TECHNICAL SPECIFICATION

ISO/IEC TS 22237-5

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Information technology — Data centre facilities and infrastructures —

Part 5: Telecommunications cabling infrastructure

Technologie de l'information — Installation et infrastructures de centres de traitement de données —

Partie 5: Infrastructure du câblage dédié télécommunications

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 39, *Sustainability for and by Information Technology.*

A list of all parts in the ISO/IEC TS 22237 series can be found on the ISO website.

Introduction

The unrestricted access to internet-based information demanded by the information society has led to an exponential growth of both internet traffic and the volume of stored/retrieved data. Data centres are housing and supporting the information technology and network telecommunications equipment for data processing, data storage and data transport. They are required both by network operators (delivering those services to customer premises) and by enterprises within those customer premises.

Data centres need to provide modular, scalable and flexible facilities and infrastructures to easily accommodate the rapidly changing requirements of the market. In addition, energy consumption of data centres has become critical both from an environmental point of view (reduction of carbon footprint) and with respect to economical considerations (cost of energy) for the data centre operator.

The implementation of data centres varies in terms of:

a) purpose (enterprise, co-location, co-hosting or network operator facilities);

b) security level;

c) physical size;

d) accommodation (mobile, temporary and permanent constructions).

The needs of data centres also vary in terms of availability of service, the provision of security and the objectives for energy efficiency. These needs and objectives influence the design of data centres in terms of building construction, power distribution, environmental control and physical security. Effective management and operational information is required to monitor achievement of the defined needs and objectives.

The ISO/IEC TS 22237 series specifies requirements and recommendations to support the various parties involved in the design, planning, procurement, integration, installation, operation and maintenance of facilities and infrastructures within data centres. These parties include:

1) owners, facility managers, ICT managers, project managers, main contractors;

2) architects, building designers and builders, system and installation designers;

3) facility and infrastructure integrators, suppliers of equipment;

4) installers, maintainers.

At the time of publication of this document, the ISO/IEC TS 22237 series will comprise the following documents:

ISO/IEC TS 22237-1, *Information technology — Data centre facilities and infrastructures — Part 1: General concepts*

ISO/IEC TS 22237-2, *Information technology — Data centre facilities and infrastructures — Part 2: Building construction*

ISO/IEC TS 22237-3, *Information technology — Data centre facilities and infrastructures — Part 3: Power distribution*

ISO/IEC TS 22237-4, *Information technology — Data centre facilities and infrastructures — Part 4: Environmental control*

ISO/IEC TS 22237-5, *Information technology — Data centre facilities and infrastructures — Part 5: Telecommunications cabling infrastructure*

ISO/IEC TS 22237-6, *Information technology — Data centre facilities and infrastructures — Part 6: Security systems*

ISO/IEC TS 22237-7, *Information technology — Data centre facilities and infrastructures — Part 7: Management and operational information*

The inter-relationship of the specifications within the ISO/IEC TS 22237 series is shown in Figure 1.

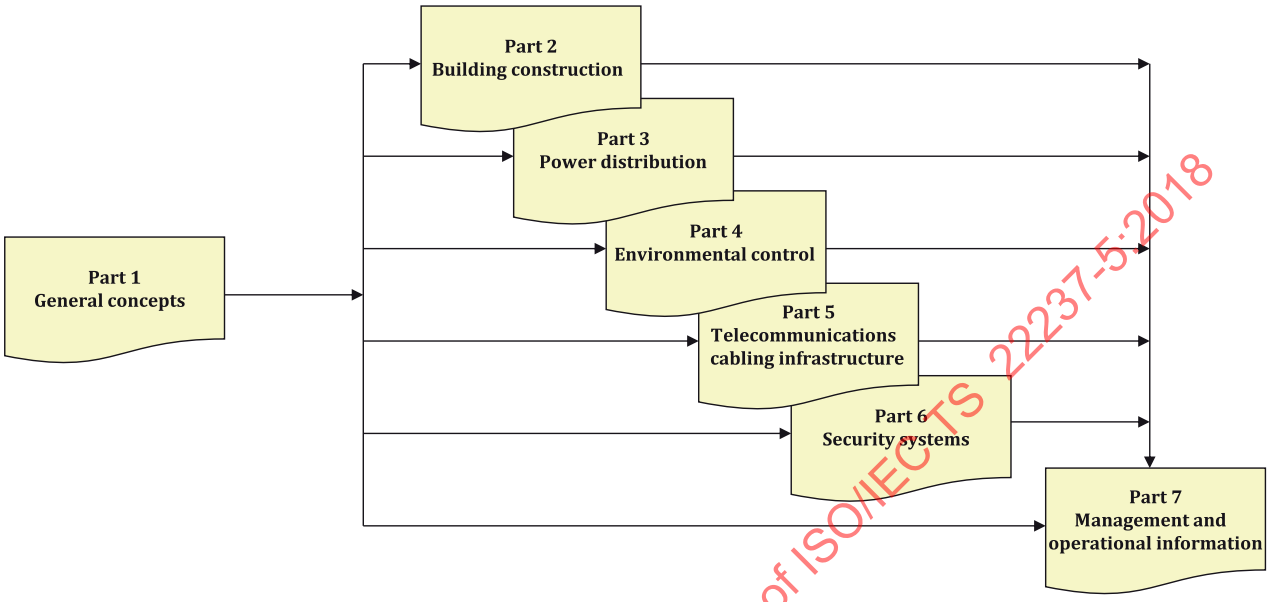

Figure 1 — Schematic relationship between the ISO/IEC TS 22237 series of documents

ISO/IEC TS 22237-2 to ISO/IEC TS 22237-6 specify requirements and recommendations for particular facilities and infrastructures to support the relevant classification for "availability", "security" and "energy efficiency enablement" selected from ISO/IEC TS 22237-1.

This document addresses the specific requirements for the telecommunications cabling infrastructure in data centres used for the purpose of IT networking and building services (in accordance with the requirements of ISO/IEC TS 22237-1).

ISO/IEC TS 22237-7 addresses the operational and management information (in accordance with the requirements of ISO/IEC TS 22237-1.

This document is intended for use by and collaboration between architects, building designers and builders, system and installation designers.

The ISO/IEC TS 22237 series does not address the selection of information technology and network telecommunications equipment, software and associated configuration issues.

Information technology — Data centre facilities and infrastructures —

Part 5: Telecommunications cabling infrastructure

1 Scope

This document addresses the wide range of telecommunications cabling infrastructures within data centres based upon the criteria and classifications for "availability" within ISO/IEC TS 22237-1.

This document specifies requirements and recommendations for the following:

a) information technology and network telecommunications cabling (e.g. SAN and LAN);

b) general information technology cabling to support the operation of the data centre;

c) telecommunications cabling to monitor and control, as appropriate, power distribution, environmental control and physical security of the data centre;

d) other building automation cabling;

e) pathways, spaces and enclosures for the telecommunications cabling infrastructures.

Safety and electromagnetic compatibility (EMC) requirements are outside the scope of this document and are covered by other standards and regulations. However, information given in this document may be of assistance in meeting these standards and regulations.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 11801-1, *Information technology — Generic cabling systems — Part 1: General requirements*

ISO/IEC 11801-2, *Information technology — Generic cabling systems — Part 2: Office premises*

ISO/IEC 11801-5, *Information technology — Generic cabling systems — Part 5: Data centres*

ISO/IEC 11801-6, *Information technology — Generic cabling systems — Part 6: Distributed building services*

ISO/IEC 14763-2, *Information technology — Implementation and operation of customer premises cabling — Part 2: Planning and installation*

ISO/IEC TS 22237-1:2018, *Information technology — Data centre facilities and infrastructures — Part 1: General concepts*

ISO/IEC TS 22237-2, *Information technology — Data centre facilities and infrastructures — Part 2: Building construction*

ISO/IEC TS 22237-4, *Information technology — Data centre facilities and infrastructures — Part 4: Environmental control*

ISO/IEC TS 22237-7, *Information technology — Data centre facilities and infrastructures — Part 7: Management and operational information*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC TS 22237-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1.1
application-specific cabling
structured cabling with a configuration and performance which is considered to provide a specific benefit for a single, or limited number of applications, as compared to generic cabling

3.1.2
central patching location
passive cross-connect to connect different functional elements of a data centre

Note 1 to entry: A central patching location can be located in the main distribution area and/or the intermediate distribution area and is therefore a special configuration of an MD and/or an ID.

3.1.3
cross-connect
method of connecting a patch panel port to another patch panel port by the use of a patch cord or jumper

3.1.4
data centre information technology equipment
equipment in the computer room space of a data centre that transports and/or stores and/or processes information

3.1.5
fixed cabling
cabling subsystem between closures which has either a peer-to-peer or hierarchical structure and which enables the installation of cross-connects or interconnects at those closures

3.1.6
generic cabling
structured telecommunications cabling system, capable of supporting a wide range of applications

Note 1 to entry: Application-specific hardware is not a part of generic cabling.

Note 2 to entry: Generic cabling can be installed without prior knowledge of the required applications.

