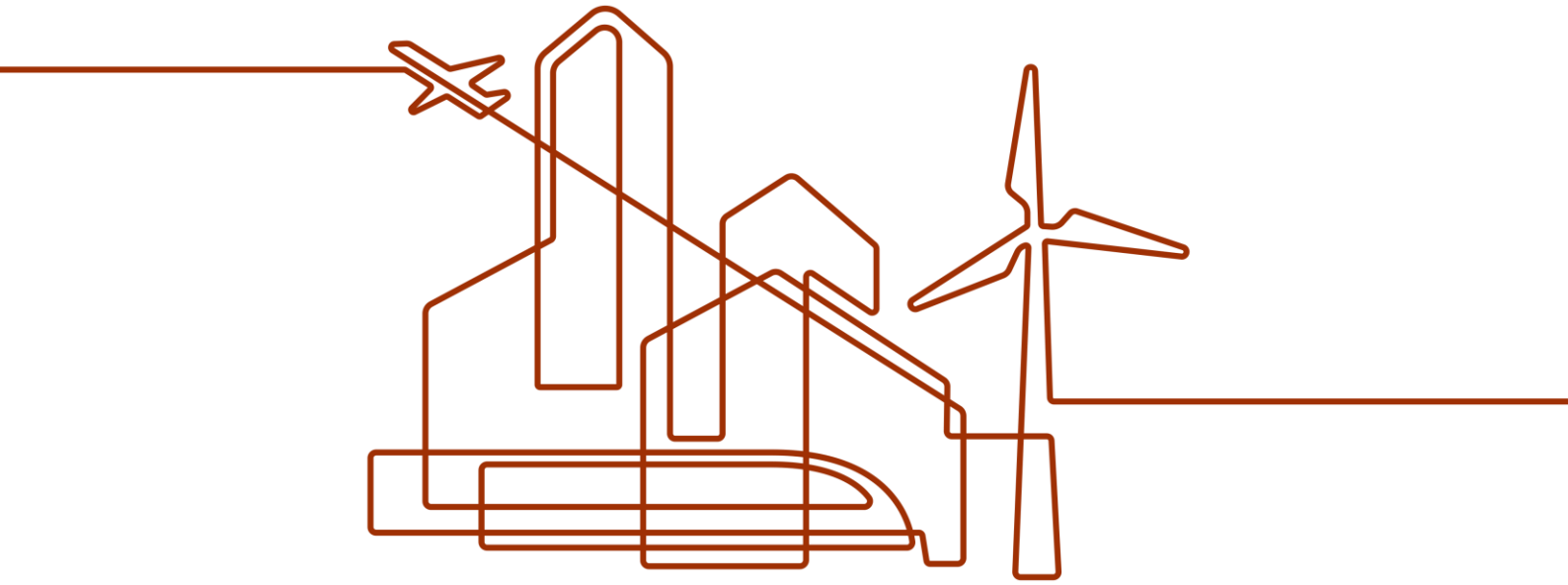
Service Description

Ethernet VPN

January 31, 2022



Eurofiber. Lifeline for the digital society

eurofiber

Contents

1 The Eurofiber fiber-optic network

Eurofiber France delivers high-end, fiber-based connectivity services for the business market. Eurofiber is at the forefront of implementing new technologies and is continuously improving the quality of its fiber-optic network. Relying on this network, Eurofiber provides future-proof and open infrastructure to companies, public authorities and non-profit organizations.

Network
Eurofiber fully owns and manages its open network, which covers France, the Netherlands, Belgium and Germany. Eurofiber's fiber-optic network provides over 39,700 kilometers[1] of fiber-optic cable across those countries. It provides more than 28,000 customer connections with high-quality glass fiber. Eurofiber invests continuously in the growth of the network.

Flexible and scalable
Our open network gives your organization complete freedom and flexibility to choose the services, applications and providers you need. Eurofiber also provides managed services based on our fiber-optic network like Ethernet VPN, and Business Internet.

Secure underground network
Eurofiber's network is installed underground at a depth of about 60 centimeters. All work on our network is carried out according to processes, which we continually monitor and evaluate yearly. We work with network engineers, including our own employees as well as contractors. In order to guarantee the high quality of our network now and in the future, we naturally carry out preventive maintenance on a routine basis.

