

# Service description

- ETHERNET



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# 1 General

The Ethernet service is part of Trafikverket Carrier Network capacity service portfolio that Trafikverket is offering based upon our own optical fibre network.

Trafikverket network capacity provides a high availability service, delivered with the same high availability requirement, flexibility, and standardization as the critical functions a data communication network, in a modern society, must contain.

All services are managed and supported 24 hours per day, 7 days per week, and 365 days per year from our Network Operator Centre (NOC), where you will have the ability to select the bandwidth and availability that meet your business requirements.

## 2 Ethernet service summary

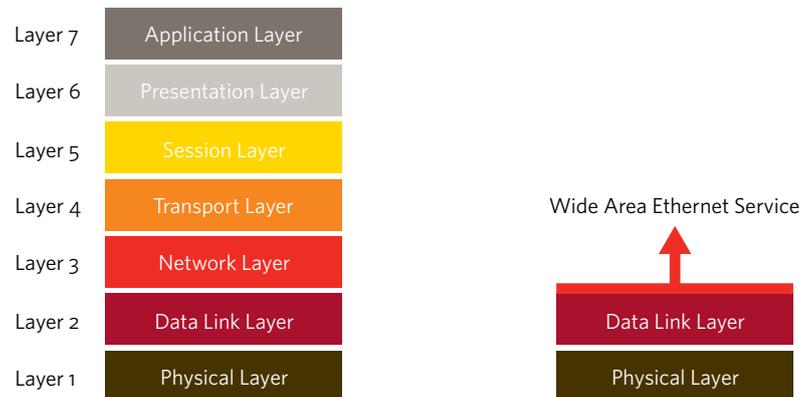
All Trafikverket Ethernet services are built with Carrier Ethernet technology – where ‘carrier’ indicates its usage and additional capabilities compared with Local Networks such as Ethernet LAN. These additional capabilities enable end-users to have flexible bandwidth increments and add new services using one technology. In order to serve as a service delivery platform for Wide Area Network (WAN) carrier services, Carrier Ethernet uses many of Ethernet LAN’s technologies as well as addressing these five attributes: Standardization, Quality of Service, Service Management, Scalability and Reliability.

Between the Transport technology and the WAN application lies the Carrier Ethernet Service. It is both a infrastructure technology and a service delivery technology.

Application	Site-to-Site L2 VPN	Private Line	IP VPN	IPTV	Internet Access	Video on Demand	Cloud Service	MBH
Ethernet Connectivity Service Type	E-Line, E-LAN, E-Tree, E-Access							
Transport Technology	Ethernet over Fiber	Ethernet over SDH/SONET	Ethernet over PDH	Ethernet over MPLS	Ethernet over WDM	Ethernet over dry Copper	Ethernet over μWave	

The Carrier Ethernet service can serve as an OSI Layer 1 (physical layer) transport technology as defined by IEEE. The service could also serve as a Ethernet access for IP applications and services such as IP-VPN and Internet access .

The applications enabled by a Carrier Ethernet network infrastructure include Ethernet Layer 2 networking and Ethernet access to IP (Layer 3) services.



Trafikverket Ethernet Services are based on Metro Ethernet Forum definitions, and our current service portfolio provides:

- Ethernet Private Line (EPL) – Point to Point
- Ethernet Virtual Private Line (EVPL) – Q
- Ethernet Virtual Private Line (EVPL) – QinQ
- Ethernet interconnect – Q
- Ethernet interconnect – QinQ

The basic services above can be adapted to your business needs, regarding both bandwidth and availability. The basic services can also be ordered with a variety of defined additional services, such as:

- Local Tail Network access
- Customer Premises Equipment
- Telehousing / Co-location

Ethernet Services ordered from Trafikverket have a well defined UNI (User Network Interface), which defines the demarcation point of the delivered service, the basic Ethernet services and, where applicable, the additional services are backed up with a Service Level Agreement as well.

### 3 Customer added value

Trafikverket makes a difference every day. When you engage Trafikverket as a supplier for your communication service, you will benefit from our robust network designed for vital public functions.

Additionally, you can improve your own competitiveness using our other services, backed with our highly experienced and engaged personnel. The Ethernet services are:

**Wide range of speeds**

Extending from 2 Mbps to 100 Gbps, with a choice of bandwidth increment options.

**Choice of interface sizes**

Allows organisations to choose between Ethernet, Fast Ethernet (100 Mbps), or Gigabit Ethernet (1 -, 10 -, 40- and 100 Gbps) depending on their requirements.