[SOURCE: ISO/IEC 11801-1:2017, 3.1.46 — modified: Notes 1 and 2 to entry added]

3.1.7
interconnect
method of connecting a patch panel port to an equipment port by the use of equipment cords

3.1.8
office network information technology equipment
equipment in data centre spaces that transports and/or stores and/or processes information

3.1.9
point-to-point connection
direct connection of two pieces of IT equipment using a dedicated cable rather than a generic cabling system

3.1.10
structured cabling
telecommunications cabling comprising fixed cables between points of distribution at which equipment or other fixed cables may be connected

3.1.11
telecommunications provider
either an access provider or a service provider

3.1.12
zone patching location
passive cross-connect to connect different function elements of a data centre zone

Note 1 to entry: A zone patching location can be located in the zone distribution area and is therefore a special configuration of a ZD.

3.2 Abbreviated terms

For the purposes of this document, the abbreviated terms given in ISO/IEC TS 22237-1 and the following abbreviated terms apply.

BEF	Building Entrance Facility
BD	Building Distributor
C	Connection
CD	Campus Distributor
CP	Consolidation Point
CPL	Central Patching Location
ENI	External Network Interface
EO	Equipment Outlet
EoR	End of Row
EQP	Transmission Equipment
FD	Floor Distributor
ID	Intermediate Distributor
LDP	Local Distribution Point
MD	Main Distributor
MoR	Middle of Row
SCP	Service Concentration Point
SD	Service Distributor

SO Service Outlet

TE Terminal Equipment

TO Telecommunications Outlet

ToR Top of Rack

ZD Zone Distributor

ZPL Zone Patching Location

4 Conformance

For a data centre to conform to this document:

a) the cabling design shall meet the requirements of Clause 5;

b) the cabling design for the selected Availability Class shall be in accordance with Clause 7;

c) the design and specifications of pathways and spaces shall be in accordance with Clauses 8 and 9;

d) the information technology cabling to support the operation of the data centre shall be in accordance with ISO/IEC 11801-2, except where 7.3 allows an alternative approach;

e) the information technology cabling to support the IT networking function of the data centre shall be in accordance with ISO/IEC 11801-5, except where 7.2 allows an alternative approach;

f) telecommunications cabling for monitoring and/or control of power distribution, environmental control and physical security shall be in accordance with ISO/IEC 11801-6, except where 7.4 allows an alternative approach;

g) installation specification, quality assurance, installation planning and practice of cabling shall be in accordance with ISO/IEC 14763-2 and Clauses 8 and 9;

h) national and local regulations, including safety, shall be met.

5 Telecommunications cabling within the data centre

5.1 General

5.1.1 The importance of telecommunications cabling within data centre spaces

The telecommunications cabling within the data centre serves to support the following:

a) data centre information technology and network telecommunications;

b) monitoring and controlling of other data centre infrastructures;

c) building management and automation.

The design and planning of cabling infrastructures should be undertaken at an early stage of the data centre design or refurbishment and should be integrated with the design and planning of:

1) electrical power;

2) environmental control systems;

3) security systems;

4) lighting systems.

This clause defines the requirements and recommendations for the performance, design criteria and architectures for the different cabling types in a data centre.

The importance of the information technology and network telecommunications cabling infrastructure is similar to that of other infrastructures such as environmental control, power distribution and security. As with other utilities, interruptions to service can have a serious impact. Poor quality of service due to lack of planning, use of inappropriate components, incorrect installation, poor administration or inadequate support can threaten an organization's effectiveness.

5.1.2 Cabling implementation

The cabling infrastructures in a data centre shall be appropriate to provide networking and telecommunications capabilities in and between dedicated data centre spaces.

For the purposes of this document, two types of cabling are considered for data centre spaces:

a) point-to-point;

b) fixed cabling implemented using structured cabling including the generic cabling solutions of the ISO/IEC 11801 series. The closures may be grouped and accommodated in cabinets, frames or racks which act as cabling presentation facilities. The cabling presentation facilities allow interconnection or cross-connections between fixed cabling or between fixed cabling and IT equipment in close proximity.

5.1.3 Point-to-point cabling

5.1.3.1 General

The point-to-point connection method uses discrete cords (typically factory-produced) that directly connect the active equipment. Each cord connects a single port of one device to a single port of another device.

Although point-to-point cabling seems to be the simplest and most cost effective method of providing connections, for several reasons this cabling type should only be used for connections within the same or two adjacent cabinets, frames or racks. Point-to-point cabling is often not reusable as the data centre evolves and equipment types and locations change and may have a limited life time expectation. Continuous changes to the required interconnections increase both the planning and the operational resources required for each change (see Figure 2 and Figure 3) and increases the risk of interfering with other infrastructures — including those for environmental control.

5.1.3.2 Restrictions on the use of point-to-point cabling

Where this document allows point-to-point cabling, it should only be used subject to the following restrictions:

a) the mechanical performance of cords or cables used for point-to-point connections shall meet the requirements of the installation environment (e.g. pathway systems);

b) connectors on cords shall be protected against damage during installation, disconnection or removal;

c) point-to-point connections shall only be used where the replacement of the cord following damage to either connector can be performed without disruption to the data centre operation;

d) cords shall be managed so as to avoid mechanical damage and/or accidental disconnection to adjacent connections during insertion or removal;

e) cords shall be labelled at both ends to show their origin and destination in accordance with the level 3 administration requirements of ISO/IEC 14763-2;

f) the impact of point to point connections on the fire load of cabling shall be assessed and mitigation provided if necessary;

g) cords providing point-to-point connections shall not be located where they restrict cooling airflow towards active equipment.

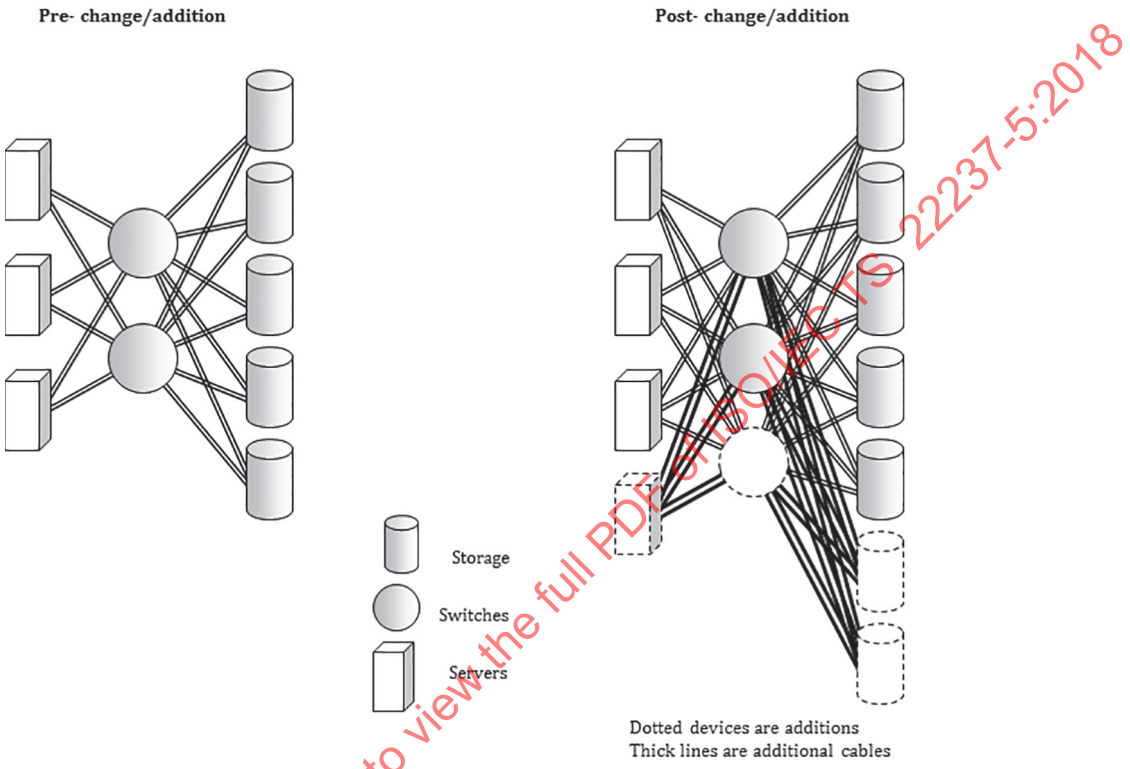

Figure 2 — Impact of growth in an unstructured point-to-point cabling infrastructure

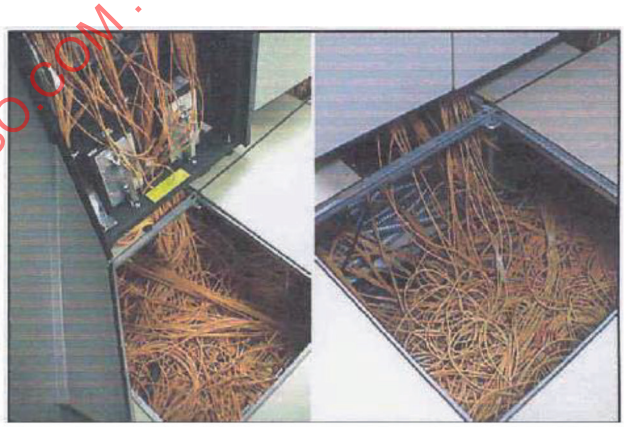

Figure 3 — Example of point-to-point cabling

5.1.4 Fixed cabling

A structured cabling system approach, illustrated in Figure 4, shows the equipment ports presented at remote central patching locations (CPLs). Server-to-storage connections are made using short, easily

managed, cords within the CPL. The use of distributed zone patching locations (ZPL), connected to the CPLs with fixed cables provides additional flexibility for managing changes.

