

# Carrier Line Services

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**Contents**

Introduction.....	3
1.1 Referenced standards.....	3
2 Technical service attributes .....	4
2.1 Implementation and architecture .....	4
2.2 Service handover .....	4
3 Technical feeders.....	8
3.1 Implementing technical feeders.....	8
3.2 Definition of technical feeders.....	8
3.3 Limitations of technical feeders .....	9
4 Technical limitations.....	10
4.1 Updating hardware and software.....	10
5 Installation.....	10
5.1 Requirements.....	10
5.2 Not included in the CLS.....	10
5.3 Telco operator’s infrastructure requirements .....	10

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## Introduction

- <sup>1</sup> This technical manual describes the technical details for the planning and realisation of the telecommunications service provider (telco) in connection with the Carrier Line Service and Carrier Line Service TCA (both hereinafter referred to as CLS).

### 1.1 Referenced standards

- [1] EN 300 386: “Electromagnetic compatibility and Radio spectrum Matters (ERM); Telecommunication network equipment; ElectroMagnetic Compatibility (EMC) requirements”
- [2] EN 302 099: “Environmental Engineering (EE); Powering of equipment in access network”
- [3] ITU-T G.703: “Physical / electrical characteristics of hierarchical digital interfaces”
- [4] ITU-T G.704: “Synchronous frame structures used at 1544, 6312, 2048, 8448 and 44 736 kbit/s hierarchical levels”
- [5] ITU-T X.21: “Interface between Data Terminal Equipment and Data Circuit-terminating Equipment for synchronous operation on public data networks”
- [6] ITU-T V.35: “Data transmission at 48 kbit/s using 60 - 108 kHz group band circuits”
- [7] ITU-T V.36: “Modems for synchronous data transmission using 60 - 108 kHz group band circuits”
- [8] ITU-T Recommendation G.691 (10/2000), Optical interfaces for single channel STM-64, STM-256 and other SDH systems with optical amplifiers.
- [9] ITU-T Recommendation G.957 (06/99), Optical interfaces for equipment and systems relating to the synchronous digital hierarchy.
- [10] ITU-T Recommendation G.707 (10/2000), Network node interface for the synchronous digital hierarchy (SDH).
- [11] IEEE Standard 802.3 (2002 Edition), IEEE Standard for information technology— Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements— Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications, SECTION THREE: This section includes Clauses 34 through 43 and Annexes 36A through 43C.
- [12] IEEE Standard 802.3ae (2002 Edition), IEEE Standard for information technology— Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements— Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications, Amendment: Media Access Control (MAC), Parameters, Physical Layers, and Management, Parameters for 10 Gbit/s Operation.
- [13] ANSI INCITS 352-2003, Information Technology - Fibre Channel - Physical Interface (FC-PI) (formerly NCITS Project 1306-D).
- [14] ANSI INCITS 404 – 2004 presently: draft proposed NCITS Standard for Information Technology – Fibre Channel – Physical Interface-3 (FC-PI-3) Rev. 1, Nov. 2004.
- [15] ANSI INCITS 364 – 2003 Information Technology - Fibre Channel 10 Gigabit (10GFC) (see also draft propose NCITS Standard for Information Technology).
- [16] ANSI INCITS 450 – 2009 Information Technology - Physical Interfaces - 4 (FC-PI-4) International Committee for Information Technology Standards (formerly NCITS)

- [17] IEEE Std 802.3ba™-2010. (Amendment to. IEEE Std 802.3™-2008). IEEE Standard for. Information technology.
- [18] ANSI INCITS 230-1994/AM 2-1999 Information Technology - Fibre Channel - Physical and Signaling Interface (FC-PH) - Amendment 2 (supplement to ANSI X3.230-1994) (formerly ANSI X3.230-1994/AM.  
ANSI INCITS 296-1997 (R2007) Information Technology-Single-Byte Command Code Sets Connection (SBCON) Architecture (formerly ANSI X3.296-1997).  
ANSI X3.303:1998, Fibre Channel—Physical and Signalling Interface-3 (FC-PH-3).