Network Operating Center
You can rely 24x7 on expert support from the Eurofiber France Network Operating Center.

Guaranteed repair time
Eurofiber's geographically registered fiber-optic network, combined with active monitoring by the Network Operating Center, entitle us to guarantee that the maximum repair time for fiber-optic connections is 8 hours, and 4 hours in the case of active services.

Available in many datacenters
Eurofiber's fiber-optic network is available in a large number of datacenters in France, Belgium and the Netherlands. In addition, we can support you with high-quality colocation solutions for secure hosting for your mission-critical information and systems.

Guarantees
Eurofiber provides connectivity on the basis of a Service Level Agreement (SLA). This sets out precisely what you can expect from us in terms of performance, quality level and guarantees. It contains a clear set of commitments on our part, so that you always know exactly where you stand.

[1] As of August 2021 excluding Germany.

2 Service description

2.1 Introduction

This service description applies to the Ethernet VPN service provided by Eurofiber France. Definitions of the various abbreviations and terms used in this service description are given in the annex to the Service Level Agreement.

Eurofiber's Ethernet VPN service enables you to connect your head office, subsidiaries and datacenters in a reliable, secure and flexible manner over a custom private network. You can choose from three options to configure the Ethernet VPN in bandwidths ranging from 10 Mbps to 10 Gbps. You can also expand Ethernet VPN with Business Internet service.

Custom private network
VPN stands for Virtual Private Network: a virtual data network between geographically dispersed locations that is separated from all other networks. Eurofiber's Ethernet VPN service provides the capabilities you need to ensure the transfer of office IT, internet, telephony, video and other services. Ethernet VPN can also be extended to include your datacenters, enabling you to provide centrally hosted applications and platforms. You have complete freedom of choice in services and service providers that are connected to the Eurofiber network.

Flexibility in locations and bandwidth
You can ensure your Ethernet VPN solution is always optimally configured to meet your organization's needs, connecting as many locations as you wish and deciding how much bandwidth you need. Ethernet VPN can be configured in bandwidths varying from 10 Mb/s to 10 Gb/s. The Ethernet connection is always provided on the basis of symmetrical bandwidth.

Redundant configuration
Ethernet VPN allows you also to choose a redundant configuration for your connections.

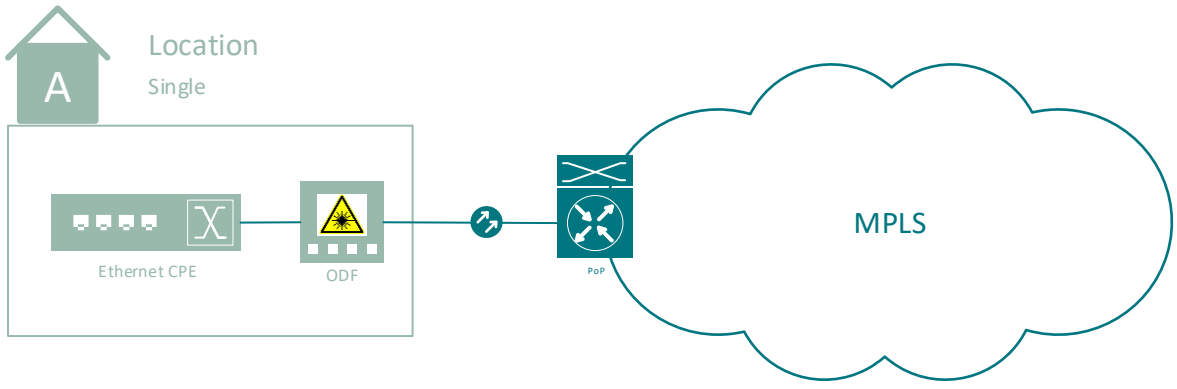
Guaranteed bandwidth
Ethernet Premium comes with a guaranteed bandwidth (99,9%) and with minimum delay and jitter on your connections.

2.2 Ethernet VPN connection options

A suitable connection between the customer location and the Eurofiber Network can be configured to match the required availability of the connection.