**Protected and restored service options**

Give customers a choice of various resiliency options depending on their business continuity requirements.

**Service level agreements**

Provide customers with service levels for service delivery and availability.

**Support when you need it : 24/7/365 customer service**

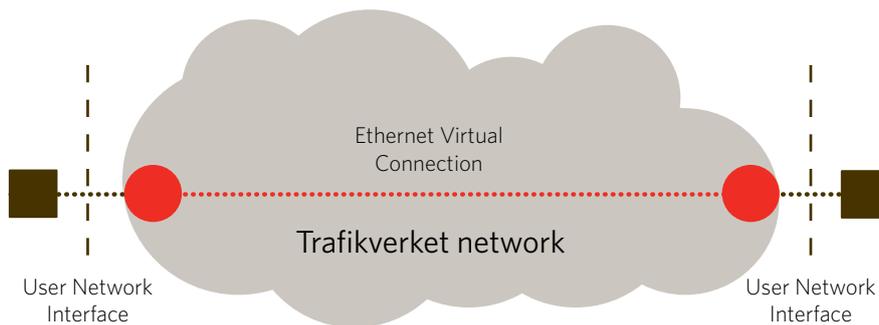
Makes specialist technical support available whenever it is needed.

## 4 Brief description of basic services

### 4.1 Ethernet Private Line (Trafikverket EPL)

#### Point to Point

Trafikverket EPL service is ideal for companies that require either dedicated bandwidth or greater data privacy, or both. The service operates at the Open Systems Interconnection (OSI) model Layer 2 and, as a result, gives you the ability to control your network routing and manage your own security. EPL is delivered over Trafikverket's extensive cable assets. EPL is a dedicated and reliable Ethernet connection that provides VLAN transparency and flexible speeds.



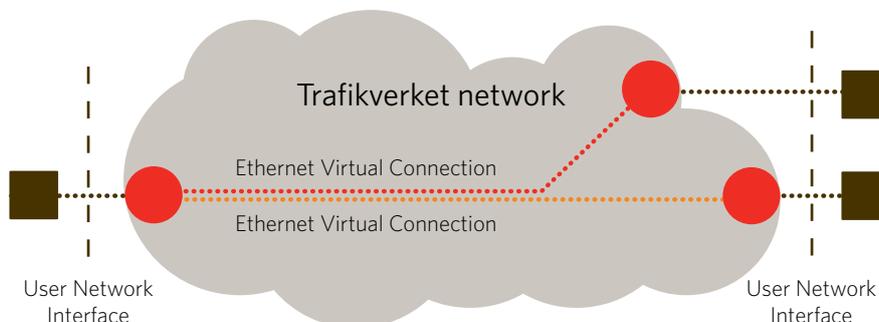
### Ethernet Private Line (EPL)

Trafikverket EPL is your service, if you wish to bypass the public Internet and transfer data safely and securely over our private network. Key features:

- Replaces a Time Division Multiplex (TDM) Private line
- Dedicated UNIs for Point-to-Point connections
- Single Ethernet Virtual Connection (EVC) per UNI
- The most popular Ethernet service due to its simplicity

### 4.2 Ethernet Virtual Private Line (Trafikverket EVPL)

This service is ideal if your organisation requires robust links between regional offices and company headquarters. Ethernet Private Virtual Line (EVPL) is a Point to Point service connected to one aggregated port UNI, which can terminate at various end-points and carry various services.



### Ethernet Virtual Private Line (EVPL)

EVPL is flexible by providing Point to Point and Point to Multipoint configurations enhanced with multi-service feature availability for key data, voice, telepresence, content warehousing, email applications, and streamed live content.

Trafikverket Ethernet EVPL service is able to differentiate traffic between end-points. The initial design of Ethernet as a LAN technology did not isolate customer traffic when crossing a provider's network. Several significant steps were made in order to enable this isolation.

**EVPL Q**

The IEEE 802.1Q standard describes a virtual LAN (VLAN). Each VLAN is identified by a Q-tag (also known as a VLAN tag or VLAN ID) that identifies a logical partition of the network that isolates the different communities of interest.

**EVPL QinQ**

Another important feature is the introduction of an additional tag that separates the VLAN ID in the provider's network from the VLAN ID in the customer's network. To do this, the S-tag was added to the Ethernet frame. This technique is also known as QinQ.

