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Elisa Ethernet Hub and Spoke Service

Elisa Ethernet Hub and Spoke is a modern and cost effective service for implementing multiple point-to-point transmission channels using Ethernet technology. The hub and spoke model means that several spoke sites are connected to a single hub site in a star like topology. Each spoke connection is associated with a separate virtual connection at the hub site. The Ethernet virtual private connections generated for the customer between spokes and the hub are isolated from each other, so traffic within each virtual private connection is secured. Elisa Ethernet Hub and Spoke service is available with multiple connection speeds nationwide in Finland and in selected International destinations.

Content of the service

Ethernet Hub and Spoke solution is composed of one hub and multiple spokes which both are referred as subscriptions. The subscriptions are delivered to Customer sites, and one logical channel (EVC, Ethernet Virtual Connection) is created from each spoke site to the hub site. Each EVC has a point-to-point topology, meaning that spokes can not send traffic directly to each other.

The content of Ethernet Hub Subscription is the following:

- Port on Elisa's Provider Edge Router, with 1 Gbit/s, 10 Gbit/s or 100 Gbit/s speed, depending on the service which has been subscribed
- Elisa SLA Basic Service Level
- Termination of the EVC which originate from the separately ordered spoke subscriptions. Each spoke subscription is associated with an individual EVC at the hub subscription

The content of the Ethernet Spoke Subscription is the following.

- Connection through available technology (selected by Elisa) from Elisa's backbone network to customer location. The handover interface of the is single mode fiber in the building distribution centre depends on the capacity and the length of the access fiber:
  - Maximum 1 Gbit/s capacities 1000Base-BX10-D, therefore CPE needs the 1000Base-BX10-U interface
  - Maximum 1 Gbit/s capacities and when the access fiber length exceeds 10 km, the handover interface is 1000Base-LX
  - 2 – 10 Gbit/s capacities 10GBase-BX10-D, therefore CPE needs the 10GBase-BX10-U interface.
  - 2 – 10 Gbit/s capacities and when the access fiber length exceeds 10 km, the handover interface is 10GBASE-ER
- Port on Elisa's Provider Edge Router, with agreed port speed
- One EVC towards the hub subscription which the Customer has earlier separately ordered
- Elisa SLA Basic Service Level

Service can be complemented with various additional features and/or services, as described later in this document. The service is technically based on Elisa's domestic and international Multiprotocol Label Switching (MPLS) network. In the Elisa's MPLS-network, the redundancy of the core network equipment are secured either at the device level - power supply, control/processor card - or with duplicated devices. Backbone fiber connections between equipment are diversified. Logical resiliency is based on the use of different protocols and mechanisms to ensure quick re-routing in case of failure.

Reference model for Elisa Ethernet Hub and Spoke Service

Example which consists of one hub subscription and two spoke subscriptions.
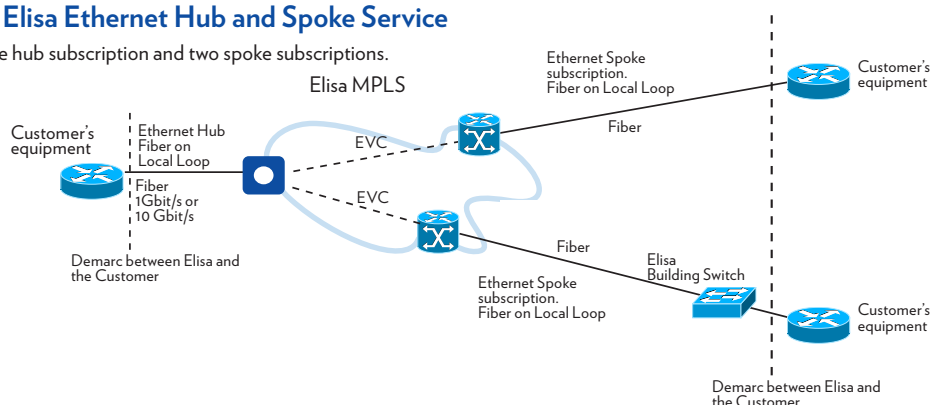
The handover interface is confirmed in the delivery confirmation/notification of completion.