2.2.1 Single connection

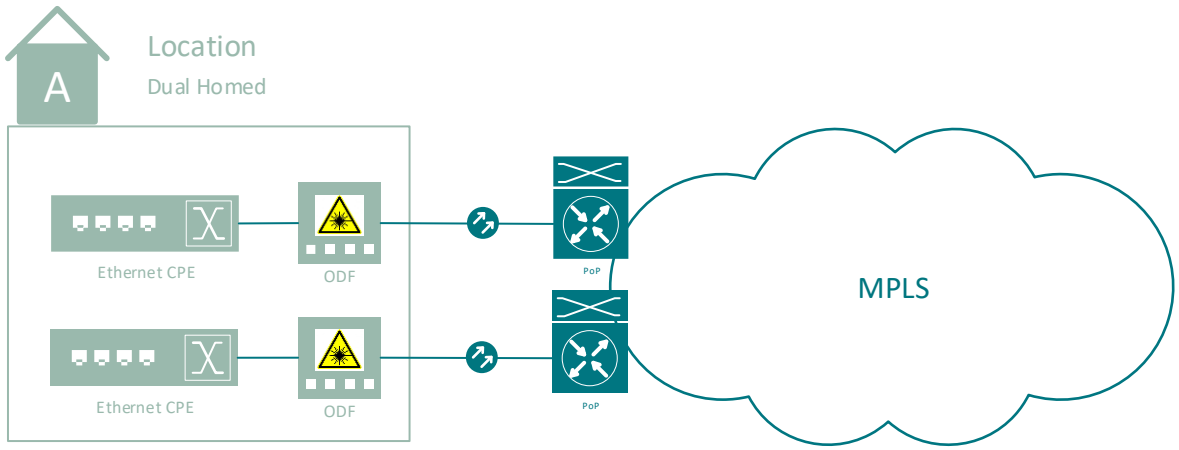
The customer location is connected in a single configuration by means of a single fiber to the nearest Ethernet PoP location. It is advised to opt for a Dual Homed connection for business-critical customer locations that guarantees maximum availability on the Eurofiber fiber-optic infrastructure.



Single connection to a standard customer location

2.2.2 Dual Homed connection

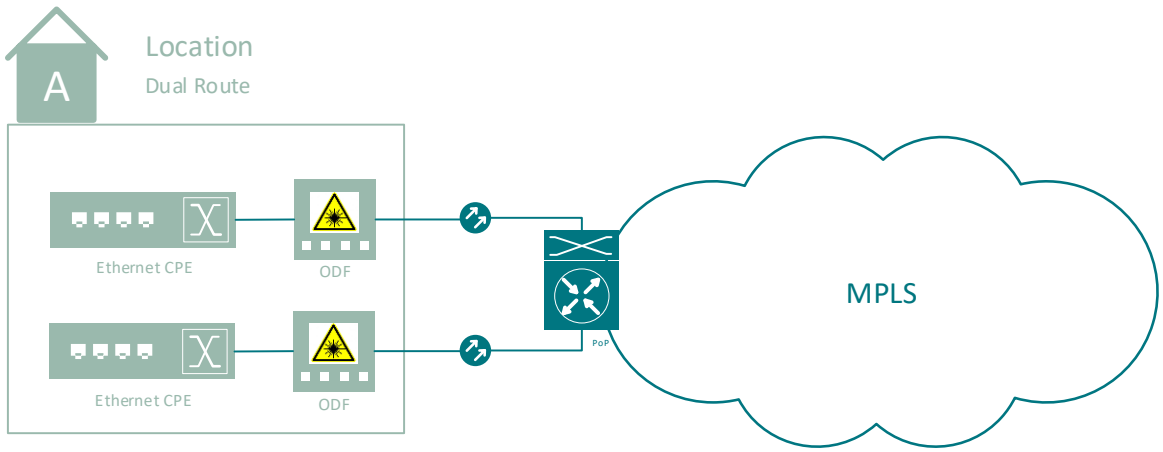
The customer location is connected via two separated fiber-optic routes to two geographically separated Ethernet PoP locations, with both fiber-optic routes being located at a distance of at least five meters from one another. The fiber-optic routes are administratively related so that in the event of a service failure or planned work on one of the routes, work will be blocked on the other routes. The customer is responsible for performing switching between the two connections in case of a failure or disaster (Failover).