Figure 4 shows how a fixed cabling implementation isolates the change activity to the defined areas. New equipment is connected to a CPL or ZPL without impacting active systems so no scheduled downtime is required. The equipment can then be connected to the active systems during the scheduled downtime by simply reconfiguring the cords at the CPL or ZPL. If a change causes a problem, it is only necessary to reconnect the cords into their pre-change configuration. The structured approach enables more accurate predictions of the time required to implement system changes and recovery resulting in easier, faster changes that introduce less risk and enable improved overall system operation.

Fixed cables may have a greater minimum bending radius than cords and this shall be considered in pathway and pathway system design and planning.

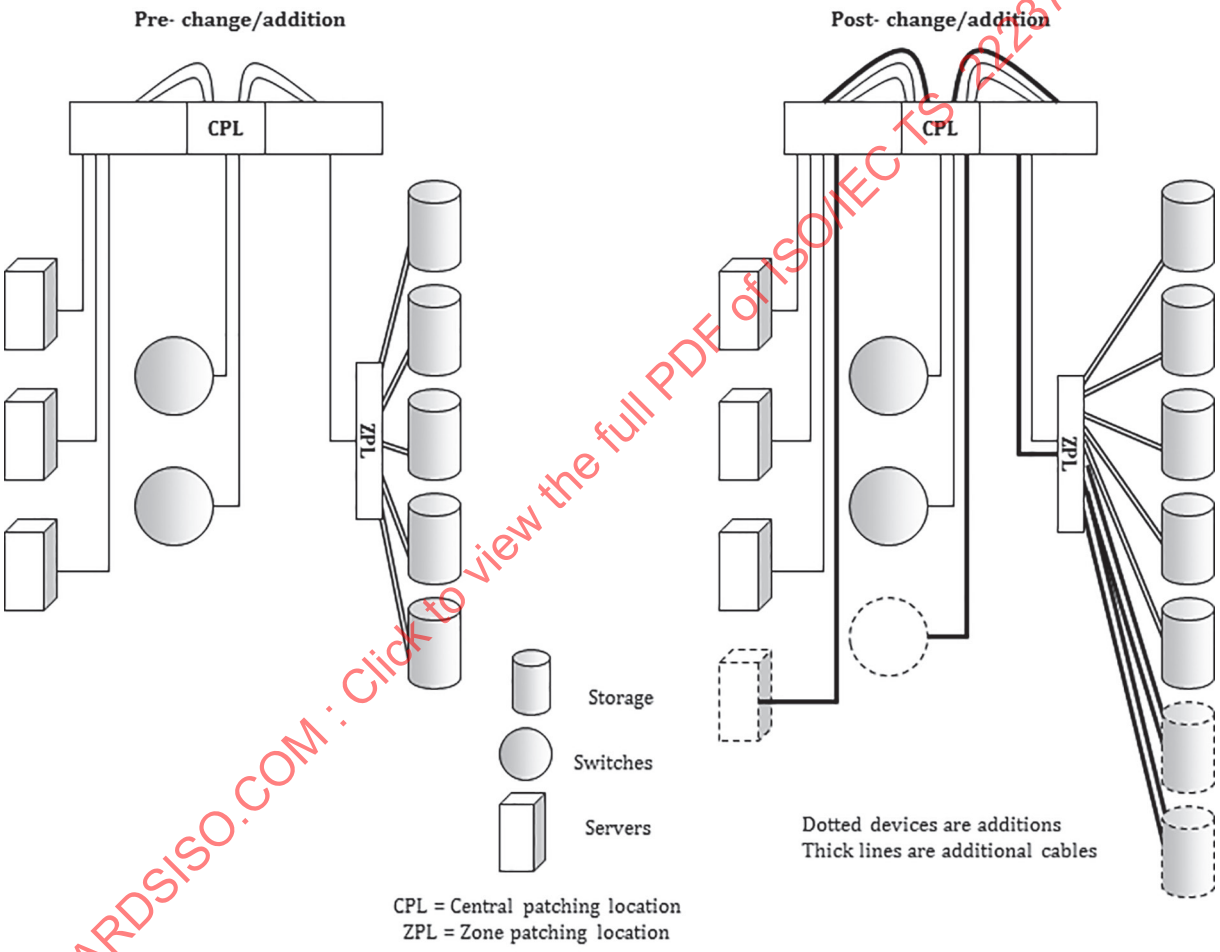

Figure 4 — Structured cabling infrastructure: setup and growth

5.2 Information technology and network telecommunications cabling in the computer room space

5.2.1 General

The cabling infrastructures in a data centre shall be appropriate to provide networking and telecommunications capabilities in and between many of the dedicated data centres spaces. The cabling infrastructure described in this clause is that between and within the cabinets, frames and racks which constitute the computer room space and may take one of, or a combination of, the following forms:

a) point-to-point;

b) fixed:

1) generic — structured cabling in accordance with ISO/IEC 11801-5 for IT and network telecommunications;

2) generic — structured cabling in accordance to ISO/IEC 11801-2 for IT and network telecommunications;

3) generic — structured cabling in accordance with ISO/IEC 11801-6 for monitoring and control;

4) application specific cabling.

The chosen infrastructure strategy shall take into account the need to support existing and future networking and storage applications and significant amounts of change.

5.2.2 Generic cabling for data centre information technology equipment

Generic cabling infrastructure designs in accordance with the ISO/IEC 11801 series are based upon a defined cabling model and support the development of high data rate applications. ISO/IEC 11801-5 defines generic cabling to provide multiple services and to connect large quantities of equipment within the limited space of data centre premises, and shall be used together with ISO/IEC 11801-1.

Information technology cabling to support the operation of the data centre shall be in accordance with ISO/IEC 11801-5.

Figure 5 shows the cabling subsystem architecture of ISO/IEC 11801-5.

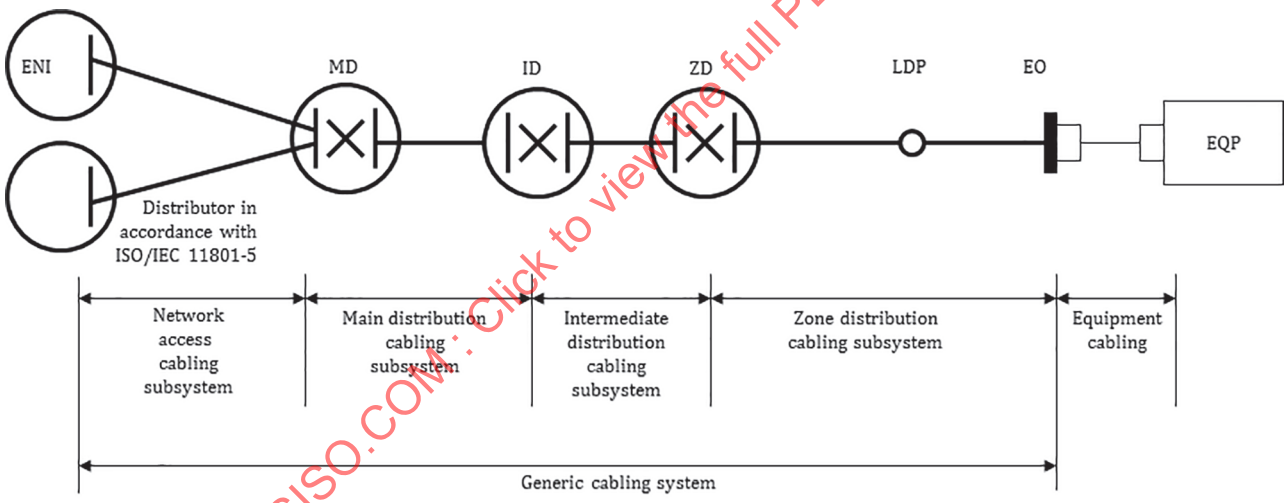

Figure 5 — Data centre cabling subsystems according to ISO/IEC 11801-5

Generic cabling in accordance with ISO/IEC 11801-5 uses pre-defined pathways and spaces that are specifically intended to support changing demands and provides:

a) scalability via a modular design;

b) a greater level of flexibility with equipment moves, adds and changes;

c) a level of consistency with generic cabling design methodology for other services such as power supply distribution and environmental control;

d) the support for a wide range of applications in the data centre.

Generic cabling systems are intended to avoid the impact of the uncontrolled use of point-to-point cables described in 5.1.3.2 by using fixed cables within defined cable pathways between panels (patch panel) at designated patching locations. This greatly simplifies cabling modifications by managing changes at

the patching locations rather than disconnecting, moving and reconnecting discrete cables under the floor or in ceiling spaces.

5.2.3 Generic cabling for office network information technology equipment

Information technology cabling to support the operation of the data centre shall be in accordance with ISO/IEC 11801-2.

Figure 6 shows the cabling subsystem architecture of ISO/IEC 11801-2.