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Q-in-Q Frame Structure is used on the hub subscription, meaning that the outer number field (q-tag) is used for identifying the relevant spoke subscription. The inner q-tag is transparent and can be freely set by the customer.
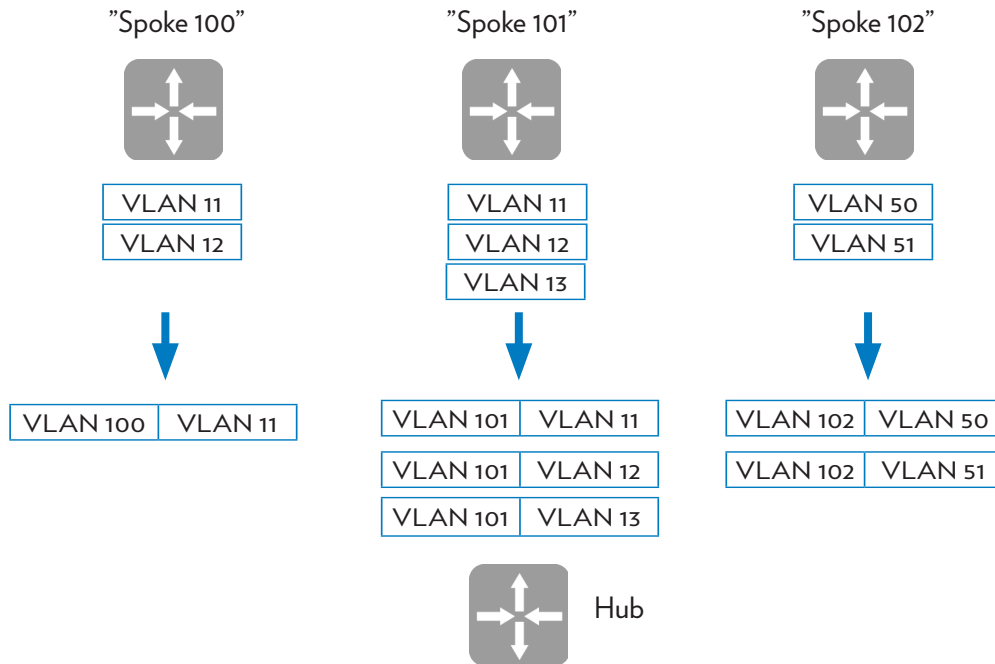
Logical speeds in the spoke subscriptions are implemented with physical port speeds of 10 Mbps, 100 Mbps, 1 Gbps or 10 Gbps at the customer interface, and the amount of traffic transmitted through the backbone network is limited to the agreed speed by means of software. The customer must configure Traffic Shaping into his equipment if the speed of the service ordered differs from the physical port speed.

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Features of the Hub Subscription	Value
Connection speeds	1 Gbit/s, 10 Gbit/s or 100 Gbit/s
Symmetry	Ethernet hub subscription is symmetric and of full-duplex type.
MAC layer	IEEE 802.3-2008
Number of EVC (Terminated Spokes)	Maximum 1000
Handling of customer's VLANs	Outer q-tag is used for identifying the related spoke subscriptions. All inner VLAN values 1-4094 are transferred through unchanged.
Handling of customer's p bits	Transparent, the network does not change the p bit values.
Traffic Class of Service (CoS)	Available as an additional service with a separate service description. Otherwise the traffic will be of the Best Effort type.
Number of MAC addresses supported.	Unlimited
Layer2 Control Protocols	Bridge Block: Unconditionally transmitted GARP Block: Unconditionally transmitted All LANs Bridge Management: Unconditionally transmitted Bridge Block of protocols with destination MAC addresses 0x0180c2000000 through 0x0180c200000f. GARP Block of protocols with destination MAC addresses 0x0180c2000020 through 0x0180c200002f. All LANs Bridge Management Group protocols with destination MAC address 0x0180c2000010. 802.1x tunneling and LLDP nearest-bridge agent's tunneling are not supported. Non-standard L2CP traffic case by case basis.
Handling of Ethernet Broadcast frames	Normal broadcasting within the EVC. Traffic may be restricted in the case of a broadcast storm.
Handling of Ethernet Multicast frames	Normally transmitted within the EVC. Traffic may be restricted in the case of a multicast storm.
Service topology	Star like hub and spokes topology. All spokes communicate with the hub only. For each spoke, an individual EVC is reserved at the hub site.
Geographical availability	Domestic and International. The technical features of international services will be determined separately on a case-by-case basis.
MTU size	1652 bytes including a check sum (CRC) and without the preamble field, as illustrated in the pictures below. A larger MTU size is available as an additional service after case specific investigation, if allowed by the access technologies used in the customer network. MTU size limitations on the spoke subscriptions may affect the MTU within each individual EVC.