Dual Homed connection

2.2.3 Dual Route connection

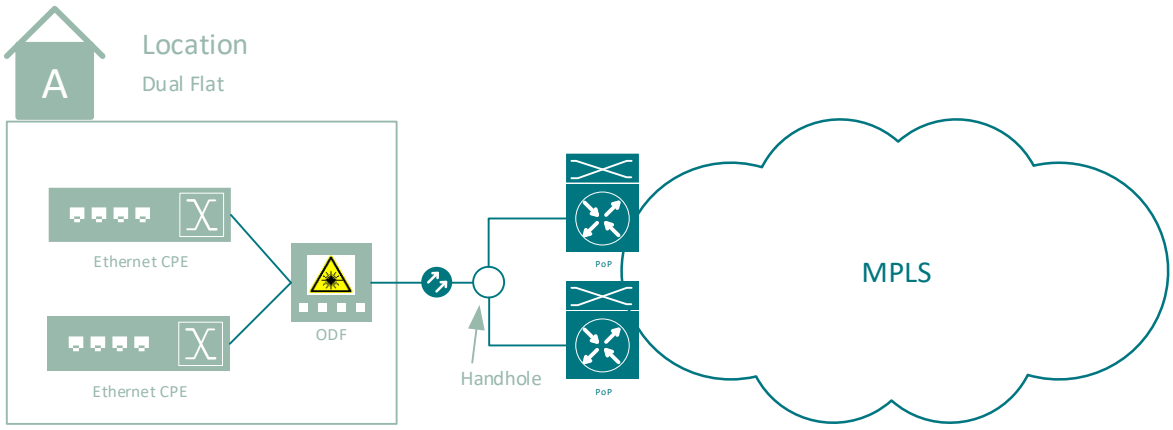
The customer location is connected via two fully separated fiber-optic routes to an Ethernet PoP location, with both fiber-optic routes being located at a distance of at least five meters from one another. The customer is responsible for performing switching between the two connections in case of a failure or disaster (failover). This type of connection is only used where a Dual Homed connection is not economically feasible.



Dual Route connection

2.2.4 Dual Flat connection

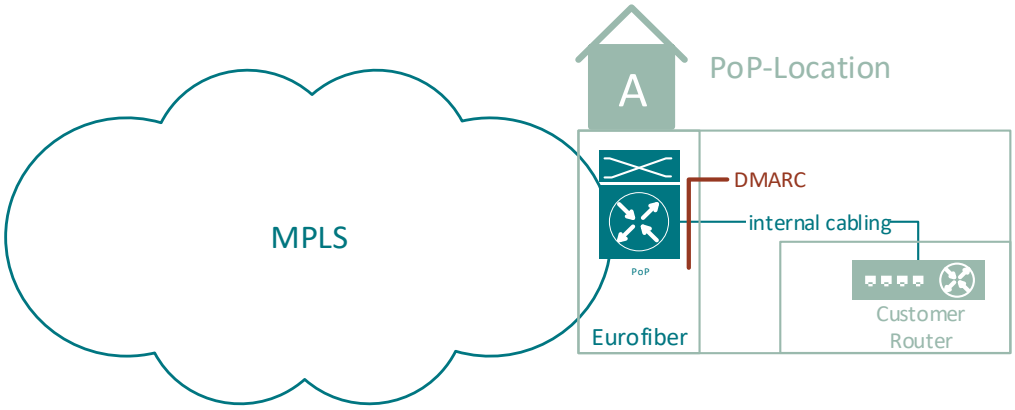
A Dual Flat connection can offer a solution where a geographically separated route to the location is considered too costly. Where a Dual Flat connection is provided, both fiber pairs are located in the same duct. Most of the route follows a geographically separated configuration, with part of the route being configured by means of a flat connection.



Dual Flat connection

2.2.5 PoP connection

Ethernet VPN can be delivered at one or more Eurofiber PoP locations, if required. These PoP locations are usually situated in a datacenter.