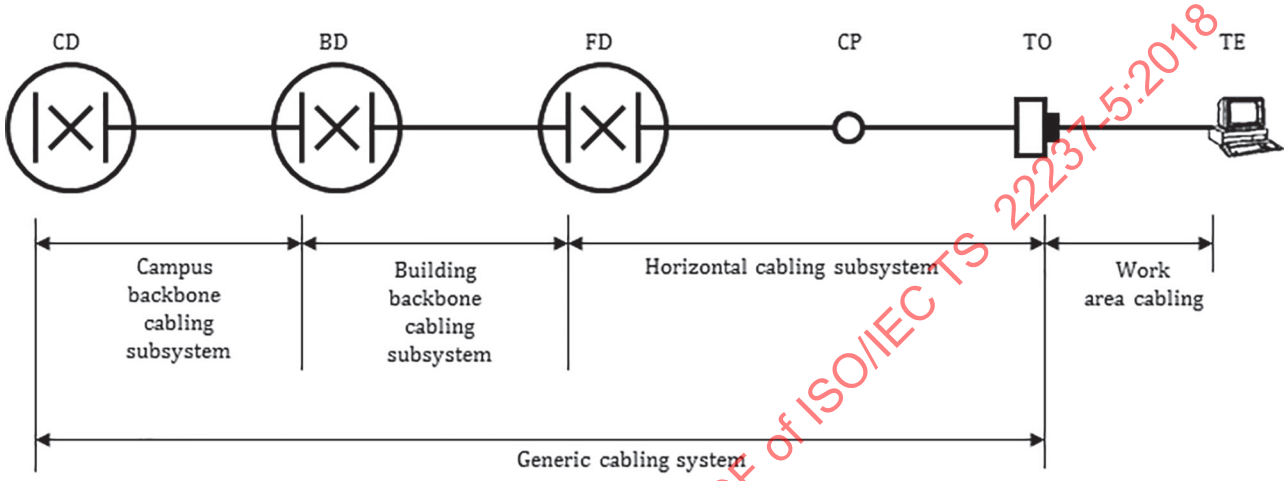

Figure 6 — Office cabling subsystems according to ISO/IEC 11801-2

5.2.4 Generic cabling for monitoring and control

ISO/IEC 11801-6 specifies generic cabling that supports a wide range of communication services within premises. It reflects the increasing use of generic cabling in support of non-user specific services, including the monitoring and control of data centre infrastructures. Many of these services require the use of remote powered devices and include:

a) energy management as described in ISO/IEC TS 22237-3, e.g. lighting, power distribution, incoming utility metering;

b) environmental control as described in ISO/IEC TS 22237-4, e.g. temperature, humidity;

c) personnel management as described in ISO/IEC TS 22237-6, e.g. access control, cameras, motion/proximity detectors, time and attendance monitoring.

Cabling for these purposes shall be in accordance with ISO/IEC 11801-6.

Figure 7 shows the cabling subsystem architecture of ISO/IEC 11801-6.

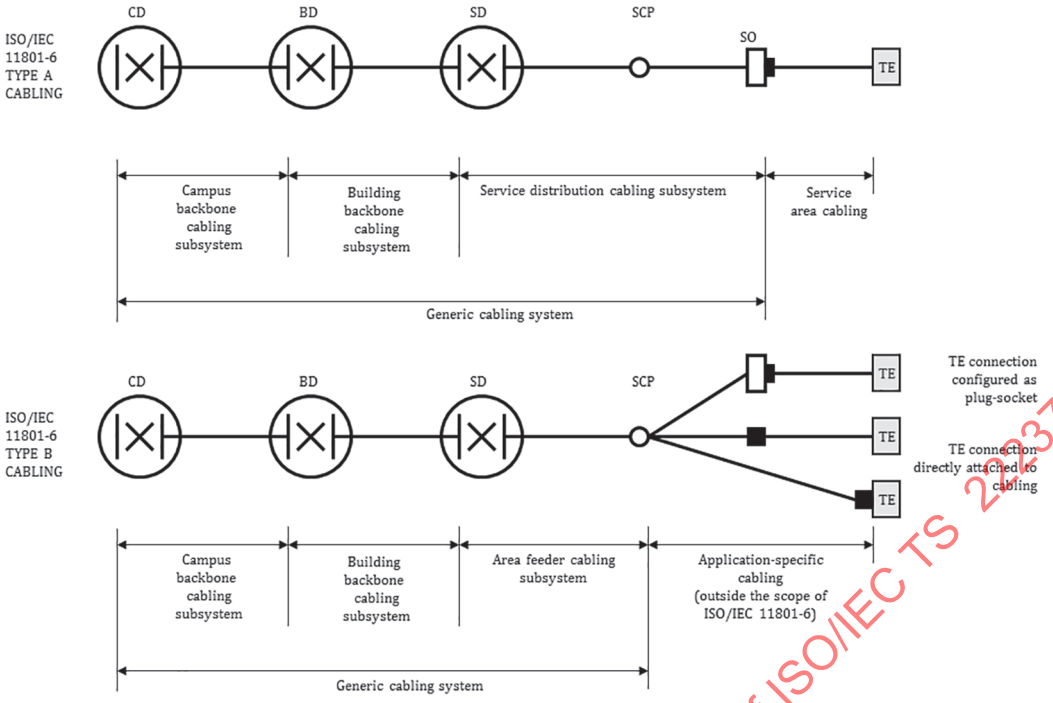

Figure 7 — Building service cabling subsystem according to ISO/IEC 11801-6

5.2.5 Application-specific fixed cabling

In cases where data centre owners agree to the use of application-specific cabling because of advantages compared with generic cabling, those application-specific cabling systems shall have a fixed and structured infrastructure approach in accordance with the cabling subsystem architecture of ISO/IEC 11801-5 (see Figure 5).

5.3 Structured cabling for other data centre spaces and application-specific structured cabling

5.3.1 General

The cabling infrastructures in a data centre shall be appropriate to provide networking and telecommunications capabilities in and between many of the dedicated data centres spaces. The cabling infrastructure between and within the data centre spaces other than the computer room space shall take one or more of the following forms:

a) generic — structured cabling in accordance with ISO/IEC 11801-2 for IT and network telecommunications (see 5.2.3);

b) generic — structured cabling in accordance with ISO/IEC 11801-6 for monitoring and control (see 5.2.4);

c) application specific (see 5.3.2).

5.3.2 Application-specific cabling using a fixed infrastructure

In cases where data centre owners agree to the use of application-specific cabling because of advantages compared with generic cabling, those application-specific cabling systems shall have a fixed and structured infrastructure approach in accordance with the cabling subsystem architecture of ISO/IEC 11801-2 (see Figure 6).

6 Availability design principles for telecommunications cabling infrastructure

ISO/IEC TS 22237-1:2018, Annex A, gives guidance about design principles for availability. This document uses the principles of:

a) redundancy;

b) maintainability;

c) scalability/future proofness;

d) simplicity.

as a basis for the design of:

1) the telecommunications cabling itself;

2) the telecommunications architecture;

3) associated pathways and spaces.

in order to achieve the desired Availability Class for the telecommunications infrastructure as described in Clause 6.

Redundancy within the networks of the data centre shall be implemented by means of the active equipment without the need for manual interaction. All redundancy implementations within the cabling (e.g. multi-path routeing; Classes 3 and 4) are in support of that provided by active equipment.

7 Availability classification for telecommunications cabling infrastructure

7.1 General

This clause classifies the architecture and the redundancy concept of all telecommunications cabling infrastructures as it relates to the chosen overall Availability Class for facilities and infrastructures of the data centre according to ISO/IEC TS 22237-1.

Table 1 defines the minimum requirements for all telecommunications cabling types in the different data centre spaces to achieve the chosen overall Availability Class of the data centre as defined by ISO/IEC TS 22237-1. All defined Availability Classes for the different cabling types and spaces shall be met in order to achieve the chosen overall data centre Availability Class for facilities and infrastructures.

Table 1 — Telecommunication cabling Availability Classes per space architecture and overall data centre Availability Class for facilities and infrastructures

Data centre space	Cabling type	Overall data centre facilities and infrastructure — Availability Class 1	Overall data centre facilities and infrastructure — Availability Class 2	Overall data centre facilities and infrastructure — Availability Class 3	Overall data centre facilities and infrastructure — Availability Class 4
Computer room space	Inter-cabinets	7.2.1 Class 1	7.2.2 Class 2	7.2.3 Class 3	7.2.4 Class 4
	Intra-cabinets	7.2.1 Class 1	7.2.1 Class 1	7.2.1 Class 1	7.2.1 Class 1
	Adjacent cabinets	7.2.1 Class 1	7.2.1 Class 1	7.2.1 Class 1	7.2.1 Class 1
	Monitoring and Control	7.4	7.4	7.4	7.4

Table 1 *(continued)*

Data centre space	Cabling type	Overall data centre facilities and infrastructure — Availability Class 1	Overall data centre facilities and infrastructure — Availability Class 2	Overall data centre facilities and infrastructure — Availability Class 3	Overall data centre facilities and infrastructure — Availability Class 4
	Office style cabling	7.3	7.3	7.3	7.3
Control room space	Office style cabling	7.3	7.3	7.3	7.3
	Monitoring and Control	7.4	7.4	7.4	7.4
Other spaces	Office Style	7.3	7.3	7.3	7.3
	Monitoring and Control	7.4	7.4	7.4	7.4

7.2 Telecommunications cabling for the computer room

7.2.1 Cabling for Availability Class 1

A telecommunications cabling infrastructure for Availability Class 1 uses either a point-to-point connection (i.e. equipment cords) for the transmission channel (see Figure 8) or a fixed cabling infrastructure (see Figure 9) in a single-path configuration as shown in Figure 10.