## 2 Technical service attributes

### 2.1 Implementation and architecture

1. CLS is based on the highly redundant transport platforms SDH and WDM.
2. CLS is a transparent point-to-point connection with pre-agreed, symmetrical transfer capacities (Layer 1 services)

### 2.2 Service handover

1. Handover of the CLS service to the end customer at the service access Point (SAP) with a network termination unit (NTU).
2. The NTU is connected via an electrical or optical access line to the local exchange of Swisscom (PoP). If the handover takes place at multiple exchanges, these are connected via the highly redundant Swisscom backbone (Swisscom network).
3. The technical solutions displayed in the illustrations are not exhaustive.

#### 2.2.1 Handover of the service outside of a Swisscom local exchange

1. If the service is handed over outside of the Swisscom exchange, this will always take place with an NTU at a customer site or the Point-of-Presence (PoP) of the telco operator (see Figure 1).
2. The telco operator is responsible for the electrical power supply (incl. installation) and the provision of an appropriate rack (19 inch or table version depending on the NTU) for the NTU.
3. The installation within the building, from the cable entry point (into the building) to the NTU, and also the installation between the NTU and the equipment of the telco operator or the customer equipment (CE) are also the responsibility of the telco operator and must be made available by it.
4. Swisscom does not provide any remote power supplies.

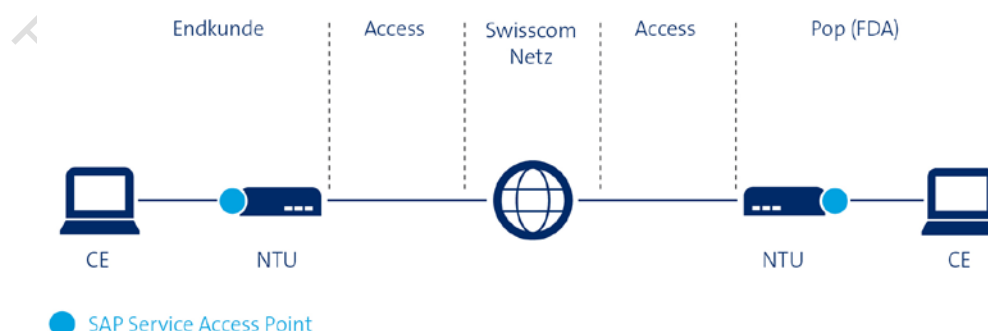


Figure 1: Handover of the CLS outside the Swisscom exchange

**2.2.2 Handover of the service within a Swisscom local exchange**

1. The handover takes place at the customer interface in a room rented by the telco operator or its end customers within the local exchange (see Figure 2).
2. The type of handover must be based on the specific requirements of each customer.
3. There are two typical types of handover and implementation, which are applied based on the type of interface, the location of the end customer, the required quality of service, and the distances of the transfer cable within the transfer point. Swisscom decides which type of transfer to apply.
4. Most interfaces can be transferred directly at the Service Access Point (SAP) without the need for an NTU (see Figure 2 “Direct transfer to SAP”).
5. If necessary, the required interface is provided on the NTU and the service is transferred accordingly (see Figure 2 “Transfer on the NTU”).
6. If the SAP is on an NTU, the telco operator must provide an appropriate rack (19 inch or table version) for the NTU as well as the electrical power supply.
7. For the realisation of the CLS service within the local exchange, Swisscom will install cabling<sup>1</sup> for the telco operator between the Swisscom distributor and the rented room of the telco operator or its end customer. Details can be found in the area agreement.