PoP connection

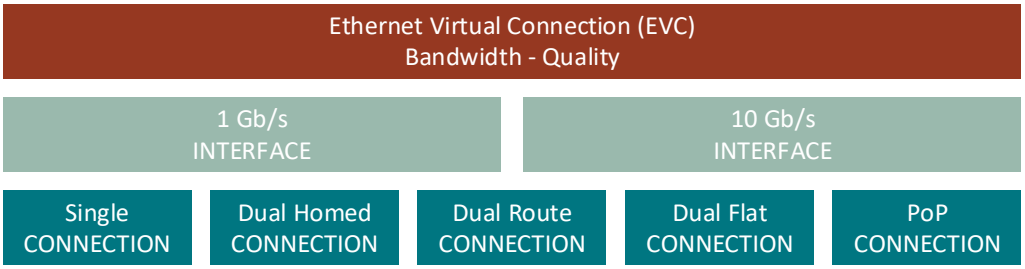
Ethernet VPN is delivered on a port on the Eurofiber switch. In this case, the customer is responsible for the cabling between this port (= Demarcation Point) and the customer's equipment in this PoP location.

2.3 Interface

Eurofiber's Ethernet VPN service is delivered over the nationwide MPLS Network.

The Service is configured with a connection, an interface and one or more Ethernet Virtual Connections (EVCs).

The structure of the Service is depicted in the figure below:



Modular configuration

Eurofiber delivers the service as standard to Customer Premises Equipment (CPE) at the customer location. Ethernet VPN terminates at a port on the CPE, which constitutes the demarcation point.

Ethernet connections are provided with CPE as standard and are available in two rates, with either a 1 Gb/s or a 10 Gb/s interface. The interface bandwidth and, in case of 10 Gb/s, the connected PoP location determine the maximum capacity of the services on the CPE.

The Ethernet service can be combined with Business Internet. These services are provided as standard to an available port on the CPE at the customer location or to an Ethernet PoP location in a Datacenter.

The table below gives an overview of the characteristics of the interface at a customer location and within a PoP location.

The CPE is equipped with multiple customer ports, both electrical and optical. The service is delivered as standard with a 1 Gb/s electrical interface. A 1 Gb/s optical interface is optional and can be provided on request at additional cost. A 10 Gb/s interface is always optical, at a customer location as well as at a PoP location.

In most cases, the CPE will be connected to the PoP with one single fiber strand, unless the interface bandwidth in combination with the fiber length require a fiber pair. A connection without CPE is always delivered as a single fiber.

	Demarcation	Interface | connector | cable type	Range	1 Gbit/s	10 Gbit/s	Client location	Client Ethernet PoP	NNI Site
1	CPE 1G	10/100/1000Base-T RJ-45 | UTP	90 meters	Standard	n/a	√		
2	CPE 1G	1000Base-SX LC | Multimode	550 meters	Optional	n/a	√		
3	CPE 1G	1000Base-LX LC | Mode simple	10 km	Optional	n/a	√		
4	CPE 10G	10/100/1000Base-T RJ-45 | UTP	90 meters	Standard	n/a	√		
5	CPE 10G	1000Base-SX LC | Multimode	550 meters	Optional	n/a	√		
6	CPE 10G	1000Base-LX LC | Mode simple	10 km	Optional	n/a	√		
7	CPE 10G	10GBASE-SR | LC Multi Mode	400 meters	n/a	√	√		
8	CPE 10G	10GBASE-LR | LC Single Mode	10 km	n/a	√	√		
9	E-POP 1G	1000Base-SX | LC Multi Mode	550 meters	Optional	n/a		√	√
10	E-POP 1G	1000Base-LX | LC Mode simple	10 km	Standard	n/a		√	√
11	E-POP 10G	10GBase-LR | LC Mode simple	10 km	n/a	√		√	√
12	ODF 1G	1000Base-LX/LH SC/APC | Single Mode	10 km	√	n/a	√		
13	ODF 1G	1000Base-EX SC/APC | Single Mode	40 km	√	n/a	√		
14	ODF 1G	1000BASE-ZX SC/APC | Single Mode	80 km	√	n/a	√		
15	ODF 10G	10GBASE-LR SC/APC | Single Mode	10 km	n/a	√	√		
16	ODF 10G	10GBASE-ER SC/APC | Single Mode	40 km	n/a	√	√		
17	ODF 10G	10GBASE-ZR SC/APC | Single Mode	80 km	n/a	√	√		

Physical Interface specifications

2.4 Ethernet virtual connection

An EVC (Ethernet Virtual Connection) is a virtually defined Ethernet connection between locations with a particular bandwidth, quality and topology.