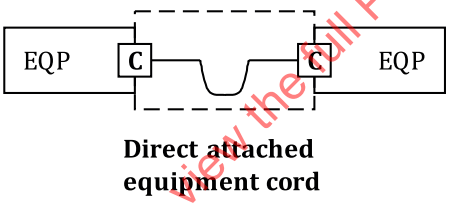

Figure 8 — Telecommunication cabling Class 1 using direct attached cords

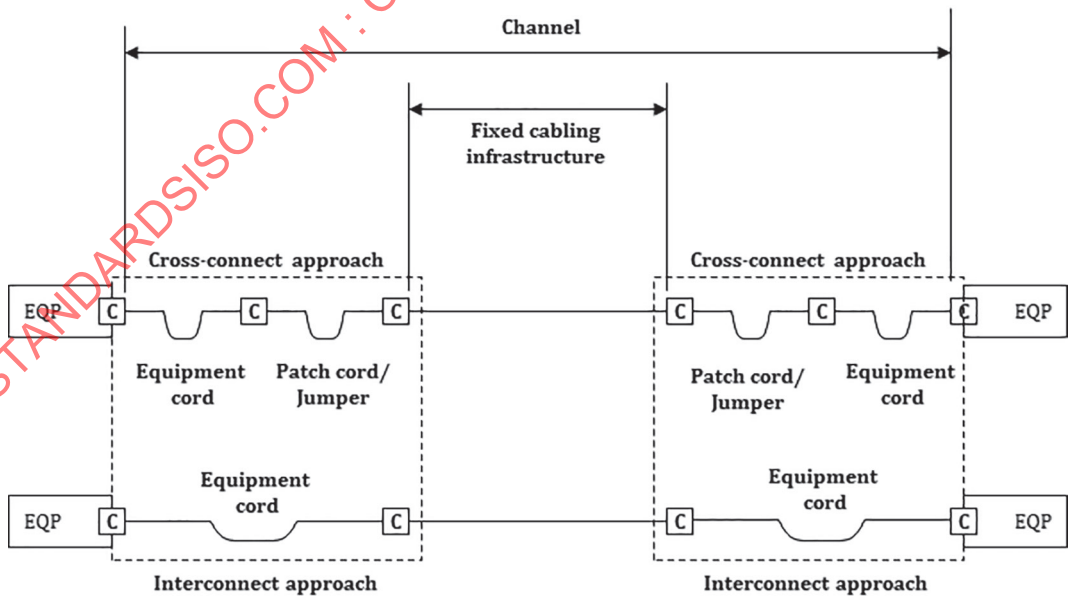

Figure 9 — Transmission channels (interconnect and cross-connect)

The point-to-point connections shall use pre-terminated cords and shall be restricted to local connections within the same cabinet or between adjacent cabinets, frames and racks.

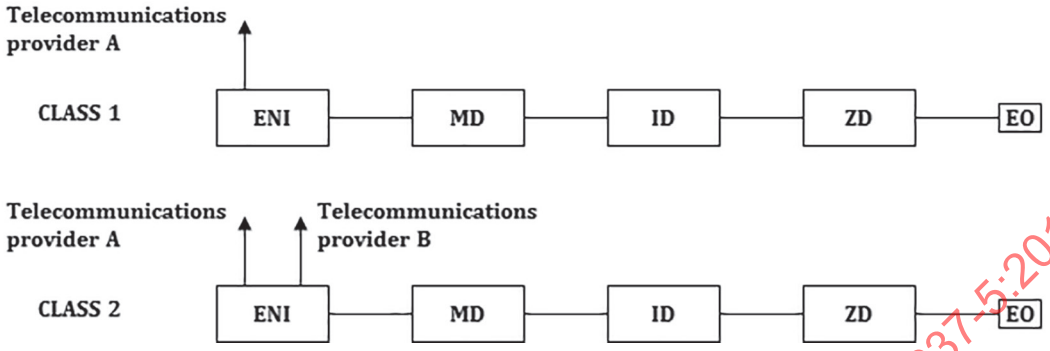

Figure 10 — ENI redundancy for Class 1 and 2

7.2.2 Cabling for Availability Class 2

A telecommunications cabling infrastructure for Availability Class 2 shall use a fixed cabling infrastructure (e.g. according to ISO/IEC 11801-5 or application-specific) in cabling subsystems defined in ISO/IEC 11801-5 for the transmission channel design (see Figure 9) with a single-path architecture with redundancy on the ENI as shown in Figure 10. The pathways for the telecommunications providers shall be designed according to Clause 8.

Furthermore, the following design criteria shall be met:

a) the design shall be flexible and scalable to allow quick moves, adds and changes by using central and local patching/cross connect locations in MD, ID and ZD as shown in Figure 11;

b) the patching/cross-connect cabinets/frames/racks used in MD and/or ID (CPL) and ZD (ZPL) shall offer rear cable management and side patch cord management. The design and selection of cross-connect cabinets/frames/racks shall take into consideration the maximum planned cabling capacity and required density inside the cabinets/frames/racks with the objective of minimising the disruption of airflow to active equipment. One possible and preferred way of achieving this functionality is to increase the width of the cabinets/frames/racks to offer more space for cable and patch cords which simplifies operations for moves, adds and changes.

c) where it is intended to create channels from more than a single subsystem via cross-connects in distributors, the selection of media and component performance shall take into account the impact of the number of connections within, and the total length of, the channels in relation to the applications which are intended to be supported.

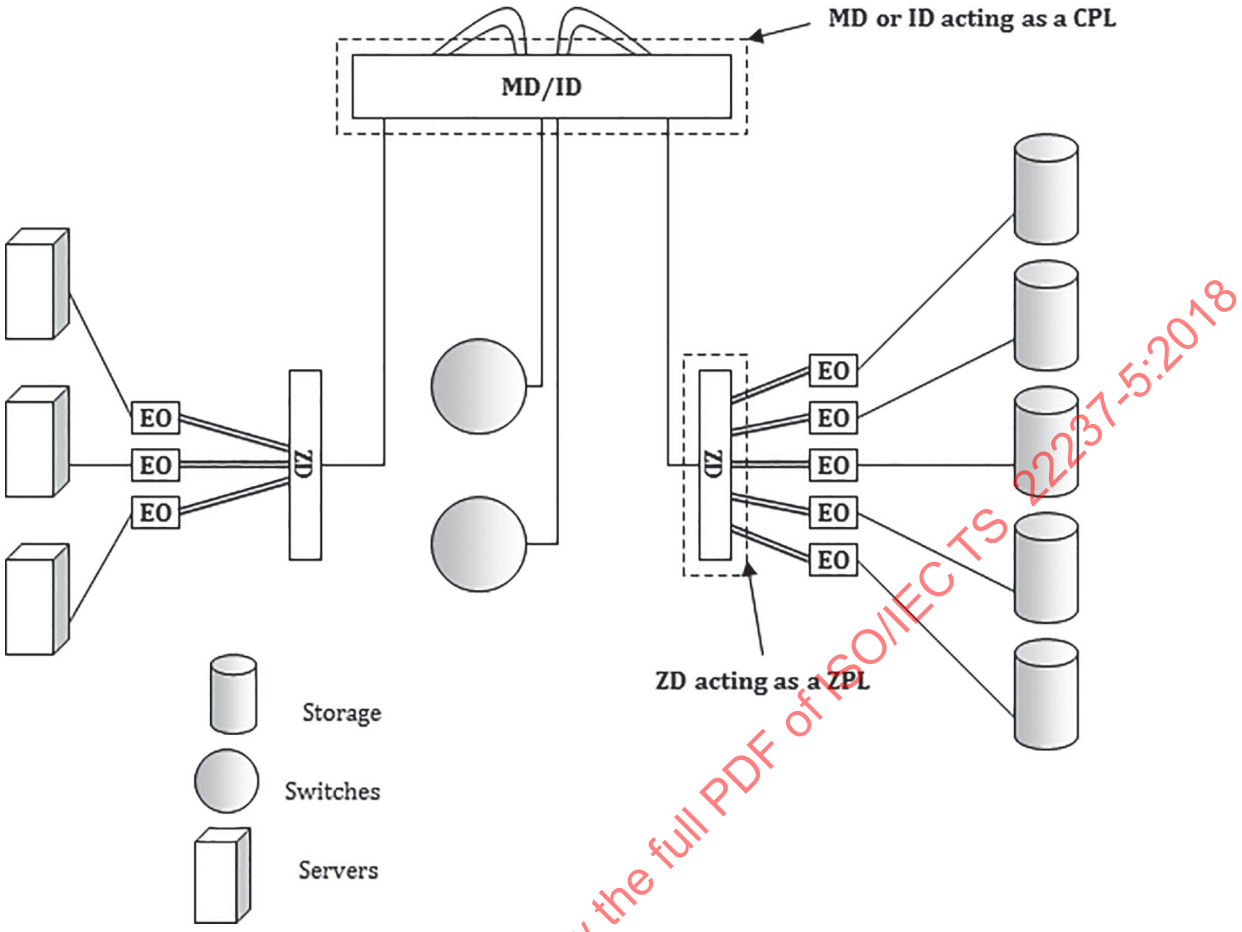

Figure 11 — Managing moves, adds and changes

7.2.3 Cabling for Availability Class 3

A telecommunications cabling infrastructure for Availability Class 3 shall use a fixed cabling infrastructure (e.g. according to ISO/IEC 11801-5 or application-specific) in cabling subsystems defined in ISO/IEC 11801-5 for the transmission channel design (see Figure 9) with a multi-path redundancy configuration using diverse physical pathways as shown in Figure 12. The pathways for the telecommunications providers shall be designed according to Clause 8.

