



International Telecommunication Union

# ITU-T Study Group 05

## Surge Protective Devices

for telecommunication networks

Gerhard Ackermann

Deutsche Telekom Germany

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# Introduction

Protection of a telecommunication network is a combination of:

- Resistibility of equipment
- Earthing, bonding and protection of the installation
- **additional use of surge protective devices, what this presentation is about**



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# Introduction

What is a **Surge Protective Device**?

Device that restricts the voltage of a designated port or ports, caused by a surge, when it exceeds a predetermined level.

- 1) Secondary functions may be incorporated, such as a current limiting device to restrict a terminal current.
- 2) Typically, the protective circuit has at least one non-linear voltage-limiting surge protective component.
- 3) An SPD is a combination of a protection circuit and holder.

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see ITU-T-Server : <http://www.itu.int/ITU-T/studygroups/com05/index.asp>  
for

- K-series Terminology
- Guide to the use of SG 5 Publications



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# Introduction

This presentation will cover three areas as follows:

- Relevant recommendations and standards
- types of SPD
- impact on SPD-need due to the evolution of the telecommunication network



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## ITU-T Recommendations\* and IEC-Standards

\*Surge Protective Devices are studied under question 13/5

### General SPD-Publications:

- K.11: Principles of protection against overvoltages and overcurrents
- K.36: Selection of protective devices
- K.69: Maintenance of protective measures
- K.app Application of Surge Protective Devices (in progress)
- Directives Volume VIII



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## ITU-T Recommendations and IEC-Standards

### Specific SPD-Publications:

- **K.65: SPD** Overvoltage and overcurrent requirements for termination modules with contacts for test ports or SPDs
- **K.12: GDT** Characteristics of gas discharge tubes for the protection of telecommunications installations
- **K.28: Diodes** Characteristics of semi-conductor arrester assemblies for the protection of telecommunications installations
- **K.30: PTC** Self-restoring overcurrent protectors
- **K.77: MOV** Characteristics of metal oxide varistors for the protection of telecommunications installations
- **K.ocp: PTC + ECL** Characteristics of solid-state, self restoring overcurrent protectors for the protection of telecommunications installations (in Progress)



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## ITU-T Recommendations and IEC-Standards

IEC 61643-2x SPD connected to telecommunication and signalling networks

IEC 61643-31x GDT Gas Discharge Tubes

IEC 61643-32x ABD Avalanche Breakdown Diodes

IEC 61643-33x MOV Metal Oxide Varistors

IEC 61643-34x TSS Thyristor Surge Suppressors

All above standards cover  
testing, performance and selection



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## Types of SPD

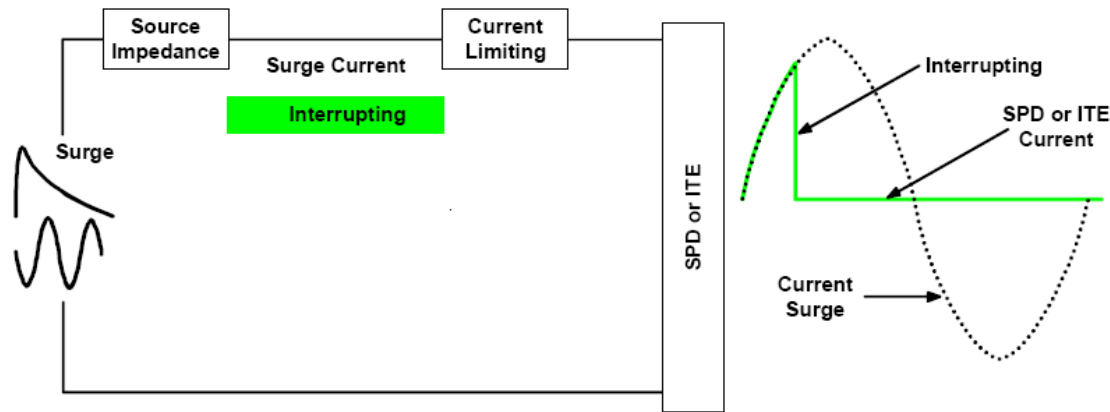
### What is an S P D used for?

- **Current Limiting**: Reduction of lightning current effects resulting from remote, adjacent and direct lightning effects.
- **Voltage Limiting**: Reduction of surge voltages resulting from indirect lightning effects or switching actions.
- Reduction of electromagnetic interference produced by electric power systems and electrified traction systems.
- Reduction/elimination of power-cross effects