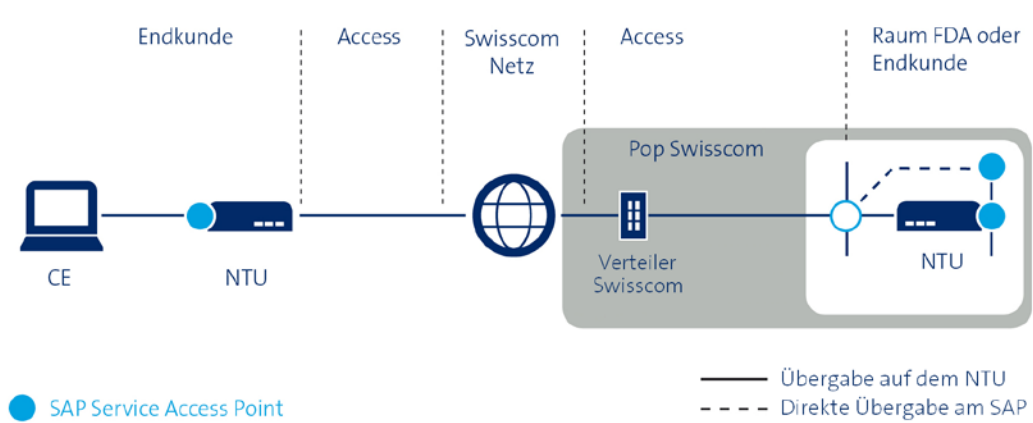


Figure 2: Handover of the CLS within the Swisscom exchange

<sup>1</sup> Cabling within the local exchanges are not covered by this service.

### 2.3 Description of the Interfaces

1. The following Table 1 describes the available interfaces with the corresponding plug-in connection options and standards.

Interface	Max. usable bandwidth [Mbit/s]	Plug-in connection		Standards
		$\lambda$ [nm]/ electrical	optical/ electrical	
2M (E1)	1,984 <sup>2</sup>	electrical	Cat5 (RJ-45)	ITU T (X.21; V.35; V.36; G.703/G704 120 $\Omega$ ) [3-7]
2M (E1)	2,048	electrical	Cat5 (RJ-45)	ITU T (X.21; V.35; G.703 120 $\Omega$ ) [3-7]
2M Ethernet (10/100 Base-T)	2,048	electrical	Cat5 (RJ-45)	IEEE 802.3, Close 25-26 [11]
4M Ethernet (10/100 Base-T)	4,096	electrical	Cat5 (RJ-45)	IEEE 802.3, Close 25-26 [11]
6M Ethernet (10/100 Base-T)	6,144	electrical	Cat5 (RJ-45)	IEEE 802.3, Close 25-26 [11]
8M Ethernet (10/100 Base-T)	8,192	electrical	Cat5 (RJ-45)	IEEE 802.3, Close 25-26 [11]
10M Ethernet (10Base-T) 12.5 Mbit/s	10	electrical	Cat5 (RJ-45)	IEEE 802.3, Close 25-26 [11]
34M (E3)	34	electrical	coaxial BNC 75 $\Omega$	ITU T G.703 75 $\Omega$ [3]
45M (T3)	45	electrical	coaxial BNC 75 $\Omega$	ITU T G.703 75 $\Omega$ [3]
100M Ethernet (100Base-T) 125 Mbit/s	100	electrical	Cat5 (RJ-45)	IEEE 802.3, Close 25-26 [11]
155M (STM-1) 155 Mbit/s	150	electrical	coaxial BNC 75 $\Omega$	ITU T G.703 75 $\Omega$ [3] G.707 [10]
		1310	SMF (LC/PC)	ITU T G.707 [10], G.957 [9]

<sup>2</sup> Structured service with 32-times 64kbit/s channels. For the purpose of management, a 64bit/s channel is used on a structured 2 Mbit/s service. As such, 31x64kbit/s channels, i.e. 1984 kbit/s, are available as usable bandwidth

Interface	Max. usable	Plug-in connection		Standards
		1550	SMF (LC/PC)	
622M (STM-4) 622 Mbit/s	599	1310	SMF (LC/PC)	ITU T G.707 [10], G.957 [9]
		1550	SMF (LC/PC)	