Trafikverket EVPL service can support Customer networks with both Q and QinQ handling. These services are named: Trafikverket EVPL-Q and Trafikverket EVPL-QinQ

**4.3 Trafikverket Ethernet interconnect**

This service is ideal for those who want to increase their service footprint using Trafikverket's large Fibre optic assets in a cost effective, future-proofed manner, and with quick implementation. It allows connectivity to remote end points through a well defined interconnect.

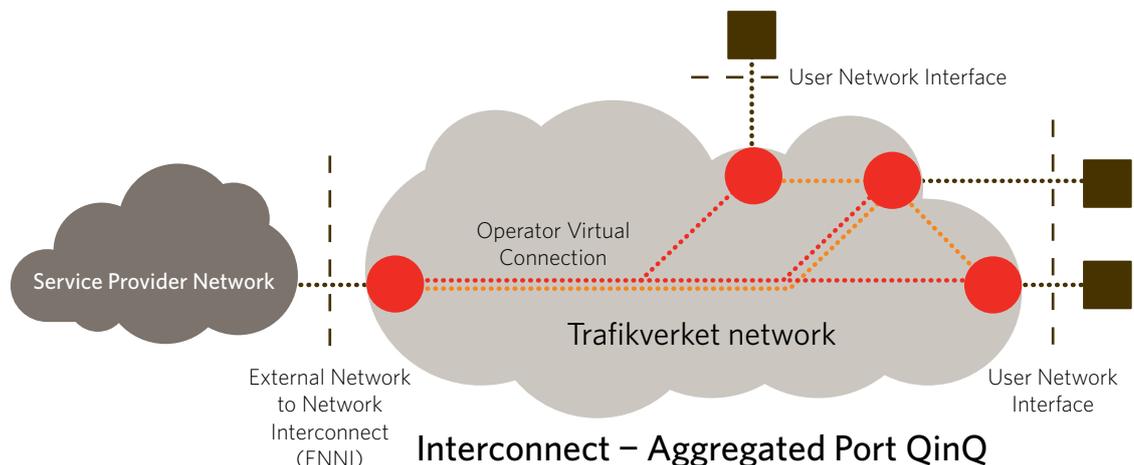
When the interconnect is in place, it is easy to add more end customers/sites to your service.

**Interconnect - Q**

This service give you access to the Trafikverket Network using a Gigabit Ethernet port (1 or 10 Gbps), with the possibility to add new sites to your network separated with VLAN.

**Interconnect - QinQ**

The service is ideal for customers who want to have QinQ possibilities in the interconnect. The interconnect will be set up using External Network to Network Interconnect (ENNI).



## 5 Brief description of Additional services

### 5.1 Local Tail (Network access)

The basic service includes delivery to Trafikverket Point of Presence, in each and every location. At this point there is access to the Ethernet service network. The service may also be delivered to other places where there is no access to the network through the addition of a local tail (Network access).

This additional service covers the technical equipment and the cabling required to deliver basic services at a different address where direct access to the Ethernet service network is not present.

Trafikverket provides a connection via fiber access, copper access, or wireless access, including the terminating equipment required to deliver the service in other locations. The technology used to realize the access is geographically and distance dependent. The composite service function for the customer will be the same as the basic service.

In-house cabling is not included in the service; this is handled by the customer.

### 5.2 Customer Premises Equipment

The basic service can be equipped with Customer Premises Equipment (CPE). This equipment is owned by Trafikverket, and will give Trafikverket the ability to supervise and monitor the network the entire way between the end points of the service. This will speed up fault isolation and give the service a well defined demarcation of responsibilities. Moreover, depending on the requirements of the interface, a CPE may be required.

At the demarcation point where the CPE is installed, it is the customer's responsibility to connect to the Local Area Network (LAN) with the correct parameter setup. The customer is also responsible for providing the power supply (the service's availability is dependent on the power nature), correct climate, patch cables between equipment, and for Trafikverket to gain access to the CPE and relevant premises for installation, troubleshooting, operation and maintenance, and disconnections. Errors within the client area of responsibility are not included when calculating the unavailability time.

### 5.3 Telehousing / Co-location

Trafikverket is able to provide customers Telehousing / Co-locations, where customers can benefit from Trafikverket's high quality infrastructure and technical buildings.

The service is only offered as an add-on for premises where Ethernet service is unavailable. The service is not offered as a stand alone service, and can only be offered together with a network capacity lease service.

Entry into the Trafikverket technical sites requires a special certification. Customers requiring access to their equipment need a certified engineer from Trafikverket as a doorway service.

