GTS Ethernet Line

Valid as of 1 March 2011.

1 Content of the service

GTS Ethernet Line is designed for high-speed interconnection local computer networks. It offers an environment providing for transfer of all types of data on a single infrastructure. The service utilises transfer of Ethernet frames within the backbone network of the Provider.

The service is based on transfer of customer's data in the form of Ethernet frames between the Subscriber's Ethernet/Fast Ethernet or Gigabit Ethernet interfaces. In the transparent variant, ever frame is transferred from the source interface to the destination in unchanged form.

GTS Ethernet Line is a complex service monitored by the Provider within the entire backbone network. In addition to the service itself, operational monitoring and maintenance, GTS Ethernet Line also includes survey, project design and installation work for the purpose of service provisioning, as well as the required equipment down to the handover interface.

GTS Ethernet line is designed so as to be compliant with the specifications of the MEF 6.1 and MEF 10.2 standards.

1.1 International GTS Ethernet Line

The international variant of GTS Ethernet Line provides for data communication among the Subscriber's sites located in different countries. Within GTS Central Europe Group, the service is provided in the following countries: the Czech Republic, Slovakia, Romania, Hungary, and Poland. The service can also be offered in other countries in co-operation with the respective partners; some of the parameters and characteristics of the service in those countries may differ from the ones offered for the service in the Czech Republic.

2 Abbreviations and concepts

C-Tag	Subscriber VLAN Tag - VLAN Tag on the side of UNI
C-VID	VLAN ID on the side of UNI
CoS	Class of Service
EVC	Ethernet Virtual Circuit
EVPL	Ethernet Virtual Private Line – non-transparent variant of the Ethernet service
EPL	Ethernet Private Line – transparent variant of the Ethernet service
GARP	Generic Attribute Registration Protocol
MAC address	Medium Access Control address
MEF	Metro Ethernet Forum
MRP	Multiple Registration Protocol
MSTP	Multiple Spanning Tree Protocol
MTU	Maximum Transmission Unit
NNI	Network to Network Interface
OVC	Operator Virtual Connection – EVC section
POP	Point to Presence
RSTP	Rapid Spanning Tree Protocol
QoS	Quality of Service
S-Tag	Service VLAN Tag – VLAN Tag on the side of NNI Central Interface
S–VID	VLAN ID on the side of NNI Central Interface
SLA	Service Level Agreement
STP	Spanning Tree Protocol
UNI	User Network Interface
VLAN	Virtual LAN - Virtual LAN
802.1p	Standard for provision of priorities in Ethernet networks

3 Variants of GTS Ethernet Line

GTS Ethernet Line is fully compliant with the technical specification of MEF 6.1 and it utilises direct interconnection of two termination points – UNI (User Network Interface). The interconnection is established in the Ethernet network by the so-called EVC (Ethernet Virtual Circuit). The service may be configured in the following topologies:

- Point – Point
- Point – Multipoint
- NNI Central Interface

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3.1 Point – Point

The Point – Point topology utilises a single EVC between two sites of the Subscriber's termination points. The service in the Point – Point topology is offered in two variants:

- EPL (Ethernet Private Line)
- EVPL (Ethernet Virtual Private Line)

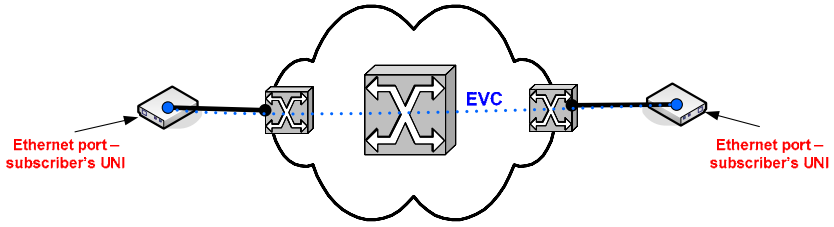

Fig. 1 – Diagram of the service variant in "Point – Point" configuration

3.1.1 Ethernet Private Line – EPL

The GTS Ethernet Line - EPL variant establishes a direct transparent point – point interconnection of two termination points – Subscriber's sites. The interconnection is established in the Ethernet network by an EVC circuit between two termination points of the Ethernet network defined by a physical port at each end of the service. The service provides for high transparency of the transferred Ethernet frames; the level of transparency of the service is to a great extent comparable with digital leased lines.

Detailed characteristics of EPL is provided in Table 1.