Interface	Max. Usable bandwidth [Mbit/s]	Plug-in connection		Standards
		$\lambda$ [nm]/ electrical	optical/ electrical	
10G Ethernet (10GBase-R) 10'312 Mbit/s	10'000 10'200	850	MMF (LC)	IEEE 802.3ae, Close 51 [12]
		1310	SMF(LC/PC)	
		1550	SMF (LC/PC)	
FC1200 (10GFC) 10'519 Mbit/s		850	MMF (LC)	
		1310	SMF (LC/PC)	
FC1600 (16GFC) 14'025 Mbit/s	12'800	850	MMF (LC)	ANSI INCITS X3 230/296/303 [18]
40G Ethernet (40GBase-LR4) 41'250 Mbit/s	40'000	850	MMF (LC)	IEEE 802.3ba [17]
		1310	SMF (LC/PC)	
100G Ethernet (100GBase-LR4) 103'125 Mbit/s	100'000	1310	SMF (LC/PC)	IEEE 802.3ba [17]
10G Ethernet (10GBase-R) 10'312 Mbit/s	10'000	850	MMF (LC)	IEEE 802.3ae, Close 51 [12]
		1310	SMF(LC/PC)	
		1550	SMF (LC/PC)	
FC1200 (10GFC) 10'519 Mbit/s	10'200	850	MMF (LC)	ANSI INCITS 364 – 2003 [15]
		1310	SMF (LC/PC)	
FC1600 (16GFC) 14'025 Mbit/s	12'800	850	MMF (LC)	ANSI INCITS X3 230/296/303 [18]
40G Ethernet (40GBase-LR4) 41'250 Mbit/s	40'000	850	MMF (LC)	IEEE 802.3ba [17]
		1310	SMF (LC/PC)	
100G Ethernet	100'000	1310	SMF (LC/PC)	IEEE 802.3ba [17]

(100GBase-LR4)				
103'125 Mbit/s				
10G Ethernet	10'000	850	MMF (LC)	IEEE 802.3ae, Close 51 [12]
(10GBase-R)		1310	SMF(LC/PC)	
10'312 Mbit/s		1550	SMF (LC/PC)	

Table 1: Description of interfaces

### 2.3.1 Further interface specifications

#### 1. 2, 4, 6, 8 Mbit/s

If inverse multiplexing is used to transfer the Ethernet Frame via multiple lines, this algorithm uses up maximum 4% of the nominal capacity.

The available transfer speed of Layer 1 is therefore  $\geq 96\%$  of the nominal capacity. Auto Negotiation is enabled by default for data transfer. In the case of Duplex processes, there are four options available.

- Half-Duplex 10Mbit/s
- Half-Duplex 100Mbit/s
- Full-Duplex 10Mbit/s
- Full-Duplex 100Mbit/s

#### 2. FE, 1GE, 10GE, 40GE, 100GE

The Full-Duplex process is configured as the Duplex process and Auto Negotiation is deactivated on the remaining Ethernet interfaces (FE, 1GE and 10GE, 40GE<sup>5</sup> und 100GE<sup>5</sup>).

#### 3. E3/T3

The E3/T3 interfaces have a VC-3 structure.

#### 4. STM-1/STM-4

The STM-1/STM-4 interfaces have a VC-4 structure. A transparent transfer is available on request.

#### 5. STM-16/STM-64

The STM-16/STM-64 interfaces are transferred transparently.

6 There is no physical difference between the Fiber Channel and FICON interface cards.

7 There is no physical difference between the STM-64 and 10GE WAN interface cards.

## 3 Technical feeders

### 3.1 Implementing technical feeders

41 The supply interfaces are configured in consultation with Swisscom, taking into account the volume development of the equipment at the transfer site of the telco provider or end customer, as well as the network situation and the relevant economic and business criteria at Swisscom. .