The service components are:

- Floor space
- Shelf
- – 48 VDC A + B power
- Operator Trunk
- Access (doorway)

## 6 Pricing

The price structure for the Ethernet service is:

- Installation fee
- Recurring rental fee

The above pricing structures apply to the standard components of the network solution. Any agreed-to changes or deviations could mean a one-time construction charge and/or a change in the annual fee.

Pricing for the service depends on the following parameters:

- Basic Service
- Additional Service
- Service level, SLA
- Contract term and agreed volume of service.
- Need for adaptation of base service due to function or other requirements.

## 7 Service levels

To meet our customers' individual requirements regarding availability and service, we offer high availability guarantees. You could choose minimum levels from 99.5% to 99.99%. This is also offered for Local Tails, provided that a service level corresponding to the levels below has been purchased: Bronze, Silver, Gold or Platinum.

Service Level	Availability	Maximum downtime per year during service time (hours)	Service starts within hours)	Maximum repair time per error during service time (hours)	Service Availability	Operating time
Platinum	99.99	52 min	20 min	52 min	00-24 Mon-Sun	24 hours a day, 7 days a week
Gold	99.95	4.4	2	4.4	00-24 Mon-Sun	24 hours a day, 7 days a week
Silver	99.8	17.5	4	8	00-24 Mon-Sun	24 hours a day, 7 days a week
Bronze	99.5	43.8	6	12	00-24 Mon-Sun	24 hours a day, 7 days a week

The Platinum service level has a maximum repair time of 52 minutes, 24 hours a day, 7 days a week. The maximum downtime per year will not exceed 52 minutes. It does not include guaranteed node diversity. Platinum with node diversity is a supplementary service and is dealt with separately, possibly on payment of an additional charge.

## Appendix 1: Technical specifications

Trafikverkets Ethernet Service	Ethernet Private Line (EPL) - Point to Point	Ethernet interconnect - Q	Ethernet interconnect - QinQ	Ethernet Virtual Private Line (EVPL) - Q	Ethernet Virtual Private Line (EVPL) - QinQ
Bandwidth (= CIR)	2Mbps - 100Gbps	2Mbps - 10Gbps	2Mbps - 10Gbps	2Mbps - 10Gbps	2Mbps - 10Gbps
Interface	10/100Base T, 10/100/1000 BaseT, 100 Base FX, 1000Base LX, 1000 Base SX, 1000 Base ZX, 10G Base LR, 40G Base LR4, 100G Base LR4	1000Base T, 1000Base LX, 1000 Base SX, 1000 Base ZX, 10G Base LR	1000Base T, 1000Base LX, 1000 Base SX, 1000 Base ZX, 10G Base LR	10/100Base T, 10/100/1000 BaseT, 100 Base FX, 1000Base LX, 1000 Base SX, 1000 Base ZX, 10G Base LR	10/100Base T, 10/100/1000 BaseT, 100 Base FX, 1000Base LX, 1000 Base SX, 1000 Base ZX, 10G Base LR
Link protocol	untagged, C-tag	C-tag	S-tag	untagged, C-tag	untagged, C-tag, S-tag
Max frame size	9600 Bytes (1522 Bytes with external Ethernet access)	9600 Bytes	9600 Bytes	9600 Bytes (1522 Bytes with external Ethernet access)	9600 Bytes (1522 Bytes with external Ethernet access)
Service Level Agreement - SLA	99.5% to 99.99%	99.5% to 99.99%	99.5% to 99.99%	99.5% to 99.99%	99.5% to 99.99%
VLAN range	1-4094 (ID = 4042 is used for Trafikverket management)	1-4094 (ID = 4042 is used for Trafikverket management)	1-4094 (ID = 4042 is used for Trafikverket management)	1-4094 (ID = 4042 is used for Trafikverket management)	1-4094 (ID = 4042 is used for Trafikverket management)
Frame Delay - FD	<40ms	-	-	<40ms	<40ms
Frame Delay Variation - FDV	<5ms	-	-	<5ms	<5ms
Number of MAC addresses	NA (may be restrictions depending on access)	NA (may be restrictions depending on access)	NA (may be restrictions depending on access)	NA (may be restrictions depending on access)	NA (may be restrictions depending on access)
Monitoring	24/7/365	24/7/365	24/7/365	24/7/365	24/7/365
Ethertype/TPID		-	8100, 88a8	-	8100, 88a8





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