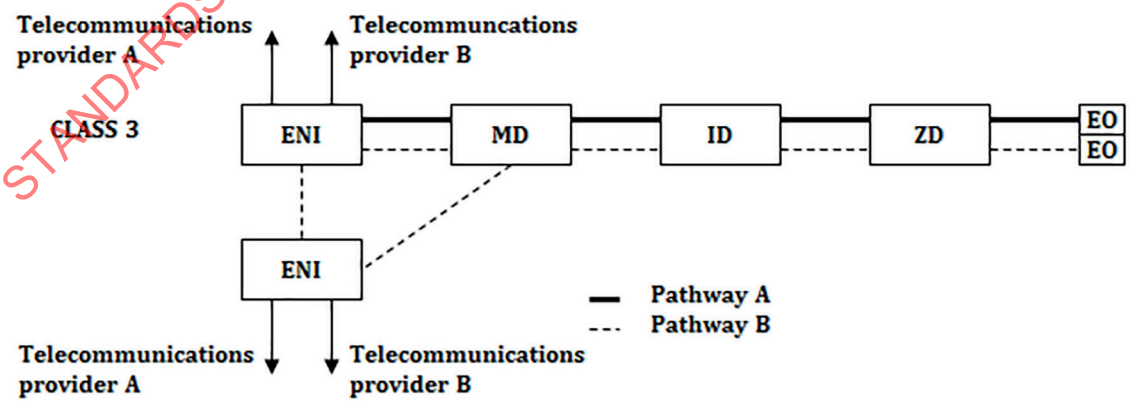

Figure 12 — Redundant multipath telecommunication cabling Class 3

Furthermore, the following design criteria shall be met:

a) the design shall be flexible and scalable to allow quick moves, adds and changes by using central and local patching/cross connect locations in MD, ID and ZD as shown in Figure 11;

b) the patching/cross-connect cabinets/frames/racks used in MD and/or ID (CPL) and ZD (ZPL) shall offer rear cable management and side patch cord management. The design and selection of cross-connect cabinets/frames/racks shall take into consideration the maximum planned cabling capacity and required density inside the cabinets/frames/racks with the objective of minimising the disruption of airflow to active equipment. The patch cord management inside the cabinets/frames/racks shall provide bend radius control. Additionally, the cabinet/frame/rack shall offer easy accessible and bend radius controlled slack storage for patch cords. One possible and preferred way of achieving this functionality is to increase the width of the cabinets/frames/racks to offer more space for cable and patch cords which simplifies operations for moves, adds and changes;

c) where it is intended to create channels from more than a single subsystem via cross-connects in distributors, the selection of media and component performance shall take into account the impact of the number of connections within, and the total length of, the channels in relation to the applications which are intended to be supported;

d) the cabling shall be routed within the data centre on appropriate pathway systems providing bend radius control (using additional fittings if not provided by the pathway system itself) and slack storage plus sufficient space for future expansions.

The use of pre-terminated cabling shall be considered for this class where:

1) on-site termination of cabling is impractical (e.g. field terminable connectors are not available);

2) operational constraints dictate that the time taken to install cabling shall be minimised (e.g. cabling needs to be in use as quickly as possible);

3) security concerns dictate that the presence in the data centre of third-party labour is minimised.

7.2.4 Cabling for Availability Class 4

A telecommunications cabling infrastructure for Availability Class 4 shall use a fixed cabling infrastructure (e.g. according to ISO/IEC 11801-5 or application-specific) in cabling subsystems defined in ISO/IEC 11801-5 for the transmission channel design (see Figure 9) with a multi-path redundancy configuration using diverse physical pathways and redundant distribution areas as shown in Figure 13. The pathways for the telecommunications providers shall be designed according to Clause 8.

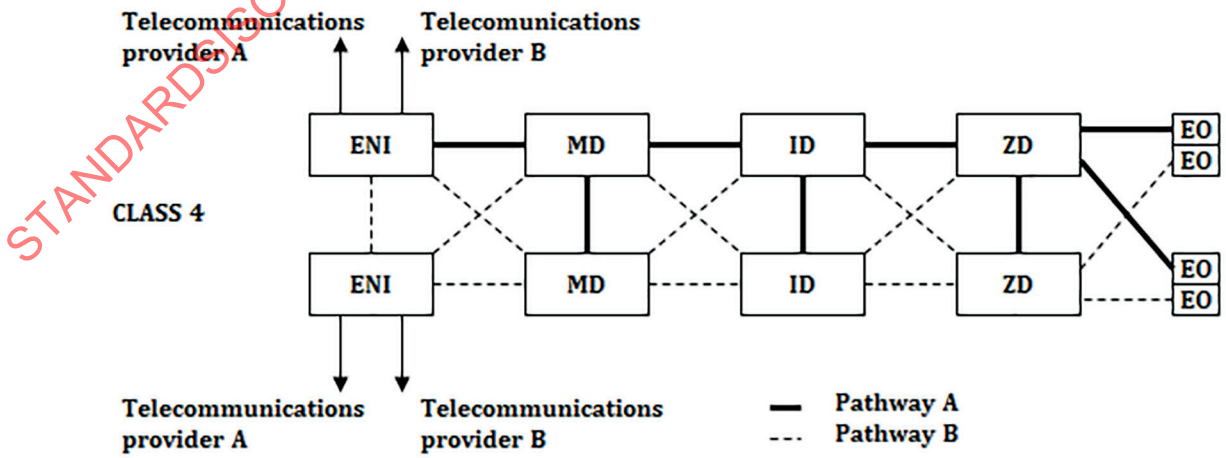

Figure 13 — Redundant multipath telecommunication cabling Class 4

Furthermore, the following design criteria shall be met:

a) the design shall be flexible and scalable to allow quick moves, adds and changes by using central and local patching/cross connect locations in MD, ID and ZD as shown in Figure 11;

b) the patching/cross-connect cabinets/frames/racks used in MD and/or ID (CPL) and ZD (ZPL) shall offer rear cable management and side patch cord management. The design and selection of cross-connect cabinets/frames/racks shall take into consideration the maximum planned cabling capacity and required density inside the cabinets/frames/racks with the objective of minimising the disruption of airflow to active equipment. The patch cord management inside the cabinets/frames/racks shall provide bend radius control. Additionally, the cabinet/frame/rack shall offer easy accessible and bend radius controlled slack storage for patch cords. One possible and preferred way of achieving this functionality is to increase the width of the cabinets/frames/racks to offer more space for cable and patch cords which simplifies operations for moves, adds and changes;

c) where it is intended to create channels from more than a single subsystem via cross-connects in distributors, the selection of media and component performance shall take into account the impact of the number of connections within, and the total length of, the channels in relation to the applications which are intended to be supported;

d) the cabling shall be routed within the data centre on appropriate pathway systems providing bend radius control (using additional fittings if not provided by the pathway system itself) and slack storage plus sufficient space for future expansions.

The use of pre-terminated cabling shall be considered for this class where:

1) on-site termination of cabling is impractical (e.g. field terminable connectors are not available);

2) operational constraints dictate that the time taken to install cabling shall be minimised (e.g. cabling needs to be in use as quickly as possible);

3) security concerns dictate that the presence in the data centre of third-party labour is minimised.

7.3 Telecommunications cabling for offices

A telecommunications cabling infrastructure shall use a fixed cabling infrastructure (i.e. according to ISO/IEC 11801-2 or application-specific) in cabling subsystems in a single-path architecture. Any required redundancy should be provided on backbone level.

7.4 Telecommunications cabling for monitoring and control

A telecommunications cabling infrastructure shall use a fixed cabling infrastructure (i.e. according to ISO/IEC 11801-6 or application-specific) in cabling subsystems in a single-path architecture.

Any required redundancy should be provided by the number of SOs provided throughout the data centre spaces.

8 Pathways and pathway systems for telecommunications cabling

8.1 General

Careful planning of telecommunications cabling routes, containment and enclosures is required to minimize adverse impact on efficient performance of air conditioning systems (see Clause 10).

The design requirements of this clause shall be implemented using the general and data centre specific requirements of ISO/IEC 14763-2.

It should be noted that ISO/IEC 14763-2 also contains recommendations which may assist in the design of a data centre telecommunications cabling infrastructure in accordance with this document.

8.2 Pathways

8.2.1 External service pathways

8.2.1.1 Requirements

The Availability Class for the entire set of facilities and infrastructures of the data centre gives guidance to determine the need for:

a) multiple service providers;

b) multiple service provider premises (i.e. operator sites or central offices);

c) diverse pathways from each of the service provider premises;

d) multiple BEFs;

e) multiple entrance rooms.

Clause 7 shall be used to determine and design the redundancy concept for the provisioning of external telecommunication services. Consideration shall be given to providing protection against failure in one or more parts of the cabling infrastructure by implementing:

1) multiple external network interfaces;

2) connections between external network interfaces;

3) multiple connections between external network interfaces and main and intermediate and zone distributors (MDs, IDs and ZDs);

4) multiple pathways between external network interfaces and main and intermediate and zone distributors (MDs, IDs and ZDs).

8.2.1.2 Recommendations

None.

8.2.2 Data centre pathways

8.2.2.1 Requirements

The design of pathways shall be coordinated with the designers of other services.

The requirements of ISO/IEC TS 22237-2 for data centre pathways shall be applied.