2.4.1 Bandwidth

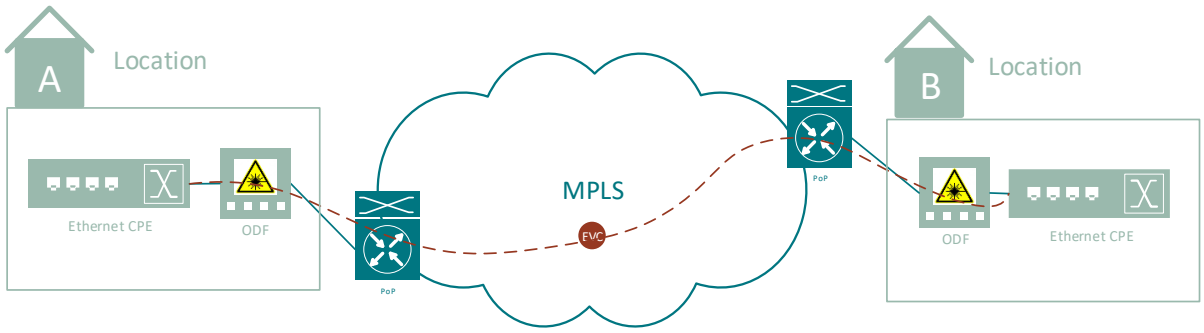
The EVC bandwidth can vary from 10 Mb/s up to 10Gb/s. The number of EVCs and the maximum bandwidth that can be configured on the CPE differs according to the type of CPE.

2.4.2 Topology

The Ethernet service can be purchased in either an E-Line (point-to-point). The EVC configuration comprises different EVC legs (one EVC leg per location). An EVC leg is a connection between a location and the Eurofiber Ethernet network.

E-Line

A point-to-point EVC configuration between two locations (customer location, datacenter or NNI) is defined as an E-Line[2] configuration.



E-Line Configuration

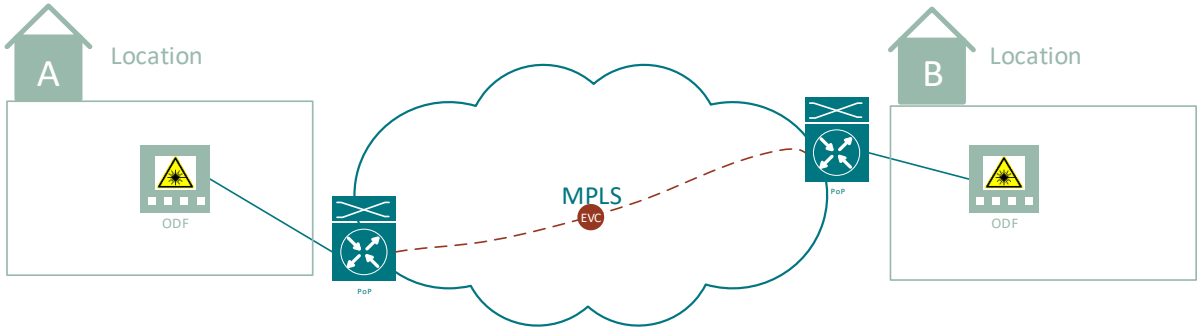
Eurofiber provides two types of E-Line configuration:

a. Ethernet Virtual Private Line (EVPL) is delivered with CPE as standard; delivery without CPE is optional.

b. Ethernet Private Line (EPL) can only be delivered without CPE. In this case, only one EVC can be configured.

The main difference between EVPL and EPL concerns L2 protocol transparency, with EPL having no restrictions in this respect. Further details are provided in the technical specifications.

The figure below depicts the principle of an EPL configuration.