# Types of SPD **Current Limiting**

## Current-interrupting devices

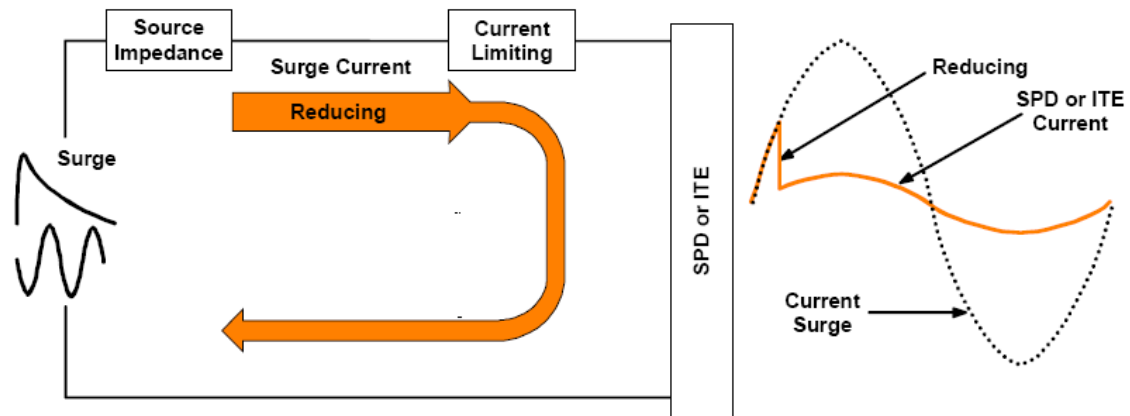


These devices are series elements which normally conduct the circuit current. An overcurrent condition causes the devices to open the circuit, interrupting the current flow. These devices are normally not resettable

- Fusible resistor
- Thick film resistors
- Wire-wound fusible resistors
- Thermal fuses

# Types of SPD **Current Limiting**

## Current-reducing devices

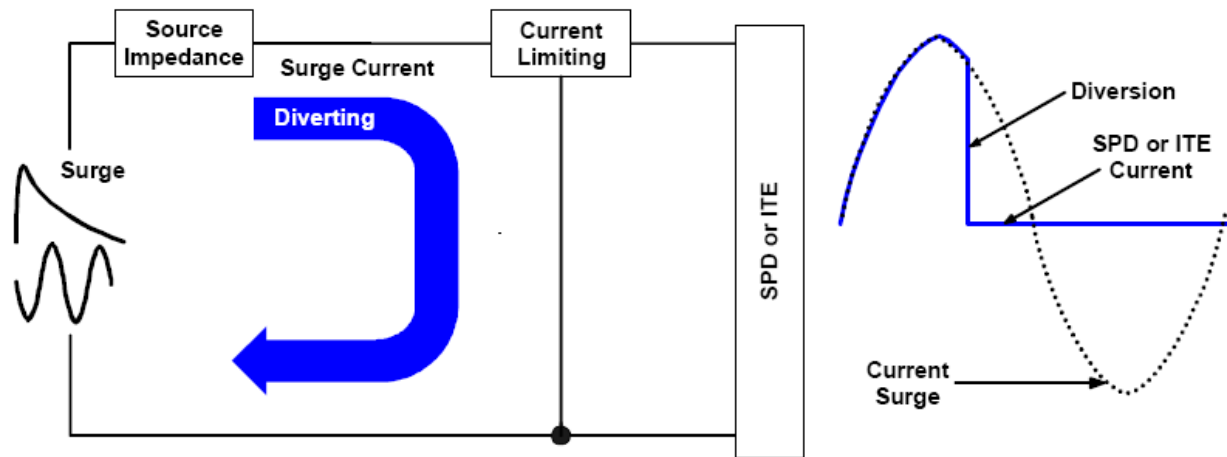


These devices are series elements which normally conduct the circuit current. An overcurrent condition causes the devices to increase their resistance, thus reducing the current flow.

- Polymer PTC (Positive Temperature Coefficient resistor)
- Ceramic PTC
- ECL (Electronic Current Limiter)

# Types of SPD **Current Limiting**

## Current-diverting devices

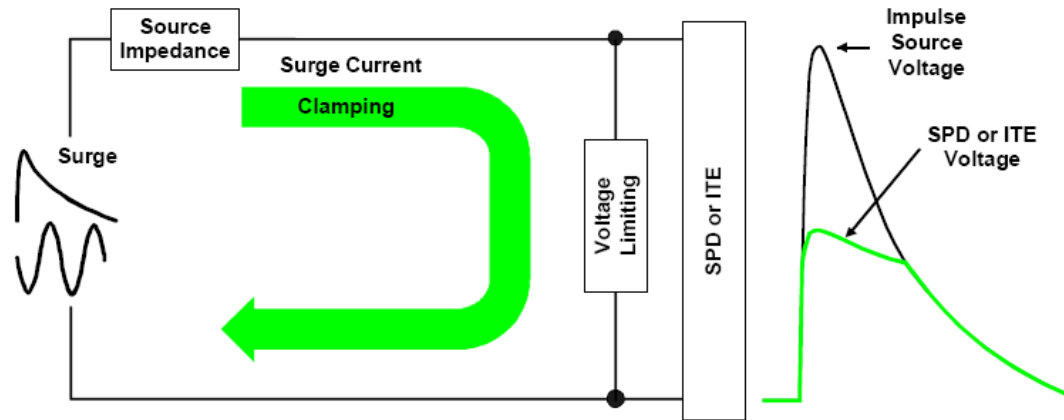


These devices are series elements that effectively place a short across the load. Operation occurs due to temperature rise of the device or load current sensing.