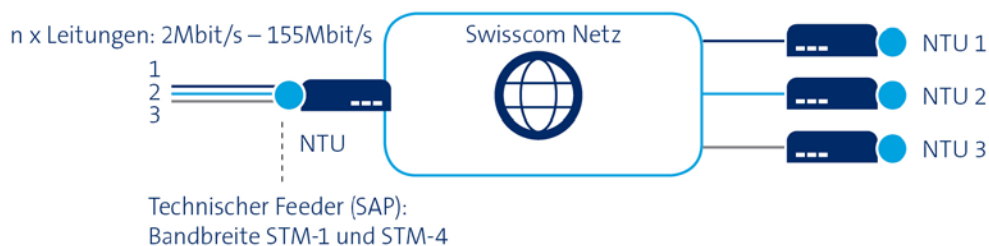
### 3.2 Definition of technical feeders

1 Technical feeders enable the concentration of multiple CLS at a single transfer point (SAP) on a

<sup>5</sup> Auto Negotiation existiert nicht für 40GE und 100GE



structured interface with a higher bandwidth (e.g. STM-1 or STM-4). Accordingly, one feeder can transfer multiple services to one interface at the SAP.



● SAP Service Access Point

Figure 3: CLS technical feeders

2. CLS supports the following feeders.

Bandwidth of the respective service	Bandwidth of the feeder interfaces at the SAP	
	155 Mbit/s	622 Mbit/s
CLS 2 Mbit/s	Yes	Yes
CLS 34 Mbit/s	Yes	Yes
CLS 45 Mbit/s	Yes	Yes
CLS 155 Mbit/s	No	Yes

Table 2: Bandwidth of CLS technical feeders

3. As listed in Table 2, there are various possible combinations of services and bandwidths available for all feeders, corresponding to the maximum bandwidth.

Examples (not exhaustive):

- STM-1: 1x45 Mbit/s and 42x2 Mbit/s
- STM-4: 1x45 Mbit/s, 42x2 Mbit/s and 2x155 Mbit/s.

### 3.3 Limitations of technical feeders

1. Technical feeders are not available for all types of NTU.
2. The following limitations apply for CLS Premium services with bandwidths of 2, 34, 45 and 155 Mbit/s:
  - A maximum of one end point (SAP) can end in a feeder per CLS Premium service.
  - In less than 10% of cases, it is possible that no warning signal is transmitted to the feeder

interface in the event of disruption to the feeder (line bandwidth not interlinked). As a result, Swisscom may not be able to guarantee proactive service management.

- Swisscom guarantees availability in accordance with the quality of service (SLA).

## 4 Technical limitations

### 4.1 Updating hardware and software

- Updating the hardware and software may result in a disruption to service. The telco operator will be notified accordingly.

## 5 Installation

### 5.1 Requirements

- If the NTU has two separate power supplies, two separately interlocked power supplies (230 VAC or optionally -48 VDC) are recommended.
- A rack (19 inch or table version, depending on the NTU) must be provided for the NTU.
- The plug type required for each interface is listed in Table 1.

### 5.2 Not included in the CLS

- Installation in the building of the telco operator or end user, from the cable entry point to the NTU.
- Cabling in the Swisscom exchange between the Swisscom distributor and the rented room of the telco operator or its end customers.
- Installation between the NTU and customer equipment (CE).
- Installation of power supply (230 VAC or -48 VDC, depending on the NTU) for the NTU.
- Power for the NTU at the two line end points.
- Rack (19 inch or table version, depending on the NTU).

### 5.3 Telco operator's infrastructure requirements

- The telco operator is obligated to only connect equipment to the interfaces that meets the appropriate interface standards (see Table 1) and at least the standards EN 300 386 [1] and EN 302 099 [2].
- If these standards are not met and Swisscom equipment is damaged as a result, the telco operator is obligated to pay the appropriate sum in compensation.
- If these standards are not met and this results in disruptions to service, Swisscom is entitled to take the connection out of commission.