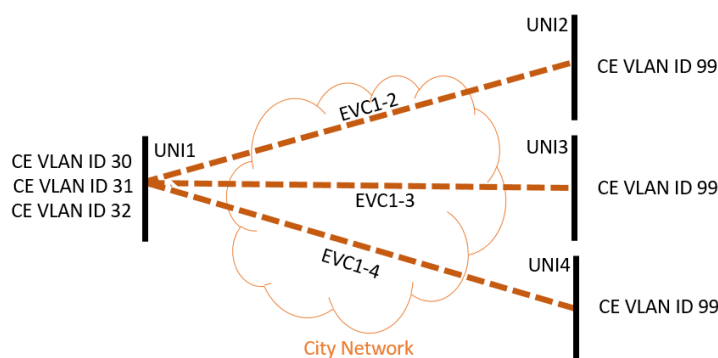
#### 4.5.1.9 VLAN

There shall be two options of an ordered connection regarding VLAN.

##### 4.5.1.9.1) transparent connection with Service Multiplexing delivery point Without Bundling

An EVC is placed between the delivery point and the end-customer's UNI where all frames shall be transported from the end-customer's UNI regardless tagged or untagged, and shall be delivered at a set VLAN at the Delivery UNI.

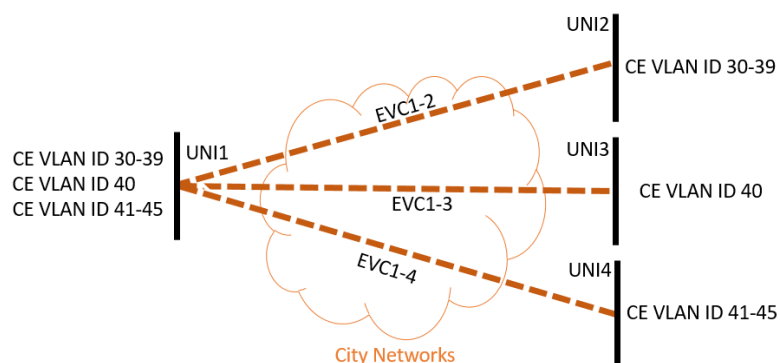
**Figure:** Example configuration VLAN ID Preservation=NO



##### 4.5.1.9.2) transparent connection with Bundling at Delivery point.

An EVC is placed between Delivery point and End-customer's UNI:s where a CE-VLAN ID/EVC Mapping is made. According to description in MEF 10.3. The Seller shall also be able to provide a management-vlan per connected customer device.

**Figure:** Example configuration VLAN ID Preservation=YES



#### 4.5.1.10 Interface for end customer (B-point)

The interface for end customer shall be 100BaseTX, 100BaseFX or 1000Base-X according to the standard IEEE 802.3. The interface shall be configured according to the following on demand:

1. 10 Mbps full-duplex
2. 100 Mbps full-duplex
3. 1000 Mbps full-duplex

If the leased capacity is 10 Mbps or 100 Mbps interface is expected to be configured in 10 Mbps/full-duplex respectively 100 Mbps/full-duplex. If the leased capacity exceeds 100 Mbps the interface is expected to be configured in 1000 Mbps/full-duplex. In case of Auto-negotiation or manual configuration of speed, this shall be specified.

#### 4.5.1.11 Interface for delivery point (Buyer)

The interface for delivery point in the Buyer's transportation net, shall be according to IEEE 802.3 standards. On demand, the interface are to be configured according to the following:

1. 10 Mbps full-duplex
2. 100 Mbps full-duplex
3. 1000 Mbps full-duplex
4. 10 Gbps full-duplex

It shall be specified if Auto-negotiation or manual configuration is applied. The interface for each speed is to be,

1. 10Base-T, 10Base-F
2. 100Base-TX, 100Base-FX
3. 1000Base-T, 1000Base-X (normalfall är 1000Base-X)
4. 10GBase-SR, 10GBase -LR, 10GBase -ER

#### 4.5.1.12 Ethernet OAM

Support for Ethernet OAM according to MEF17 (based on IEEE 802.1ag and ITU-T Y.1731) is eligible.

#### 4.5.1.13 Multi-and Broadcast frame delivery

If the Seller has limitations or terms which ensures the net, this will be clear according to 4.5.6, deviation from requirement specification.

## 4.5.2 TECHNICAL SPECIFICATION, PERFORMANCE REQUIREMENTS

### 4.5.2.1 Available bandwidth

The Seller shall guarantee that the leased capacity of the Buyer is available through the Seller's net at the availability guaranteed of the Connection.