3.1.2 Ethernet Virtual Private Line - EVPL

The GTS Ethernet Line - EVPL variant establishes a direct non-transparent point – point interconnection of two termination points – Subscriber's sites. The interconnection is established in the Ethernet network by an EVC circuit between two termination points of the Ethernet network defined by a physical port and a VLAN ID. VLAN ID is always allocated by the Provider and it is identical for both termination points. The GTS Ethernet Line - EVPL variant offers limited transparency as no L2 control protocols are tunnelled.

GTS Ethernet Line – EVPL can also be provided in the "Point – Multipoint" configuration.

3.2 Point – Multipoint

The Point – Multipoint topology supports termination of multiple EVC circuits in a single common termination point (multiplex UNI) thanks to the so-called service multiplexing. This configuration is based on the properties of the **EVPL** service.

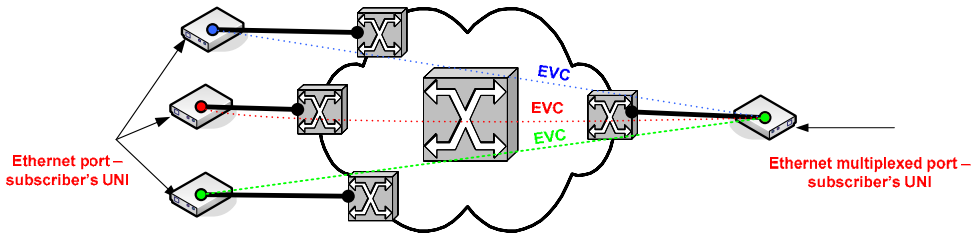

Fig. 2 – Diagram of the service variant in "Point – Multipoint" configuration

Services in multiplex UNI are handed over with different VLAN ID's allocated by the Provider. The maximum number of EVC circuits depends on the type of the access technology where the multiplex UNI is terminated. The sum of service capacities in multiplex UNI is limited b the capacity of the access circuit. Each service terminated in multiplex UNI is determined by a separate GTS Ethernet Line service description.

Detailed characteristic of EVPL is provided in Table 1.

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Table 1 – Characteristics of EPL (Ethernet Private Line) and EVPL (Ethernet Virtual Private Line)

Parameter	EPL	EVPL
Basic properties		
Service management	YES	YES
Format of Ethernet frames	IEEE 802.3, 802.1Q, 802.1AD	IEEE 802.3, 802.1Q
TAG manipulation	Managed by Subscriber	Managed by Provider
Service multiplexing	NO	YES (Standard = 4)
MAC addresses	100/1000 [1)]/unlimited [1)]	8
Max. MTU (frame size) of UNI [2)]	1534B	1522B [3)]
Max. MTU (frame size) of NNI [2)]	1538B	1526B
Transparency		
Customer VLAN ID Preservation	YES	YE
Customer CoS Preservation (P-bit)	YES	NO [4)]
Broadcast limitation	NO [5)]	NO
Multicast support	YES	YES [6)]
L2 control protocols (L2CP)	802.1x, all-bridges-block, bridge-block, cisco-cdp, cisco-dtp, cisco-pagp, cisco-pvst, cisco-stp-uplink-fast, cisco-udld, cisco-vtp, garp-block, gmrp, gvrp, lacp, lacp-marker, lldp, oam, rstp, vlan-bridge (cisco).	Not transmitted

1) An increase of the number of MAC addresses shall be charged for according to the valid pricelist of GTS Ethernet Line.
2) Maximum size of an Ethernet frame (Max. MTU) always depends on the access line. In case of POP-POP, the max. MTU of UNI is 2000B, max. MTU of NNI is 2004B.
3) The MTU value of 1522B cannot be guaranteed for some access technologies (e.g. SHDSL).
4) Depending on the access technology.
5) This may be activated upon Subscriber's request - the service then restricts transfer of frames to specific destination MAC addresses to 15% of the capacity of the line. Specific destination MAC addresses are broadcast/multicast/unknown unicast. The above only applies on condition that transfer of frames to specific destination MAC addresses is supported by the access technology.
6) Depending on the access technology.

3.3 NNI Central Interface

This service topology provides for termination of several OVC circuits in a single NNI Central Interface of the Provider. The topology is of the Hub and Spoke type. The individual OVC circuits associated in the NNI Central Interface are handed over to the Subscriber via individual VLAN (so-called S-VIDs). NNI Central Interface supports both variants of the service (EVPL and EPL).