- Heat coils
- Gated thyristor, current operated
- Thermal Switch

# Types of SPD Voltage Limiting

## Voltage clamping devices

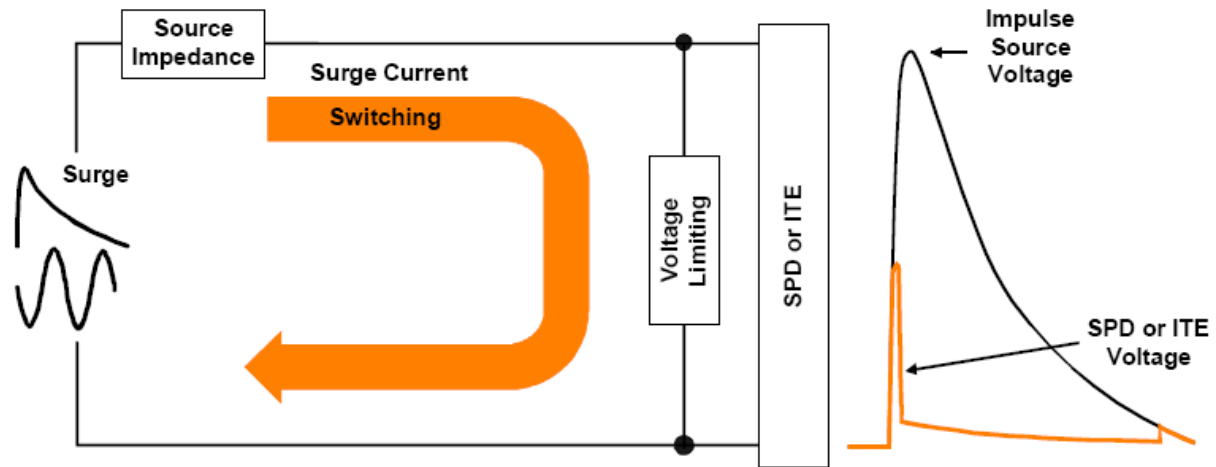


These devices are shunt elements that limit overvoltages by providing a low impedance path to divert the current by clamping at a given voltage

- **MOV** (Metal Oxide Varistor)
- **Silicon semiconductor** Avalanche Breakdown Diode, Punch-through Diode, Zener Diode, Foldback Diode

# Types of SPD Voltage Limiting

## Voltage switching devices



These devices are shunt elements that short circuit by switching at a given voltage.

- GDT Gas discharge tube
- TSS Thyristor surge suppressor
- Air gaps; isolating spark gaps