The Availability Class for the entire set of facilities and infrastructures of the data centre gives guidance to determine the need for:

a) multiple computer rooms and other spaces served by the computer room cabling;

b) hierarchical redundant distribution areas within the computer room(s);

c) segregation between redundant areas using different fire protection zones (fire compartmentation);

d) independent pathways for each redundant area.

The selected Availability Class for the cabling in the computer room space (Table 1) shall be used to determine and design the data centre pathways. Consideration shall be given to providing protection against failure in one or more parts of the cabling infrastructure by implementing:

1) multiple MDs;

2) multiple IDs;

3) multiple ZDs;

4) multiple pathways between the MDs;

5) multiple pathways between the IDs;

6) multiple pathways between the ZDs;

7) multiple pathways between each MD and IDs;

8) multiple pathways between each MD and ZDs;

9) multiple pathways between each ID and ZDs.

8.2.2.2 General recommendations

Overhead telecommunications cabling may improve cooling efficiency and is recommended where ceiling heights permit because it can substantially reduce airflow losses due to airflow obstruction and turbulence caused by under floor cabling and cabling pathways.

8.3 Pathway systems

8.3.1 Requirements for data centre pathway systems

The design of pathway systems shall take into account the security requirements applicable to the data intended to be transmitted over the cabling (see ISO/IEC TS 22237-6).

Pathway systems shall not be located under piping systems except for piping system used for cooling and fire extinguishing systems. This requirement also applies in other data centre spaces.

8.3.2 Access floor tile openings

The requirements of ISO/IEC TS 22237-2 for access floor systems shall be applied.

8.3.3 Cable management systems

8.3.3.1 General

8.3.3.1.1 Requirements

In addition to the requirements of ISO/IEC 14763-2, particular attention is drawn to the following:

a) pathway systems shall have sufficient capacity to cater for the defined maximum capacity level;

b) pathways systems shall have slack storage capabilities;

c) pathways systems shall have bend radius control;

d) pathway systems which do not provide continuous support (e.g. mesh, basket, hooks etc.) shall only be considered for non-vertical pathways where:

   — the cable to be accommodated is suitable for non-continuous support;

   — a list of acceptable combinations of pathway systems and cables shall be provided to the operator of the data centre;

   — mitigation is applied e.g. cable mat.

The design of pathway systems shall take into account the security requirements applicable to the data intended to be transmitted over the cabling (see ISO/IEC TS 22237-6).

8.3.3.1.2 Recommendations

A list of acceptable combinations of pathway systems and cables should be provided to the operator of the data centre.

8.3.3.2 Requirements for under-floor systems

The requirements of ISO/IEC TS 22237-2 for access floor systems shall be applied.

9 Cabinets and racks for the computer room space

9.1 General requirements

Cabinets and racks shall be selected to:

a) provide a growth path for future technologies and data centre capacity demands;

b) provide adequate cable management and bend radius functionality;

c) provide and support adequate ventilation and cooling for the equipment it will house (see ISO/IEC TS 22237-4).

Cabinets, racks and frames shall be provided with cable and cord management fittings.

9.2 Requirements for dimensions

The minimum width of the cabinets/racks used for CPL and ZPL shall be 0,8 m with a preference for a larger width (see Clause 7).

The minimum width of the cabinets/racks used for equipment shall cope with the current and future cable management requirements. A width of 0,8 m is recommended.

The minimum depth of the cabinets/racks used for equipment shall cope with the current and future equipment dimensions. A depth of 1,2 m is recommended.

Cabinets and racks shall not be located under piping systems (both for reasons of breakage or aggregation of condensation), except piping systems used for cooling and fire extinguishing systems. This requirement also applies to other data centre spaces. Blanking panels should be installed in unused cabinet positions in order to avoid mixing of hot and cold air.

9.3 Recommendations

The following cable management methods should be considered:

a) for low density systems, there should be one rack unit of horizontal cable management for each rack unit of termination points;

b) for high density applications, horizontal cable management systems that require rack units should be replaced with cable management without rack unit usage;

c) the capacity of the vertical cable management within cabinets should be twice the cross-sectional area of the cables to be installed when the cabinets/racks are at full capacity;

d) cabinets may require additional depth or width to provide adequate vertical cable management.

10 Documentation and quality plan

10.1 Requirements for documentation

The documentation of the installation shall be in accordance with ISO/IEC 14763-2.

10.2 Recommendations for documentation

The identifier scheme for cabinets, frames and racks should use a grid coordinate system based on the access floor grid.

In cases where no access floor exists, a grid should be created by aisles and cabinets, frames and racks.

The identifier scheme should also identify the rack until location of the termination points/closures; see ISO/IEC TR 14763-2-1 for an example of one such scheme.

10.3 Requirements for the quality plan

The quality plan of the installation shall be in accordance with ISO/IEC 14763-2. Additional requirements for the quality plan are under consideration.

11 Management and operation of the telecommunications cabling infrastructure

11.1 General

See ISO/IEC TS 22237-7.

11.2 Automated infrastructure management systems

Automated infrastructure management (AIM) systems offering real time documentation and efficient management of the physical layer should be considered for availability and operational purposes. Ideally, the functionality of these systems should be integrated into existing or planned data centre management tools offering an overall infrastructure management.

11.3 Fibre optic cabling

In order to maintain optical fibre connection performance and in order to prevent optical fibre end-face damage to both the cabling and equipment, optical fibre end-faces shall be inspected for loose contamination which shall be removed prior to any connection being established. Inspection equipment is specified in IEC 61300-3-35 and cleaning procedures, where necessary, are specified in IEC/TR 62627-01.

Annex A
(normative)

Cabling design concepts

A.1 General

This annex presents design concepts for different equipment row configurations according to the Availability Classes 1 to 4 for telecommunications cabling.

Figure A.1 shows the keys used in Figures A.2 to A.9.

NOTE Interfaces are normally accommodated in patch panels.

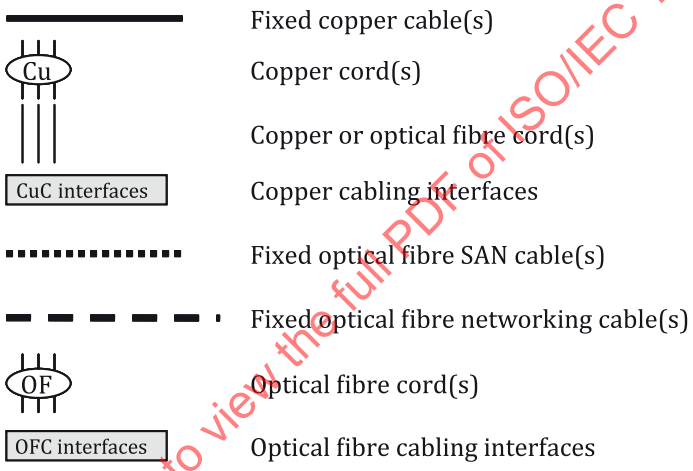

Figure A.1 — Symbols of network elements

Figures A.3 to A.9 show EOs of ISO/IEC 11801-5 but the interfaces may also be interfaces to application-specific cabling.

A.2 Class 1 cabling concept

Figure A.2 illustrates a Class 1 cabling implementation using point-to-point cabling.

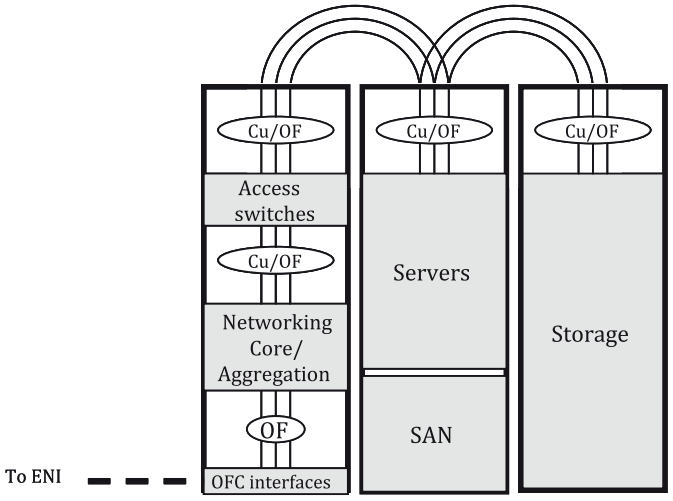

Figure A.2 — Example of a Class 1 cabling implementation

A.3 Class 2 cabling concepts

A.3.1 End of row and middle of row concepts

The end of row (EoR) and middle of row (MoR) networking concepts shall be implemented with Class 2 cabling according to Figure 9 and a CPL/ZPL configuration according to Figure 11.

These two concepts are the preferred concepts for server zones because future applications like 40GBase-T will be specified for EoR/MoR configuration.

A Class 2 cabling does not provide for redundancy.

For power budget reasons the SAN concept is a collapsed backbone.

Figure A.3 and Figure A.4 illustrate the EoR and MoR concepts.