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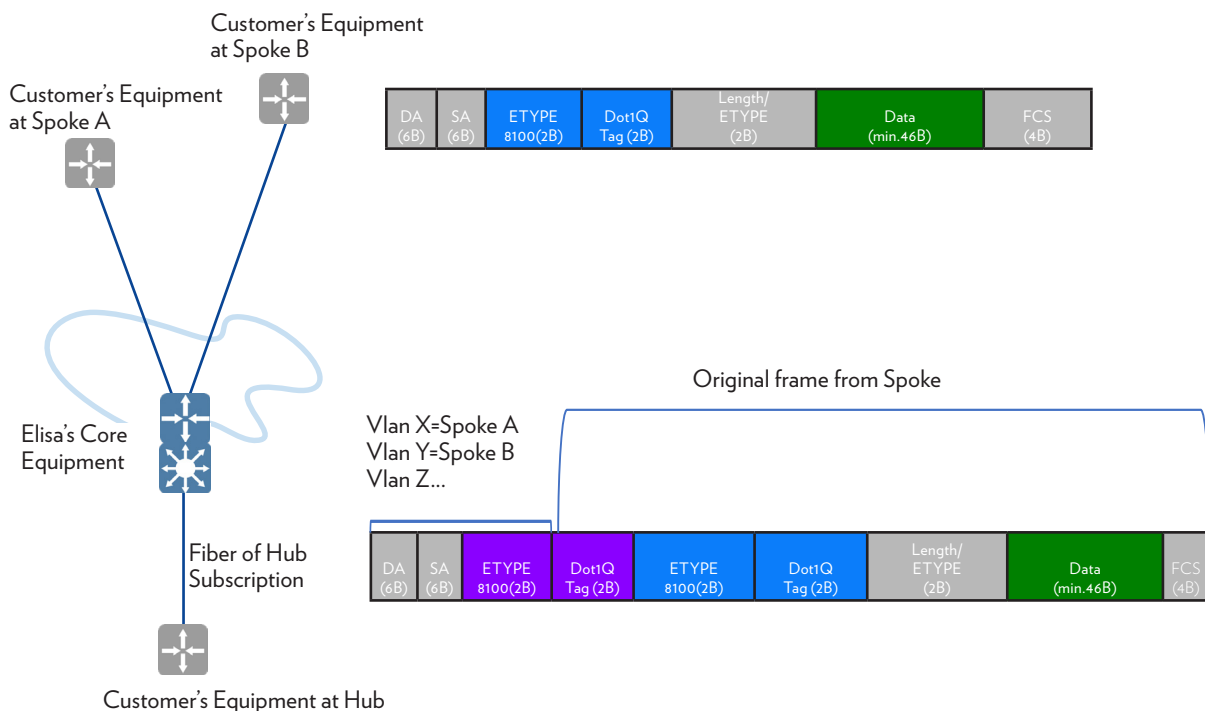| Technical features of the spoke connections	Value
Connection speeds	2 Mbit/s – 10 Gbit/s
Symmetry	Ethernet spoke subscriptions are always symmetric and of the full-duplex type.
MAC layer	IEEE 802.3-2008
Number of EVC between the End Points	One.
Handling of customer's VLANs	Outer q-tag is used for identifying the related spoke subscriptions. All inner VLAN values 1-4094 are transferred through unchanged.
Handling of customer's p bits	Transparent, the network does not change the p bit values.
Traffic Class of Service (CoS)	Available as an additional service with a separate service description. Otherwise the traffic will be of the Best Effort type.
Number of MAC addresses supported.	Unlimited
Layer2 Control Protocols	Bridge Block: Unconditionally transmitted GARP Block: Unconditionally transmitted All LANs Bridge Management: Unconditionally transmitted Bridge Block of protocols with destination MAC addresses 0x0180c2000000 through 0x0180c200000f. GARP Block of protocols with destination MAC addresses 0x0180c2000020 through 0x0180c200002f. All LANs Bridge Management Group protocols with destination MAC address 0x0180c2000010. 802.1x tunneling and LLDP nearest-bridge agent's tunneling are not supported. Non-standard L2CP traffic case-by-case basis.
Handling of Ethernet Broadcast frames	Normal broadcasting within the EVC. Traffic may be restricted in the case of a broadcast storm.
Handling of Ethernet Multicast frames	Normally transmitted within the EVC. Traffic may be restricted in the case of a multicast storm.
Service topology	Point-to-Point. At hub, traffic from multiple spokes is terminated, each spoke being associated with a separate virtual connection.
Geographical availability	Domestic and International. The technical features of international services will be determined separately on a case-by-case basis.
MTU size	1648 bytes for fiber subscriptions including a check sum (CRC) and without the preamble field, as illustrated in the pictures below. A larger MTU size is available as an additional service after case-specific investigation, if the available access technology enables such MTU size. Older copper subscription implementations had a MTU size limitation of 1534 bytes, and their MTU size cannot be increased.