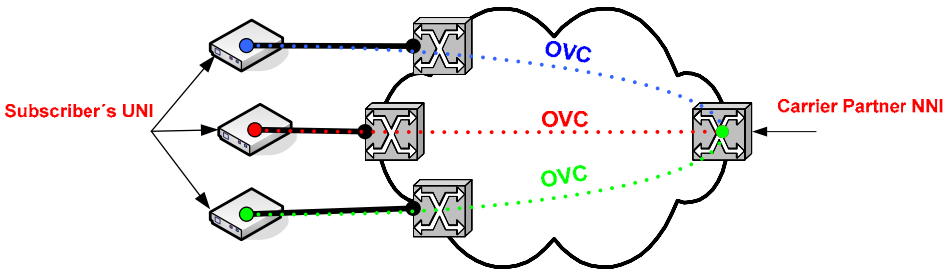

Fig. 3 – Diagram of the service variant in "NNI Central Interface" configuration

NNI Central Interface is provided at the following locations:

Table 2 – Locations of NNI Central Interface

No.	City	Data Centre / POP	Address
1.	Prague	Nagano (PH700-SDS1)	Praha 3, K Červenému dvoru 3156/25
2.	Prague	Sitel (PH780-SDS1)	Praha 10, Nad Elektrárnou 411
3.	Prague	THP (PH482-SDS1)	Praha 3, Vinohradská 190/1630
4.	Brno	Brno (B0169-SDS2)	Brno, Veveří 102

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3.3.1 Redundancy of NNI Central Interface

In order to achieve higher service availability, the Subscriber may be provided with redundancy of the NNI Central Interface. Redundancy is based on two connections between the communication equipment of the Provider and the communication equipment of the Subscriber, where "Link Aggregation Control Protocol" (LACP – IEEE 802.1AX-2008) will be configured. Redundancy of the NNI Central Interface is configured so that one interconnection within the interface will be active, while the other will be in the standby mode (1+1 redundancy).

3.3.2 Types of Ethernet frames on the side of the NNI Central Interface

The available values of the Ethernet frame format are presented by Table 3:

Table 3 – Ethernet frame format

Type	Ethernet frame format
1	DA(6 bytes) : SA(6 bytes) : S-Tag (4 bytes) : ET (2 bytes) : payload and FCS
2	DA(6 bytes) : SA(6 bytes) : S-Tag (4 bytes) : C-Tag (4 bytes) : ET (2 bytes) : payload and FCS

Legend:

- DA = Destination Address,
- SA = Source Address,
- ET = Ethertype/Length – field of the Ethernet frame used for designation of the protocol encapsulated in the Ethernet frame.

The following ET (Ethertype) value is used for the format of the Type 1 Ethernet frame:
S-Tag with Tag Protocol Identification Field (TPID) = 0x8100,

The following ET (Ethertype) values are used for the format of the Type 2 Ethernet frame:
S-Tag with Tag Protocol Identification Field (TPID) = 0x88A8,
C-Tag with Tag Protocol Identification Field (TPID) = 0x8100.

The Ethernet frame format, i.e. the method of tagging, must always be selected at the ordering of GTS Ethernet Line – NNI Central Interface. The selection will always be valid for the entire NNI Central Interface.

3.3.3 Scenarios of encapsulation on the side of NNI Central Interface

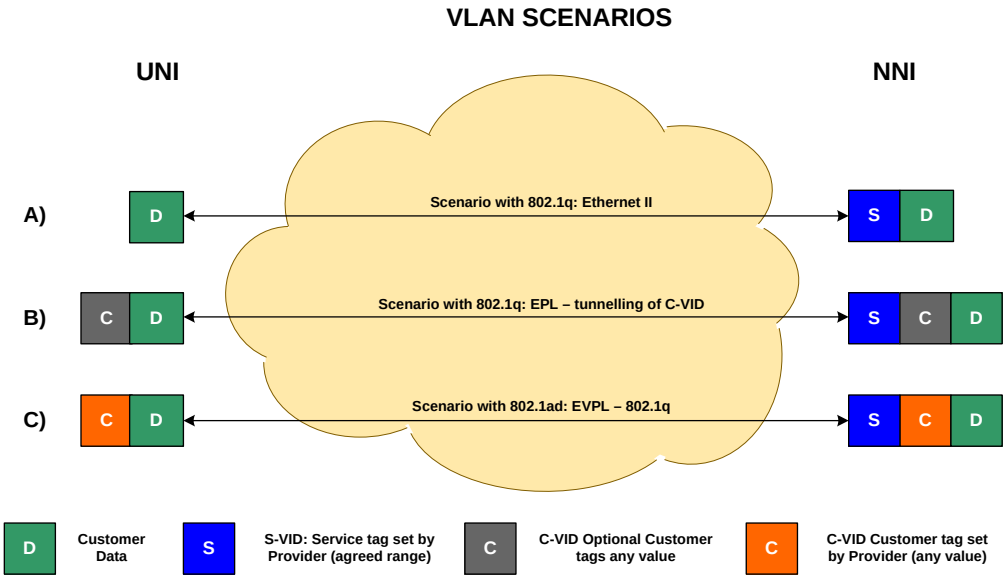

Fig. 4 – Scenarios of encapsulation on the side of NNI Central Interface

Scenario A:

- C-Tag is not included in the Ethernet frame at UNI (untagged UNI variant)
- S-VID is allocated by the Provider on the side of the NNI Central Interface

Scenario B:

- C-Tag may be included in the Ethernet frame at UNI. The customer C-Tag is considered a part of the Payload
- Customer C-VID is transferred by the GTS Ethernet network in a transparent way.
- S-VID is allocated by the Provider on the side of the NNI Central Interface (the service is handed over as 802.1q – variant 1 in Table 3)
- The service will only be functional when provisioned as the EPL variant

Scenario C:

- C-Tag must be included in the Ethernet frame at UNI.
- Customer C-VID is allocated by the Provider and retained throughout the GTS Ethernet network.
- S-VID is also allocated on the side of the NNI Central Interface (the service is handed over as QinQ – variant 2 in Table 3)

The allocated VLAN ID values allocated by the Provider are always specified in the Acceptance Protocol of the service, or the Subscriber is expressly notified of the value by the Provider.

4 Technical data

All parameters required for provisioning of the service, particularly the location, specification and type of interface of the service termination point, the capacity of the access circuit, etc. are provided in the GTS Ethernet Line Service Specification agreed upon by the Provider and the Subscriber.

The technical parameters not specified by the respective GTS Ethernet Line Service Specification will be determined in the GTS Ethernet Line Acceptance Protocol (e.g. the VLAN ID values allocated by the Provider).

4.1 Handover interface and transfer capacities of the service

The network handover interfaces for connection to the GTS Ethernet network are available in the following variants:

- 100Base-TX (Copper) - Connector RJ-45F,
- 1000Base-T (Copper)- Connector RJ-45F,
- 1000BASE-LX (Single mode fibre, 1310 nm) - Connector LC, SC, E2000/APC.

The Autonegotiation function is activated by default.

An EVC of the following transfer capacities is dedicated to the connection between any of the two network termination points in the backbone network of the Provider:

- 512, 1024 kbps,
- 2, 4, 6, 8, 10, 12, 14, 16, 18 Mbps,
- N x 10 Mbps,
- N x 100 Mbps,
- 1 Gbps.

Access circuits to the Subscriber's sites are provided on different technologies according to the local conditions and the required transfer capacity.

The throughput of GTS Ethernet Line may be reduced by the overhead of the second layer protocols. Therefore, the maximum throughput of GTS Ethernet Line may be reduced to 95% of the transfer capacity provided in the Service Specification. The transfer capacity of the service provided in the Service Specification shall be understood as the service capacity on the level of the physical layer.

4.2 NNI Central Interface – Handover interface and transfer capacities of the service

The NNI Central Interface of GTS Ethernet Line will be offered in the following types of Fast Ethernet or Gigabit Ethernet interfaces using fibre or metallic transfer medium:

- 100Base-TX (Copper) - Connector RJ-45F,
- 1000Base-T (Copper)- Connector RJ-45F,
- 1000BASE-LX (Single mode fibre, 1310 nm) - Connector LC, PC.

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The NNI Central Interface may be configured with the following maximum transfer capacity:

- Port/Rate: 10/100 – 10, 50, 100 Mbps,
- Port/Rate: 1000 – n x 100 Mbps up to 1 Gbps.

The Subscriber is responsible for planning of the utilisation of the capacity of the NNI Central Interface. The total capacity of the access circuit terminated in the NNI Central Interface may exceed the capacity of the NNI Central Interface (so-called overbooking). However, if utilisation of the NNI Central Interface exceeds 80% of the capacity, the Provider does not guarantee the QoS parameters.

5 Value added services to GTS Ethernet Line

5.1 QoS

GTS Ethernet Line may be ordered with the QoS value added service. The service allows for allocation of capacity of an Ethernet circuit to classes of service (CoS). Classes of service are intended for data communication of different applications (e.g. VOIP, SAP, Internet, etc.) by priorities allocated based on importance. Setting of priorities and allocation of capacities to each individual class is up to the Subscriber. GTS classes of service are based on the 802.1p designation (using CE-VLAN CoS) and the values presented in Table 4.

Table 4: QoS

Class	Applications	Allocated capacity
REAL-TIME	VoIP	Max. 50% of capacity of the end user transfer line
BUSINESS	Crucial corporate applications, ERP and CRM systems, database synchronisation	Proportion in %
STANDARD	Internet, email	Proportion in %

Undesignated services (one CoS per EVC) will be transferred within the STANDARD class.