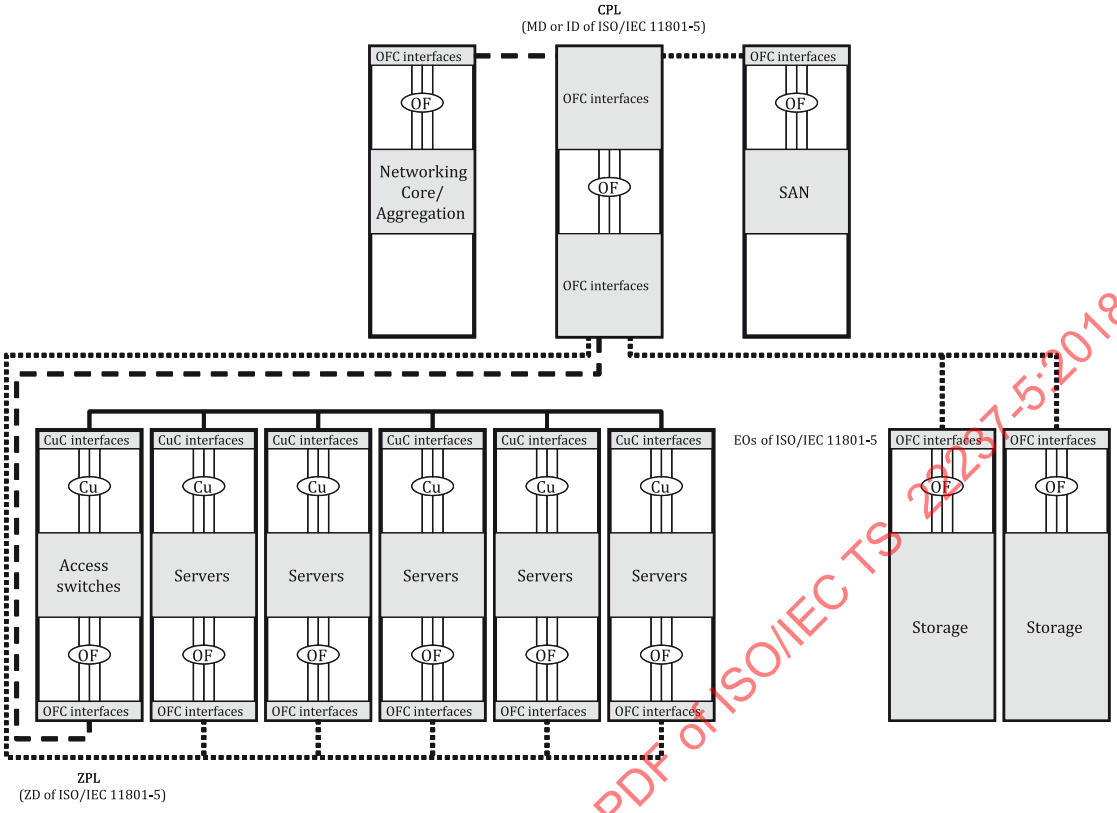

Figure A.3 — Example for Class 2 EoR cabling implementation

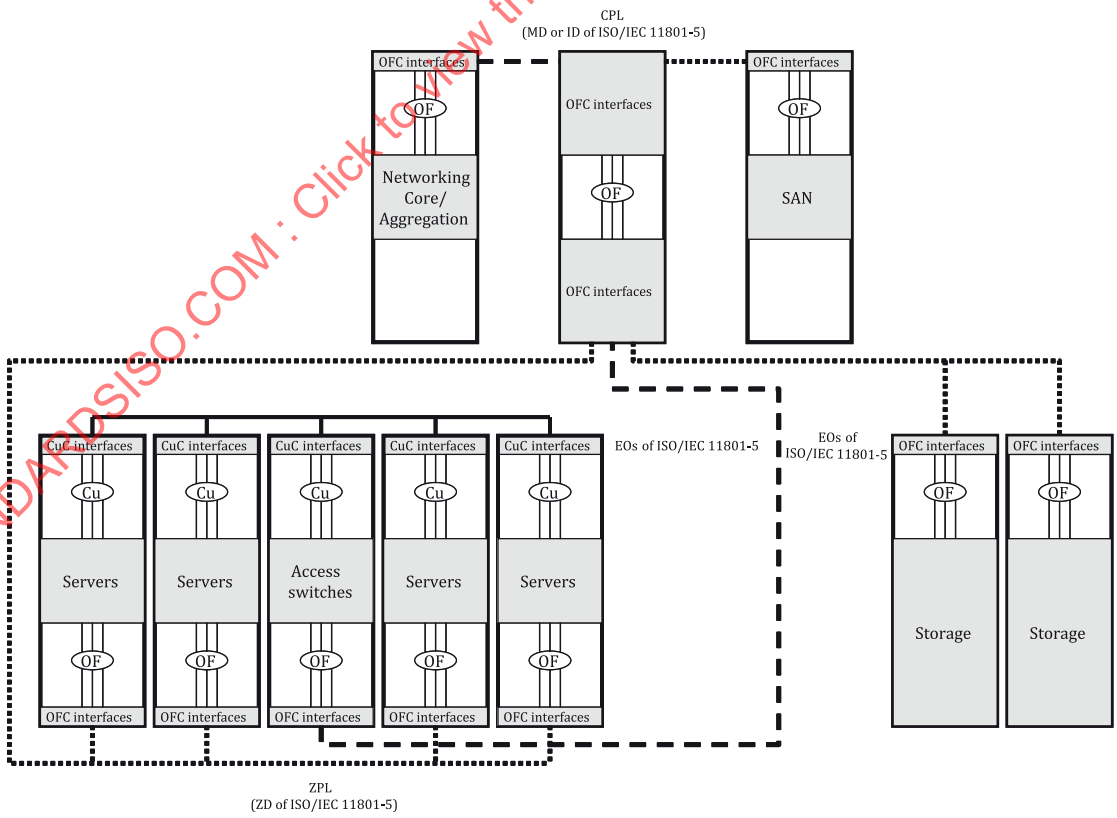

Figure A.4 — Example for Class 2 MoR cabling implementation

A.3.2 Top of rack concept

The top of rack (ToR) networking concept shall be implemented with Class 2 cabling according to Figure 9 and a CPL/ZPL configuration according to Figure 11.

A Class 2 cabling does not provide for redundancy.

For power budget reasons the SAN concept is a collapsed backbone.

Figure A.5 illustrates the ToR concept.

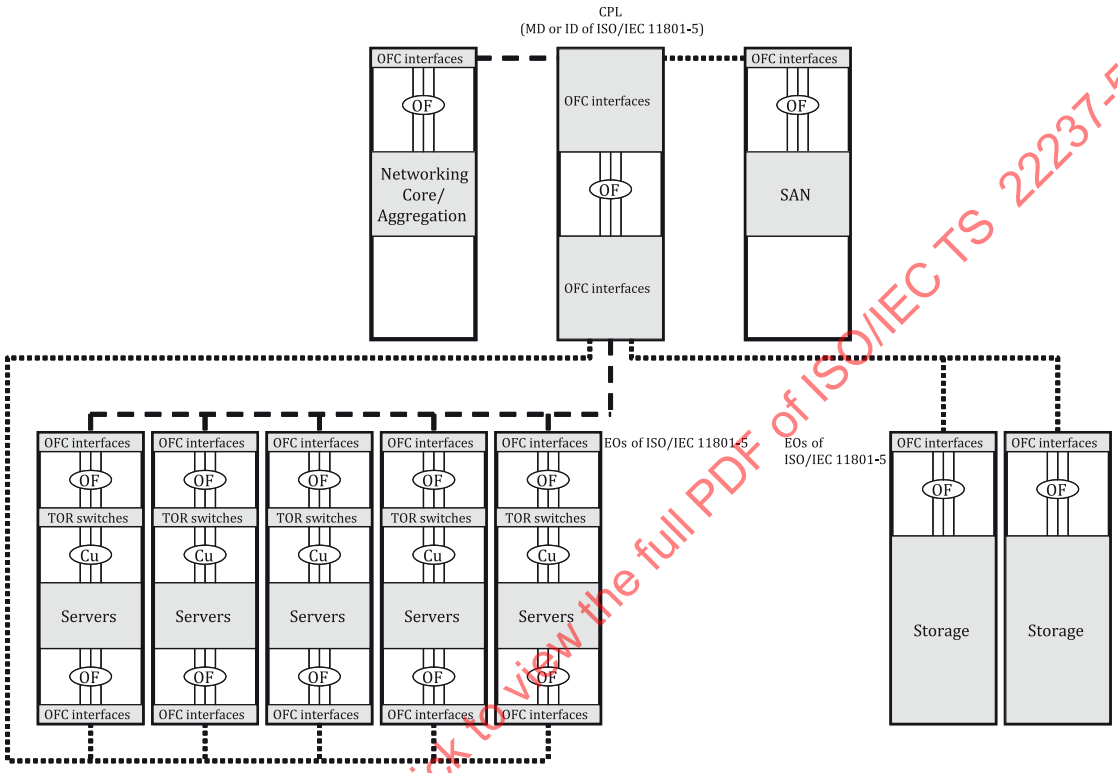

Figure A.5 — Example for Class 2 ToR cabling implementation

A.4 Class 3 cabling concepts

A.4.1 End of row and middle of row concepts

Redundant end of row (EoR) and middle of row (MoR) networking concepts shall be implemented with Class 3 cabling according to Figure 12 and a CPL/ZPL configuration according to Figure 11.

These two concepts are the preferred concepts for server zones because future applications like 40GBase-T will be specified for EoR/MoR configuration.

A Class 3 cabling provides redundancy with multiple pathways.

For power budget reasons the SAN concept is a collapsed backbone.

Figure A.6 illustrates the EoR concept. An MoR implementation is identical to the EoR implementation, except that the ZPL (i.e. the ZD of ISO/IEC 11801-5) is located in the middle of the row.