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Examples of possible frame structures are illustrated in the pictures below. The frames are shown in the format in which Elisa's customer sends it to or receives them from the network.

Below are three examples of frame structures. The maximum length of the Data field depends on the access technology (fiber or copper), as described in the table above.

- 802.3 frame
- 802.1q frame
- 802.1q frame, with Customer's MPLS label

Spoke   Hub
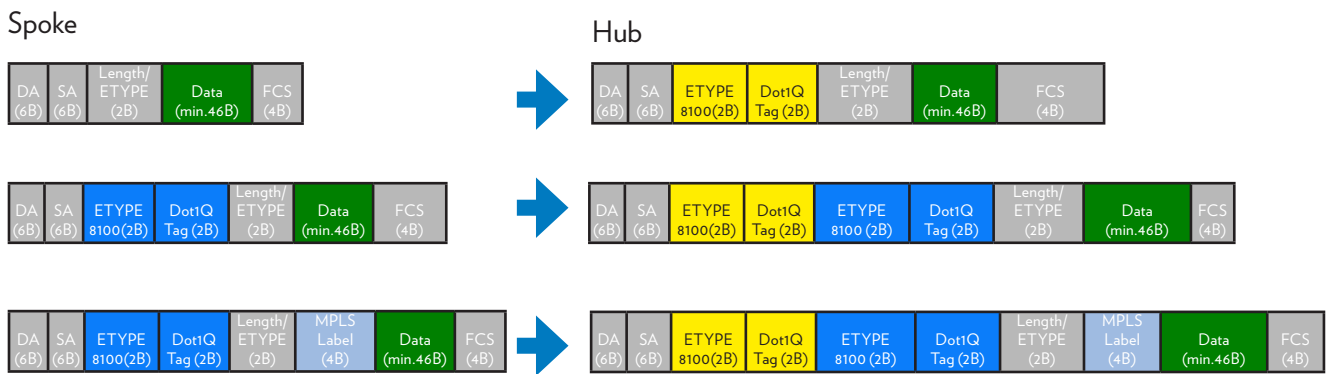
At hub subscription, each frame format has one additional VLAN field, as seen in picture above. This VLAN identifier (or q-tag) is used for identifying the related spoke subscription. This arrangement is illustrated in the diagram below.

Customer's Equipment at Spoke B

Customer's Equipment at Spoke A

Original frame from Spoke

Elisa's Core Equipment

Vlan X=Spoke A
Vlan Y=Spoke B
Vlan Z...