If traffic generated within a class exceeds the value stipulated in the GTS Ethernet Line Service Specification, all excess traffic will be dropped first.

QoS is not supported for the EVPL variant in Point – Multipoint topology (so-called multiplexing).

5.2 Performance parameters of GTS Ethernet Line

The below values of the following performance parameters (Frame Loss, Frame Delay, Frame Delay Variation) are common (approximate) in the backbone network of the Provider and in the access network with regard to provision of GTS Ethernet Line. The above applies on condition that utilisation of the Ethernet circuit does not exceed 75 %.

Performance parameters

- **Frame Loss** – expresses the percentage of lost Ethernet frames that do not make it from the source UNI to the destination UNI, or are not confirmed by the destination UNI. The value is provided as an average per calendar month;
- **Frame Delay** – one-way delay of an Ethernet frame in ms. The time from the moment of sending of the Ethernet frame from the source UNI to the moment of the Ethernet frame reaching the destination UNI. The value is provided as an average per calendar month;
- **Frame Delay Variation (= Frame Jitter)** – variation of Frame Delay between the source and destination UNI. The value is provided as an average per calendar month.

Performance parameters in the backbone network of the Provider
The following values of performance parameters are common (approximate) in the backbone network of the Provider:

Table 5: Performance parameters in the backbone network of the Provider

Class	Application	Measured in countrywide backbone network (PE-PE)	Measured in international backbone network (PE-PE)
REAL-TIME	Frame Loss	≤0.01%	≤0.01%
	Frame Delay Variation	≤3ms	≤5ms
	One-way Frame Delay	≤20ms	≤30ms
BUSINESS	Frame Loss	≤0.01%	≤0.01%
	Frame Delay Variation	-	-
	One-way Frame Delay	≤20ms	≤30ms
STANDARD	Frame Loss	≤0.1%	≤0.1%
	Frame Delay Variation	-	-
	One-way Frame Delay	≤30ms	≤40ms

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Performance parameters in the access network
Common (approximate) value of performance parameters in the access network are dependent on the access technology used for GTS Ethernet Line. Depending on the type of technology, the typical values of performance parameters are the following:

Table 6: Performance parameters of the access network

Class	Applications	Measured in countrywide backbone network (CE-CE)	Measured in international backbone network (CE-CE)
REAL-TIME	Frame Loss	≤0.05% (0.1%)*	≤0.05% (0.1%)*
	Frame Delay Variation	≤10ms	≤20ms
	One-way Frame Delay	≤40ms	≤50ms
BUSINESS	Frame Loss	≤0.05% (0.1%)*	≤0.05% (0.1%)*
	Frame Delay Variation	-	-
	One-way Frame Delay	≤40ms	≤50ms
STANDARD	Frame Loss	≤0.2% (0.5%)*	≤0.2% (0.05%)*
	Frame Delay Variation	-	-
	One-way Frame Delay	≤50ms	≤60ms

* xDSL is the access technology

The Subscriber acknowledges and expressly agrees that the values of performance parameters of GTS Ethernet Line provided herein are just common (approximate) values for the given service in the Provider's network, i.e. that the values are not guaranteed to the Subscriber by the Provider and that the Subscriber shall not be eligible to any sanction, discount of the service price or compensation of damage in case the Provider fails to comply with the values.

5.3 Pro-active monitoring

The Provider shall commence the process of remedying an access circuit defect within 15 minutes as of detection of the status of 100% Frame Loss (identified by internal monitoring tools of the Provider). The defect remedy process includes notification of the Subscriber's contact person using the communication channel agreed upon in advance (e-mail, telephone).

The optional value added service of pro-active monitoring is only available for GTS Ethernet Line where the CPE is provided and administered by the Provider. The value added service is available on most access technologies of the Provider.

6 Service provisioning

The service is provisioned and handed over to the Subscriber after a survey of the access circuit verifying the functionality and qualitative parameters of the circuit.

7 Service availability – SLA

All information regarding the definition of the service availability parameter as well as compliance with the parameter is common to all data services by the Provider and it is stipulated in the "Operational Terms and Conditions of Telecommunication Services" of GTS Czech.

The Subscriber is eligible to select a service level agreement (SLA) depending on the type of connection used for GTS Ethernet Line; the specific SLA for an individual GTS Ethernet Line is determined by the respective GTS Ethernet Line Service Specification agreed upon by the Provider and the Subscriber. Detailed terms and conditions of the service level agreement (SLA) are stipulated by the SLA Service Description.