### 4.5.2.2 Frame Loss Ratio

(Defined by MEF 6.2 Frame Loss Ratio)

The amount of lost ethernet frames through the net of the Seller shall never exceed  $FLR = 0.01\%$  counted over a period of  $T = 5$  minutes. If controlled, there should be at least one measure point collected, one at the beginning and one at the termination of the period.

### 4.5.2.3 Frame Delay

(Defined by MEF 6.2 Frame Delay)

The delay of ethernet frames shall not exceed  $\leq 10\text{ms}$  for a distance  $< 250\text{km}$  and  $\leq 25\text{ms}$  for a distance  $> 250\text{km}$  och  $< 1200\text{km}$ .

### 4.5.2.4 Frame Delay Variation

(Defined by MEF 6.2 Frame Delay Variation)

The variance of delay of ethernet frames shall not exceed  $< 3\text{ms}$  for a distance  $< 250\text{km}$  and  $\leq 8\text{ms}$  for a distance  $> 250\text{km}$  och  $< 1200\text{km}$ .

### 4.5.2.5 Arrangements of Ethernet frames (FIFO)

The Ethernet frame order shall always be kept according to the model First In, First to Go.

#### 4.5.2.6 Frame size

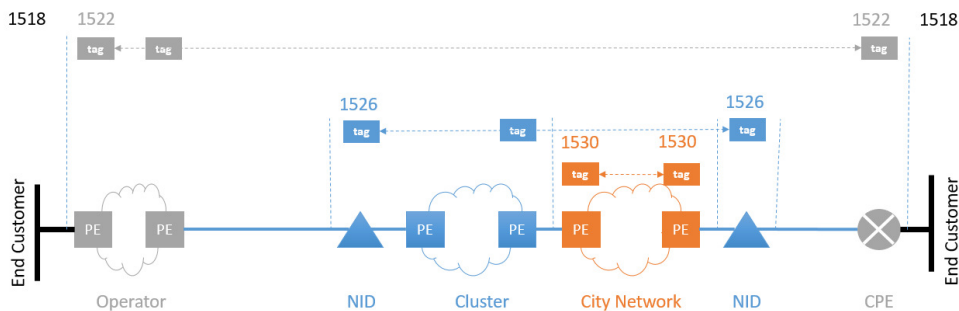
The frame size shall follow each product specified in table 4.1. To support Wholesale- and the operator business, technically the Seller must offer MTU-size at 1534 on medium, premium och EA MEF. If inquired, there is a choice where MTU 1522 can be chosen for the Medium product for Buyers who require less frame size.

Pictures below show the connection from delivery to end customer, where traffic shall be transported from one operator to another who sells capacity as a wholesale product. This Wholesale operator is transporting the service through a regional/national actor, e.g. clusters that finally terminate the connection through a city network.

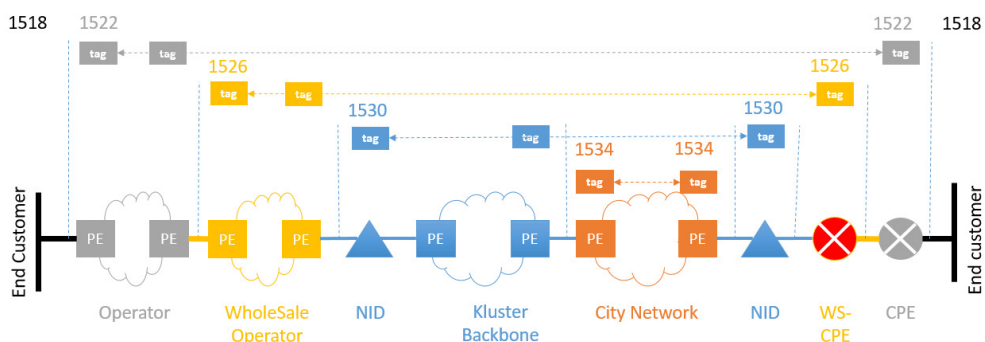
**Table: MTU-sizes**

Spec.	Ram size	Comments
Ethernet MTU	1500 bytes	
Ethernet Standard	1518 bytes	8 bytes for the Standard
Ethernet VLAN with C-tag	1522 bytes	
Ethernet VLAN with C-, & S-tag	1526 bytes	Q-in-Q
Ethernet C,S and cluster-tag	1530 bytes	Support for national operator
Ethernet C,S, cluster and <u>carrier</u> -tag	1534 bytes	Support for international operator

**Picture: E.g.: national operator business through clusters**



**Picture: E.g.: International operator business through national operator and clusters**



## 4.5.3 REDUNDANCY

### 4.5.3.1 Fysical redundancy

If redundant Ethernet Access is required, the following are applied (occasionally called protected connection)

Redundant Ethernet Access shall be based on Redundant Connection according to the definition applied to the Service specification conditions of Dark fibre (reference)

### 4.5.3.2 Logical redundancy

If redundant Ethernet Access is required, logical redundancy is applied. This way two or several entries can be recieved at the delivery point, which logically means one entry that holds the same content.