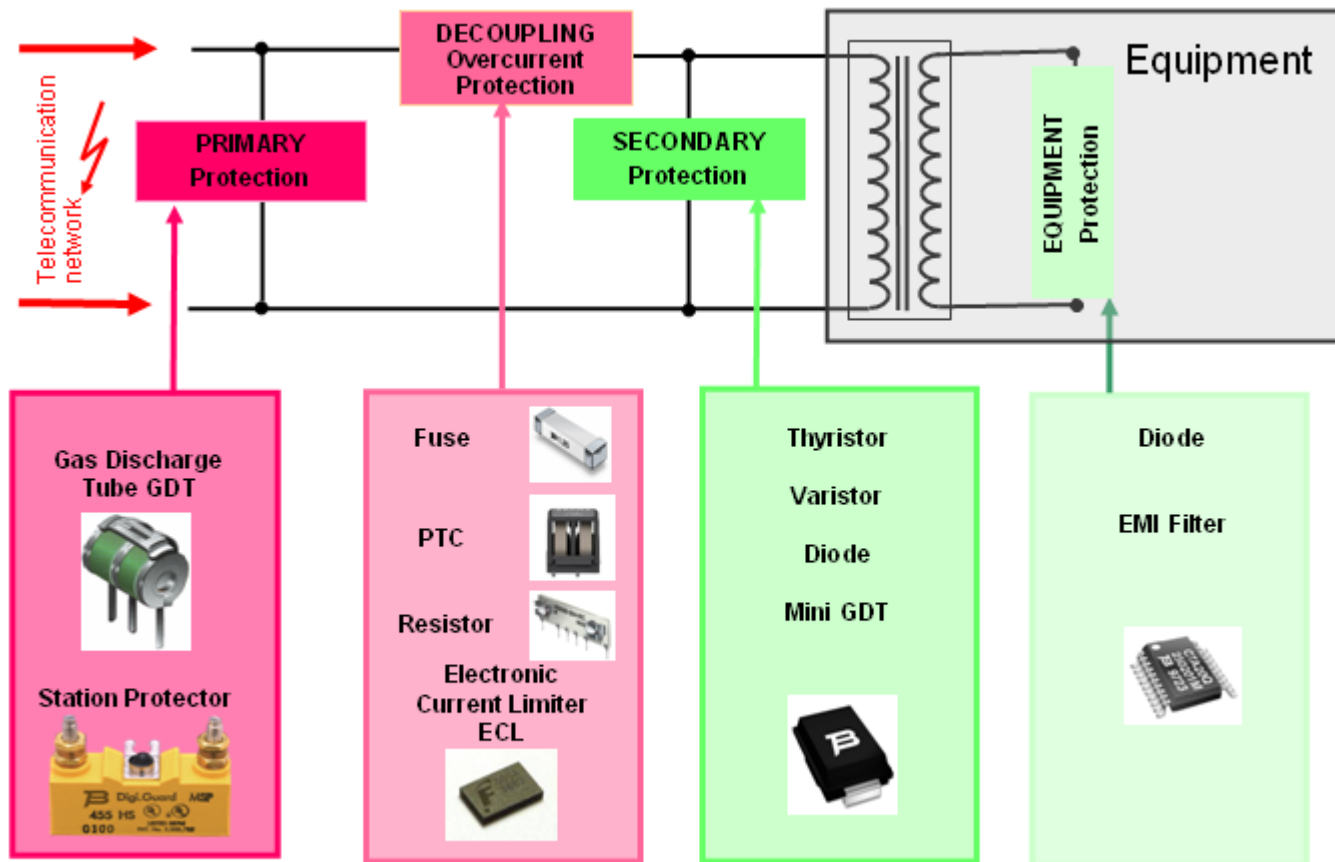


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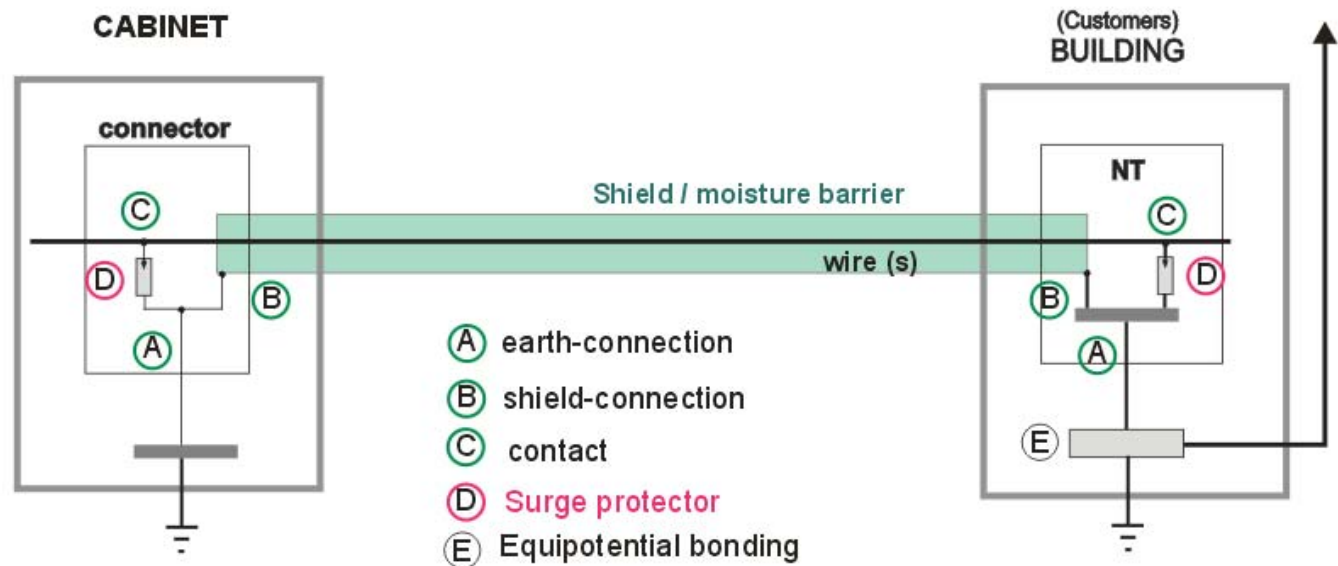
## Types of SPD

### Use of the different Devices/Components



## Types of SPD

What other devices and/or components are important?