EPL Configuration

[2] E-Line is defined by the MEF, see also www.MEF.net

2.5 Ethernet Interconnect (E-NNI)

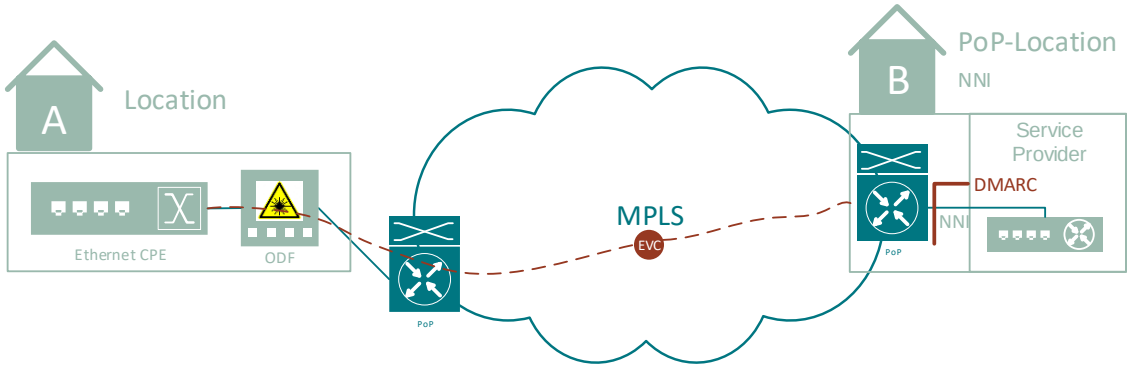
E-NNI is the abbreviation for Ethernet Network-to-Network Interface and is used to denote the connection between one or more customer locations and the infrastructure of a Service Provider[3] or the network of another telecommunications provider. An E-NNI can also be used in a configuration that provides for trunked delivery of several EVCs (on one logical port).

A Service Provider may purchase a single NNI service, where all the connections are aggregated as an E-Line on a single port, or may alternately purchase a dual E-NNI. The latter is expressly advised, since it allows for each terminating location to be connected via an E-LAN configuration with both NNI ports. The Service Provider is responsible for the Failover between both NNI ports.

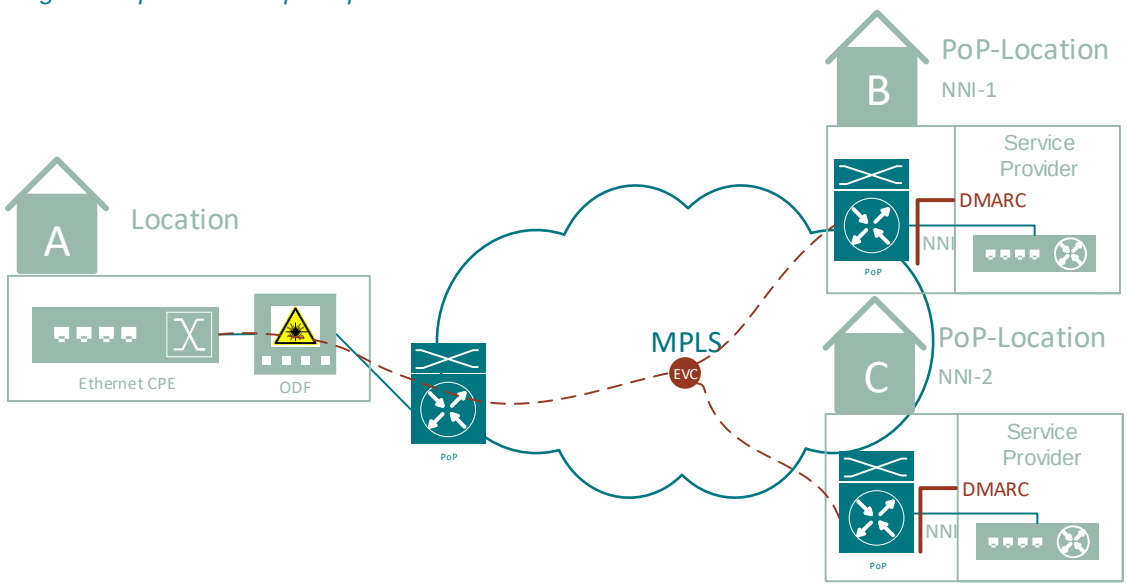
Each type of Service with the exception of an EPL configuration can be delivered to an NNI port. Eurofiber leaves the so-called S-tag unchanged on an NNI port in order to permit the traffic flows of the individual customer locations to be distinguished.