Fiber of Hub Subscription

Customer's Equipment at Hub

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The default traffic class is basic traffic (best effort), which parameters are:

Typical delay (fiber connections)	5-30 ms
Typical delay (copper connections)	15-60 ms
Delay variations (JITTER)	Not defined
Maximum package loss	Not defined

The above values apply when the customer's traffic profile matches the ordered capacity. Although nominal quality parameters are not guaranteed for basic traffic, the basic traffic category has been designed for use by typical data applications. The basic aim is that the average basic traffic throughput is at least 70% of the connection speed, with 1000 bytes test packages and a measuring sequence of at least 15 minutes. The parameters for other traffic classes are listed in the Elisa Ethernet CoS service description.

Additional services

The additional, optional services for the Elisa Ethernet Hub and Spoke Service include:

- Class of Service (CoS) for Ethernet traffic
- International Services
- SLA Special Service Levels
- Access Backup Service
- Dual-fiber Handover
- NNI Protection Service
- Customer Premises Equipment

Class of service (CoS) for Ethernet traffic

Applications requiring a special CoS for Ethernet traffic typically include:

- Voice over IP
- Video conferences
- Terminal sessions or IT applications especially sensitive to delay or packet loss

The CoS for Ethernet traffic is defined on a case-specific basis with the Elisa's specialists to ensure that the implementation meets the customer's requirements.

There are four service categories to choose from:

- Gold – Designed for Real Time applications, like for IP voice transfer (VoIP, Voice Over IP).
- Silver – Designed for Multimedia, like for video conferences, for example.
- Bronze – Traffic class for other critical data.
- Basic traffic category – Best Effort traffic class

The quality parameters and classification rules of the various traffic categories are described in a separate Elisa Ethernet CoS service description. The customer is responsible for the setting the p bits values of the Ethernet frame in accordance with Elisa's CoS specifications. If the customer sends more CoS traffic than what it has ordered, Elisa will reserve the right to drop frames that are against the agreement.

International Services

Elisa Ethernet Hub and Spoke services are also available outside Finland within Elisa's international MPLS network. Elisa International partners can be used to extend the services to additional destinations. Services outside Finland may differ from domestic services with regard to their features and levels of service. Overseas subscriptions are priced on a case-by-case basis and their features are defined at the same time. International Ethernet Hub and Spoke solutions are usually delivered on a turnkey basis, in which case network design and project planning are included in the delivery.

SLA Special Service Level

The service includes the Basic Service Level.

Service Level Category	Service Hours Category	Response Time	Repair Time
P0V8h Basic Service Level	P0: Mon-Fri 8 am–4 pm	target 8 h	target 24 h

The Special Service Levels are:

Service Level Category	Service Hours Category	Response Time	Repair Time
P1K6h	P1: Mon-Fri 7 am-6 pm	30 min	6 h
P2K6h	P2: Mon-Fri 7 am–9 pm, Sat 8 am-6 pm	30 min	6 h
P25K6h	P2.5: Mon-Sun 7 am-11 pm	30 min	6h
P3K6h	P3: 24h/365d	30 min	6 h

Service hours refer to the time when fault limitation and repair measures will be carried out.

Response time refers to the time within which actions according to a service request will be started.

Repair time refers to the time within which a fault has been repaired.

The content and application of the service levels are described in more detail in the Elisa SLA service description.
Elisa reserves the right to restrict the number of the service levels offered on a subscription-specific basis in offices where restrictions are imposed by:
- Geographical distances
- Technical quality of the access connection implemented using copper cable
- The limited level of service for the access connection provided by a third party (local network operator)

Access Backup Service

Elisa offers the Access Backup Service at four different implementation models. The service is described in more detail in a separate document.

Dual-fiber Handover

When ordered separately, it is also possible to implement a fiber-based connection (when available) as dual-fiber. In that case, the hand-over in a building's distribution center is single-mode fiber pair, and depending on a capacity either 1000Base-LX or 10GBase-LR.