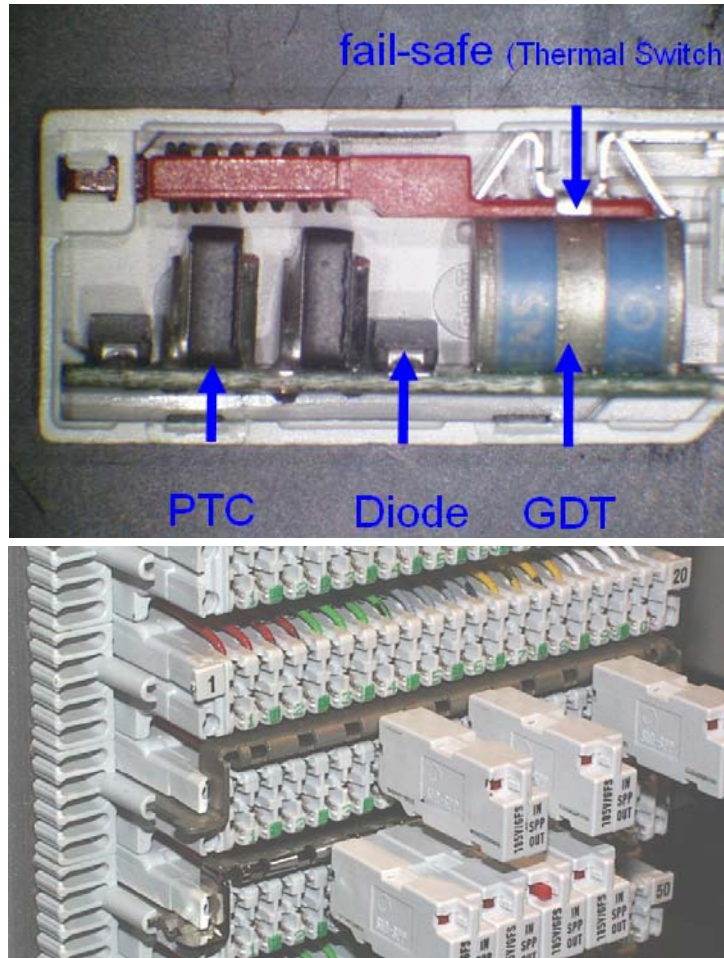


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# Types of SPD

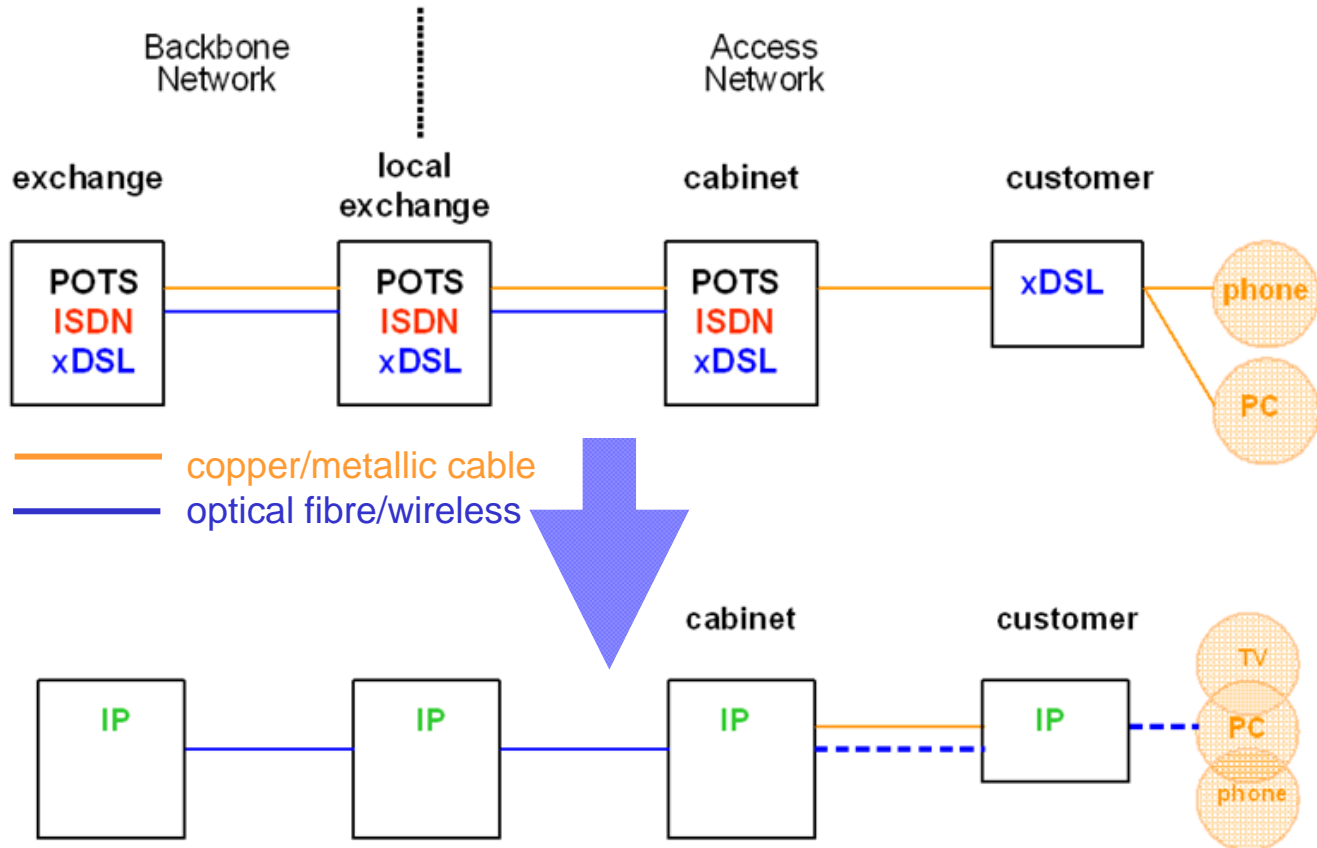
## Combination of different Devices







# Impact on SPD-need due to evolution of the telecommunication network



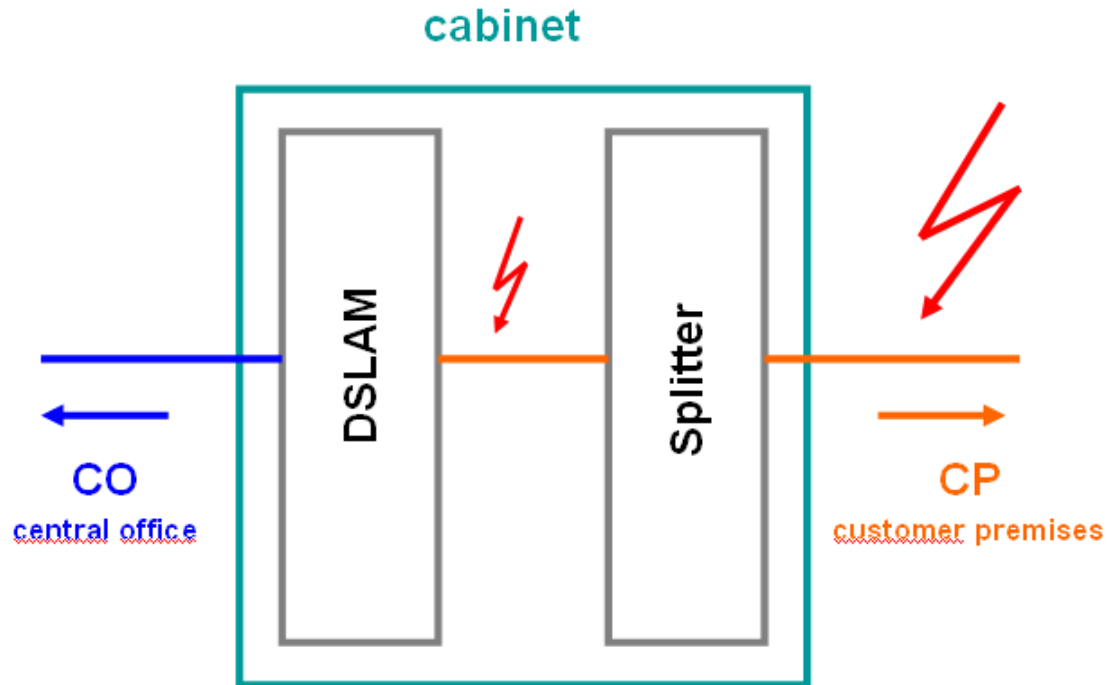
The conversion of the PSTN (Public Switched Telephone Network) into an IP-based Network “pureDSL” has impact on resistibility of the equipment , the protection and of the network and the need for additional surge protective devices



# Impact on SPD-need due to evolution of the telecommunication network

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Situation Today: DSLAM with Splitter acting as an SPD for POTS and DSL. DSLAM and Splitter are within the requirements acc. to ITU-T K.45 for the set.