## 4.5.4 OBLIGATIONS OF THE BUYER

The Buyer is responsible, and pays for the connection to contracted Delivery points and for possible equipment needed for the implementation of the connection plus possible CPE:s.

If the Buyer are to install equipment at the Buyer's property, the Buyer is responsible for the following requirements:

- Space: Enough space for 19" **rack mount** or similar
- Temperature: Air temperature between 10-30 Celcius degrees and relative humidity within the span 10% -80%, non condensed.
- Electricity connection AC 230V
- To eliminate the risk of stoppage it is recommended that the included equipment of the Connection shall be placed separately.

## 4.5.5 Test/measurement protocol

Test of serviceis done according the following levels:

- 1) Measurement based on Y.1564. Test is done on performance/traffic profile/ stability
- 2) Measurement based on MEF48, in principle Y.1564 plus tests for CoS and VLAN, Preservation, MTU-size, Multicast/broadcast frame delivery.
- 3) Measurement verifying"all" attributes according to specification.



**Notice:** *There is no standard specifying that the L2CP must be tested at delivery, but there are some potential problems to it. To show entirety presents credibility and a very good verification.*

Minimal measurement requirements as follows. Document test deviations shall be done. (E.g. capacity is measured 900Mbps on a 1000Mbps-link)

LEVEL OF MEASUREMENT	SERVICE
1	Ethernet Light
2	Ethernet Medium
3 alt. 2	Premium
3 alt. 2	Ethernet Access MEF

## 4.5.6 DEVIATION OF STANDARD COMPLIANCES

Standard compliances shall be done according to technical functionality, read table 4.1 Overview of service specification Ethernet and eligible qualities, read 4.6. If there is anything not in line with the specification, it should be declared in the following table. If a requirement is missing it shall be filled in as other.

	Demands	Yes	No	Comment
<b>4.5.1</b>	<b>Standard requirements</b>			
4.5.1.1	Outline of solution			
4.5.1.2	E-line EPL (by MEF 6.2)			
4.5.1.3	E-line EVPL (by MEF 6.2)			
4.5.1.4	Operation and maintenance			
4.5.1.5	Ethertype			
4.5.1.6	Bandwidth			
4.5.1.7	CoS and DSCP-value			
4.5.1.8	L2CP			
4.5.1.9	VLAN			
4.5.1.10	Interface of end customer			
4.5.1.11	Interface of delivery connection point			
4.5.1.12	Ethernet OAM			
4.5.1.13	Multi- and broadcast			

4.5.2	Performance requirements			
4.5.2.1	Available bandwidth			
4.5.2.2	Frame Loss Ratio			
4.5.2.3	Frame Delay			
4.5.2.4	Frame Delay Variation			
4.5.2.5	Order of the Ethernet frames			
4.5.5	Test/measurement protocol			
Other				

## 4.6 Options/Variables (for Ethernet products)

Following variables for Ethernet products shall be accessible for the buyer to order.

<b>Options ETHERNET (variables)</b>				
	<b>Ethernet Light (4.2)</b>	<b>Ethernet Medium (4.3)</b>	<b>Ethernet Premium (4.4)</b>	<b>EA-MEF (4.5)</b>
<b>Connection</b>				
- E-Line EPL (point to point gate based) UNI-UNI (4.5.1.2)			X	X
- E-Line EVPL (point to point VLAN based) UNI-UNI (4.5.1.3)			X	X
- Point to Point (P-P)	X	X		
- Point to multipoint (P-MP)	X	X		
- Redundant connection (4.5.3)		X	X	X
<b>VLAN (CE-VLAN ID Preservation) (4.5.1.9)</b>				
Alt 1 – No, a specified VLAN to UNI regardless of what is being sent (4.5.1.9)			Only EVPL	Only EVPL
Alt 2 – Yes, VLAN preservation end-to-end (4.5.1.9)			X	X
Alt1: No means that every site gets its own VLAN ID. Could be used for EVPL only. Alt2: VLAN ID is kept above the connection. At EPL-connection Alt2 is the only option.				
Manage- VLAN, read chapter 4.5.1.4				X
<b>Interface to end customer (B-point)</b>				
<b>Gate bandwidth (Mbps) (UNI same as EVC bandwidth PIR, peak information rate) (4.5.2.1)</b>				
10/10	X	X	X	X
100/10	X			
100/100	X	X	X	X
1000/1000		X	X	X