The traffic is not tunneled on an NNI port. This means that incoming customer traffic must be delivered as tunneled traffic.

Eurofiber's E-NNI service is configured to accept jumbo frames with a MTU size of 9000 bytes (IP packet size excluding Ethernet header and tags).



Single NMI port service principal



Dual NNI port service principle

[3] The Service Provider shall be the Customer in the case of wholesale activities

2.5.1 E-NNI Bandwidth Options

The E-NNI service is available in 3 different bandwidths as depicted in the table below.

E-NNI Bandwidth (Gb/s)	Port Count
1G	1 x 1G
10G	1 x 10G
100G	1 x 100G

Bandwidth Options E-NNI

3 Demarcation

An ODF is installed at the building entry point by Eurofiber for the Ethernet VPN service. The service is delivered as standard by means of CPE (demarcation point) that is installed in the customer cabinet, not more than 100 meters from the building entry point. Eurofiber is responsible for providing the cabling between the ODF and this CPE. Additional costs may be charged, depending on the situation. Certain situations may result in Eurofiber not being able or permitted to install the aforementioned cabling. In this case, the customer will have to assume full responsibility for installing the (internal) cabling itself. Internal cabling is then excluded from the scope of the SLA. A failure or other incident affecting the internal cabling will, in that case, also not affect the availability of the service and can never result in Service Credits being provided.

If the service is provided without CPE (EPL configuration), then the ODF is the demarcation point.

If Ethernet VPN is provided at a PoP location via a port on a Eurofiber switch, the customer is responsible for the cabling between this port (demarcation point) and the customer's equipment in this PoP location.

4 Technical specifications

The technical specifications of the E-Line is given in the following two tables. A distinction is made between Ethernet Virtual Private Line/LAN and Ethernet Private Line.

Servie type	E-Line (Ethernet Virtual Private Line)
EVC quality	Premium
Available bandwidths (Mb/s)	10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000
Throughput guarantee[4]	99,9 %
Customer demarcation	CPE or ODF
VLAN transparency	Yes
Frame Delay	<50 ms
Frame Delay Variation (Jitter)	< 5 ms
Frame Loss Ratio	< 0,1%
Supported protocols	All OSI layer 3 protocols
	The most common OSI layer 2 protocols[5]
Tunneled traffic	Tunneled OSI layer 2 control frames will not be accepted on the UNI
Max. # MAC addresses	E-Line: unrestricted
MTU size (standard)	1596 bytes
MTU size	9000 bytes

[4] Throughput guarantee includes frame header

[5] CDP, STP, VTP and LACP are the protocols currently supported. The 802.1ea (mac-sec) protocol is not supported. An up-to-date list of tested OSI layer 2 protocols is available on request. An untested protocol can be tested for transparency on request.

(jumbo frame, optional)	
Priority (IEEE802.1p)	Customer P-bits will not be changed and will be transmitted without the value affecting the prioritization of the traffic in the Eurofiber Network.
Ethertype	0x8100 or 0x9100
Maximum Broadcast / Multicast traffic	5% of the interface bandwidth

EVC specifications (EVPL and EVPLAN)

Servie type	**E-Line (Ethernet Virtual Private Line)**
Available bandwidths (Mb/s)	10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000
Throughput guarantee	99,9 %
Customer demarcation	ODF
VLAN transparency	Yes
Frame Delay	<50ms
Frame Delay Variation (Jitter)	<5ms
Frame Loss Ratio	< 0,1%
Supported protocols	All OSI layer 2 and layer 3 protocols
Max. # MAC addresses	Unrestricted
MTU size (standard)	1596 bytes
MTU size (jumbo frame, optional)	9000 bytes
Ethertype	0x8100 or 0x9100
Maximum Broadcast / Multicast traffic	100% of the interface bandwidth

EVC specifications (EPL)