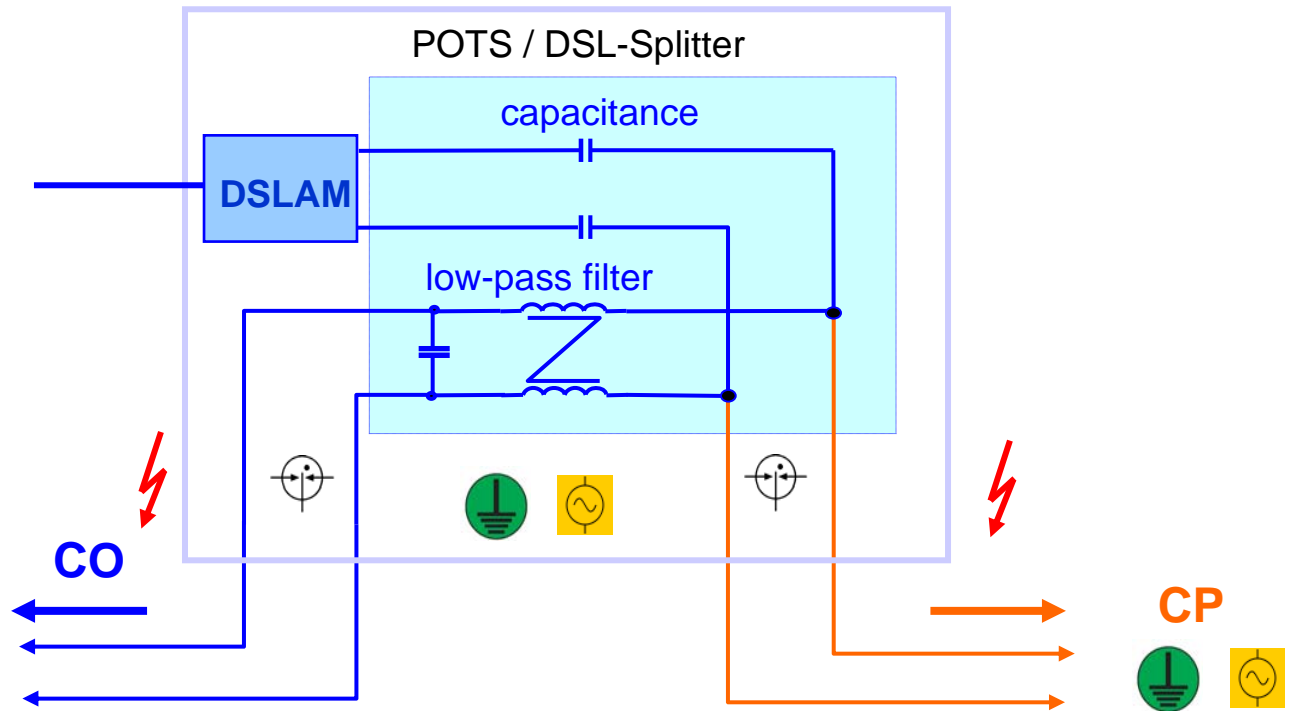




# Impact on SPD-need due to evolution of the telecommunication network

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Situation Today: SPD in front of DSLAM and Splitter  
(after risk-calculation in exposed areas)  
cabinet



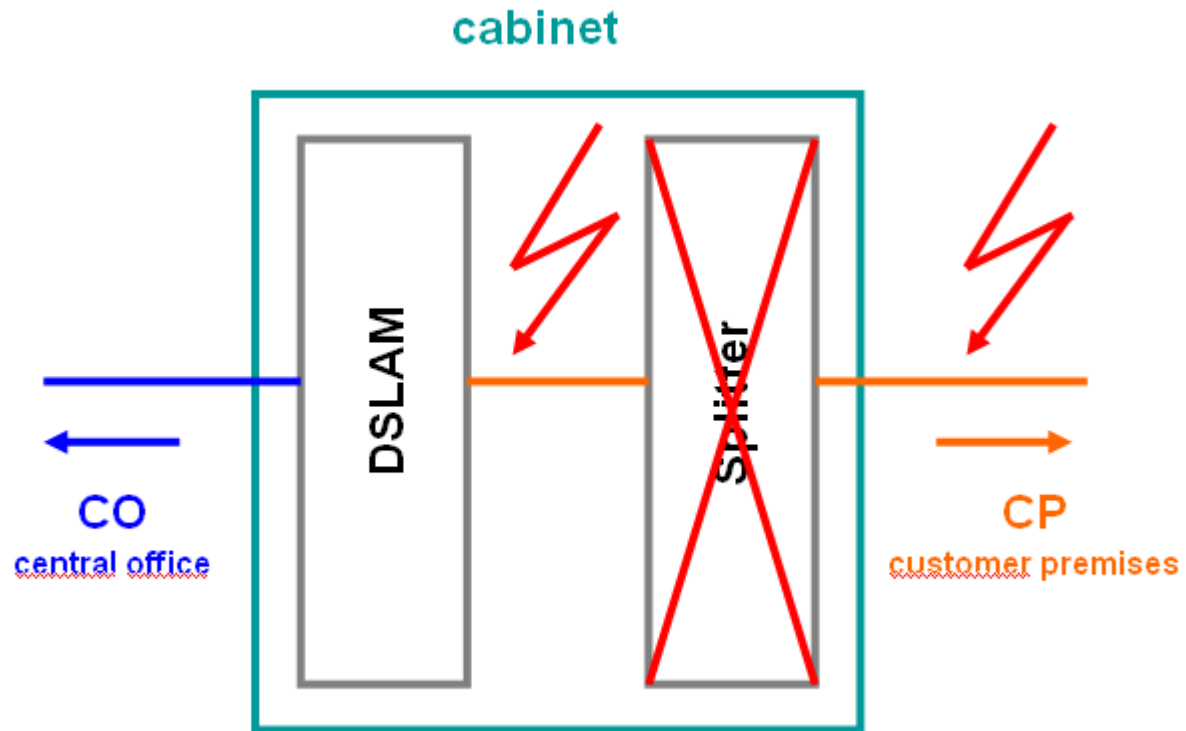


# Impact on SPD-need due to evolution of the telecommunication network

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Situation pure DSL: DSLAM without Splitter  
DSLAM is no longer protected by the splitter  
How to protect the DSLAM-Port /Line card?