NNI Protection Service

Using the NNI Protection Service, customers can make the interface (NNI port) between their network and Elisa's network redundant and, in this way, increase the availability of the services purchased from Elisa's network. The service is described in more detail in a separate document.

Customer premises equipment

There are possibility to have L3 customer premises equipment (CPE) delivered by Elisa, when this is pointed out on an order. Elisa owns the CPE and is responsible for its installation with set up configuration and maintenance.

Customer answers for CPE's monitoring and managing together with configuration specifications. Furthermore, customer is responsible for fulfilling the environmental conditions for CPE as stated in place "Requirements and restrictions of the service".

Fault diagnosis and CPE swap process begins from fault notification made by customer (see "User support").

The handover at the customer premise is the LAN interface of the CPE.

CPE offer is in the table below. CPEs are delivered with Cisco IOS release defined by Elisa. After the installation, customer can change IOS to an optimum release over remote management. By default in Elisa's CPE service all CPEs are delivered with Advanced IP Feature License.

Capacity of connection	Elisa CPE
2M-200M	Cisco C1111-8P Integrated Services Router
500M-10Gb	Cisco ASR-920-4SZ-A Series Ethernet Access Switch

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Requirements and restrictions of the service

If the implementation of the service requires the construction of a new physical cable route, the customer is responsible for the cable routes on the plot area. The customer is responsible for ensuring that the condition of the inhouse network in all installation locations allow for the installation of the Elisa Ethernet Hub and Spoke Service.

- Cabling (copper or single mode fiber, depending on the subscription type) from the building's main distribution frame to the final installation location
- Power supply (230V AC) for the possible network terminal
- Sufficient rack or shelf space for the possible network terminal
- Environmental conditions suitable for electrical equipment

The pricing for the Elisa Ethernet Hub and Spoke service is subject to the following restrictions if an availability survey has not been performed in advance:

- The pricing is based on the precondition that an access connections to the customer's office premises exist at both ends and a new physical network (optical fiber) need not be constructed
- The standard pricing is only valid for regions with an access point to Elisa's backbone network

Availability of subscriptions and availability of certain features or additional services may differ, depending on the desired installation address.

Delivery and commissioning of the service

The fiber connection service is installed on the premises ODF using the existing in-house fiber cabling. If the in-house fiber cabling is inadequate, the connection is installed on the premises ODF.

If Elisa 's building switch is located in the delivery address the handover of the service is in the Ethernet port unless otherwise agreed.

Ordering and delivery time

Orders are placed through the Elisa Carrier Services Online order and delivery system. Target-oriented delivery time is 2 weeks from the accepted order in the Elisa's on-net area. Delivery time will be confirmed in the order acknowledgment, also in deliveries where special construction is needed. Elisa and the customer may also agree about another delivery time on a case-by-case basis.

Elisa's network maintenance and change work timetable

Elisa will perform scheduled network maintenance and change work on the second and fourth Wednesday each month at 00:30 a.m.–05:30 a.m. Elisa reserves the right to perform network maintenance and change work as needed. The maintenance and change work are attempted to announce in advance and to minimize outage and downtime of the services.

User support

Elisa's technical support provides assistance in technical issues and case of faults in the service. Fault notifications should be made through the Elisa Carrier Services Online order and delivery system or by phone to the Service Desk (24h), service in English tel. +358 10 26 096, service in Finnish tel. +358 10 804 400.

Data protection

Personal data is processed in the service, such as installation address and contact details for the onsite persons. The personal data is processed for service implementation. Concerning the personal data processed in the service, the telecommunications operator is the personal data controller stated in the data protection legislation and Elisa is the processor.

Personal data processed in the service can be processed outside the EU / EEA area. Elisa ensures that in a country where personal data is processed, the level of data protection is adequate and in accordance with the European Commission's decision, or alternatively, that the transfer is subject to a legally appropriate safeguard measure such as a data transfer agreement in accordance with the EU standard contractual clauses on the transfer of personal data outside the EEA.

Elisa has the right to use subcontractors in the provision of services and in the processing of personal data.

Terms of agreement

Elisa's General Terms for Operator products will be applied to the agreement. Service Description is valid from 1 July 2020.