<b>Product type: ETHERNET</b>				
<b>VARIABLES</b>	<b>PRODUCTS</b>			
	<b>Ethernet Light</b>	<b>Ethernet Medium</b>	<b>Ethernet Premium</b>	<b>EA- MEF</b>
<b>Media contact (4.5.1.10)</b>				
100Base-TX	X	X	X	X
100Base- FX		X	X	X
1000Base-T	X	X	X	X
1000Base-X SFP-gate where end customer delivers/gets eligible SFP		X	X	X
<b>Interface to delivery point (A-point)</b>				
<b>Gate bandwidth (Mbps) (UNI same as EVC bandwidth PIR, peak information rate) (4.5.2.1)</b>				
10/10	X	X	X	X
100/100	X	X	X	X
1000/1000	X	X	X	X
10000/10000	X	X	X	X
<b>Media contact (4.5.1.11)</b>				
10Base- TX	X	X	X	X
10Base- FX	X	X	X	X
100Base-TX	X	X	X	X
100Base- FX	X	X	X	X
1000Base-T	X	X	X	X
1000Base-X (SFP-gate where end customer delivers/gets eligible SFP)	X	X	X	X
10GBase-ER	X	X	X	X
10GBase-SR	X	X	X	X
10GBase-LR	X	X	X	X

<b>Product type: ETHERNET</b>				
<b>VARIABLES</b>	<b>PRODUCTS</b>			
	<b>Ethernet Light</b>	<b>Ethernet Medium</b>	<b>Ethernet Premium</b>	<b>Ethernet Access MEF</b>
<b>Service level</b>				
SN 0 - 99.5% Non-holiday weekdays	X	X	X	X
SN 1 - 99.7%		X	X	X
SN 2 - 99.9%		X	X	X
Option - On demand or continuous SLA measurement (additional service). Measurement of EVC with presentation through a portal. Real time/history		X	X	X
<b>One-time fees/Contract duration</b>				
<b>Connection fee (fixed fee for connection of point)</b>	X	X	X	X
<b>Digging cost (digging costs etc. for connection of point)</b>	Node required	X	X	X
<b>Contract duration</b>	X	X	X	X

## 5 Wave-length products

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Will be developed during 2016.

## 6 Revision notes

Rev.nr	Datum	Sign	Beskrivning
3.1	140820	JP	Rectified misspellings, Reflexion black fibre changed to -50 from -40
3.2	141112	JP	Clarifications in Ethernet attributes and variables
3.3	150101	JP	Incorporated in the package of agreement
3.4	150128	JP	Requests introduced before referral
3.5	151006	JP	MTU discussion on medium, premium and MEF service, plus small corrections
3.5	151015	JP	Ethernet Minimum is now renamed Ethernet Light
3.5	151019	JP	Clarifications of MTU with picture p.4.5.2.6. Clerical error of size, corrected from 1532 to 1534.
3.5	151022	JP	New picture 4.5.1.9.1—2 to show VLAN ID Preservation =YES and NOJ
3.5	151022	JP	Table 4.1. Regional connection defined.
3.5	151022	JP	Provider is changed to Seller and Customer is changed to Buyer throughout the document.
3.5	151104	JP	Correction after remittance for consultation before legal review.
3.5	151117	JP	4.5.5 Test process changed
3.5	151130	JP	Picture 2 corrected from minimum to Light 3.2.2 Removal of double spaced text
3.5	151112	JP	There is a choice at the enquiry where MTU 1522 can be eligible on the Medium product for buyers with less need of frame size, read 4.5.2.6 and 4.1 tabell.
3.5	160224	JP	Corrections in Table 4.1. Under the Link Trace message has



			<p>added selectable yes / no choice. And footnote corrected.</p> <p>Table 4.1 EVC values on medium FD and FDV is "&lt;" replaced with "≤"</p> <p>4.5.1.8 MEF6.2 replaced with MEF45.</p> <p>Illustrations in section 4.3, 4.5, 4.5.1.2 and 4.5.1.3 are replaced with a updated design.</p>
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