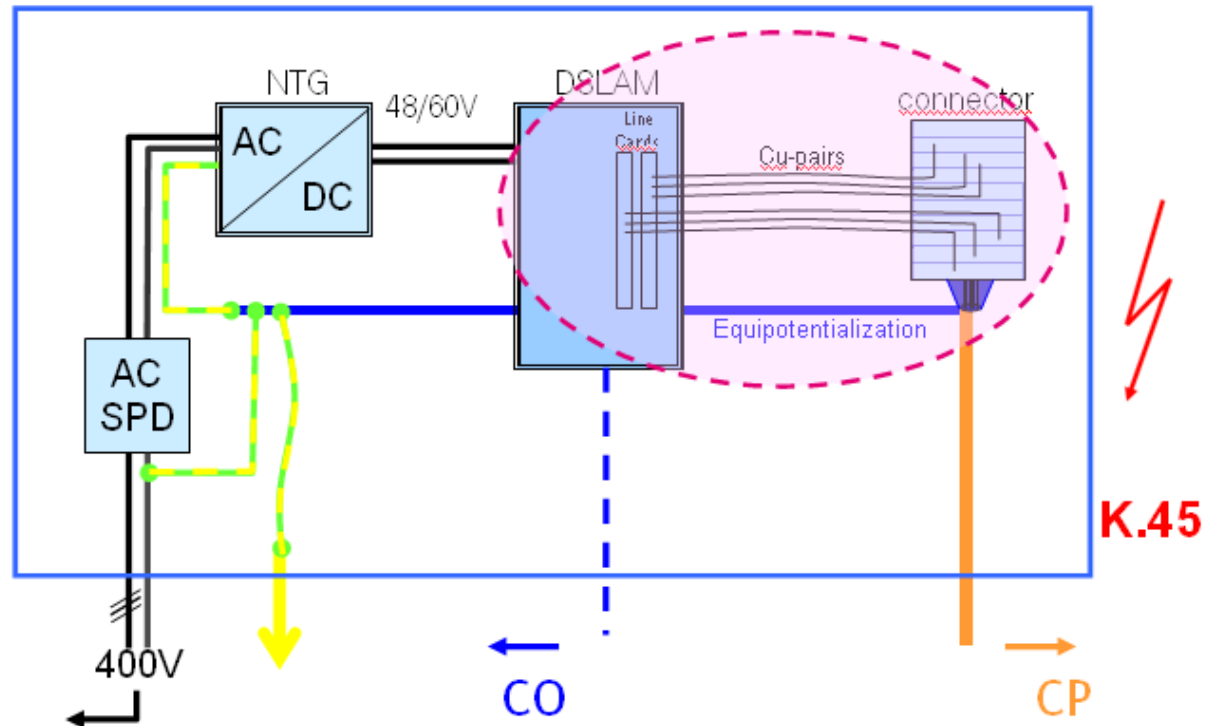
# Impact on SPD-need due to evolution of the telecommunication network

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Situation pureDSL: DSLAM without Splitter

What to do?





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## Impact on SPD-need due to evolution of the telecommunication network

Situation pureDSL: **How to protect the DSLAM-Port /Linecard?**

Option 1: Keeping the existing DSL-Linecards

Depending on the resistibility test results SPD on all customers lines or on all DSLAM-lines necessary

- + no reconstruction of DSLAM if SPD realized external to the DSLAM
- + packing density
- + time to market
- responsibility operator
- one side protection
- space for additional connector
- risk of loss of function for moderate exposed linecards if no SPD

Option 2: Reconstruction of the DSL-Linecards

- + responsibility manufacturer
- price
- time to market;
- less packing density (space for SPD on the linecard)



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## Conclusion

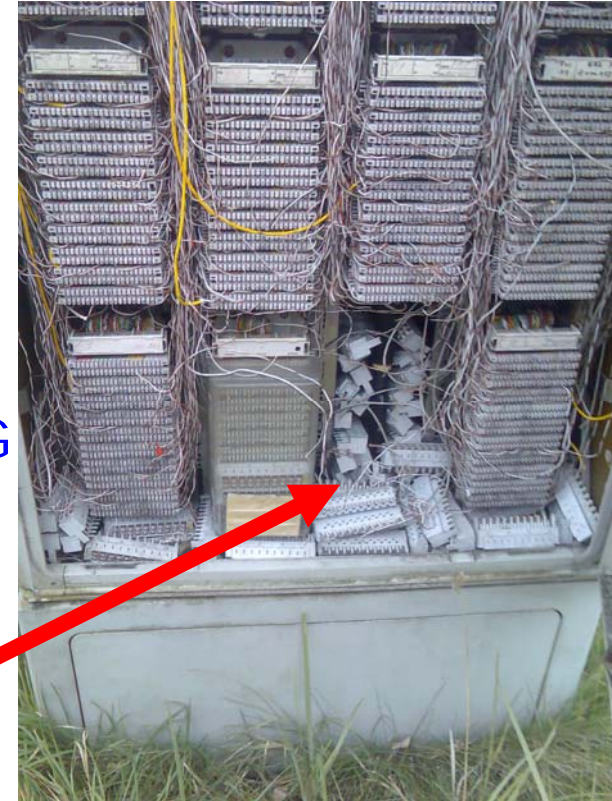
Protection with SPD is a well studied field and should be carried out in the sense of

**“good engineering practice”**

This means - beside a system-dependent (resistibility!) selection of the SPD-type- to include EARTHING and BONDING (don't forget the powersupply!!!) and sophisticated construction methods!

**Oh nice, some SPDs!**

**... good idea, but has to be fitted to the connector!!!**





# Question time

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- 1
- 2
- 3