



International Telecommunication Union

ITU-T Study Group 5

Lightning Protection for Telecommunication Systems

Célio Fonseca Barbosa

Rapporteur of Question 5/5

CPqD - Brazil

Workshop on:
"EMC, safety and EMF effects in telecommunications"



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Lightning discharges can reach a telecommunication system by the following mechanisms:





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Direct strikes



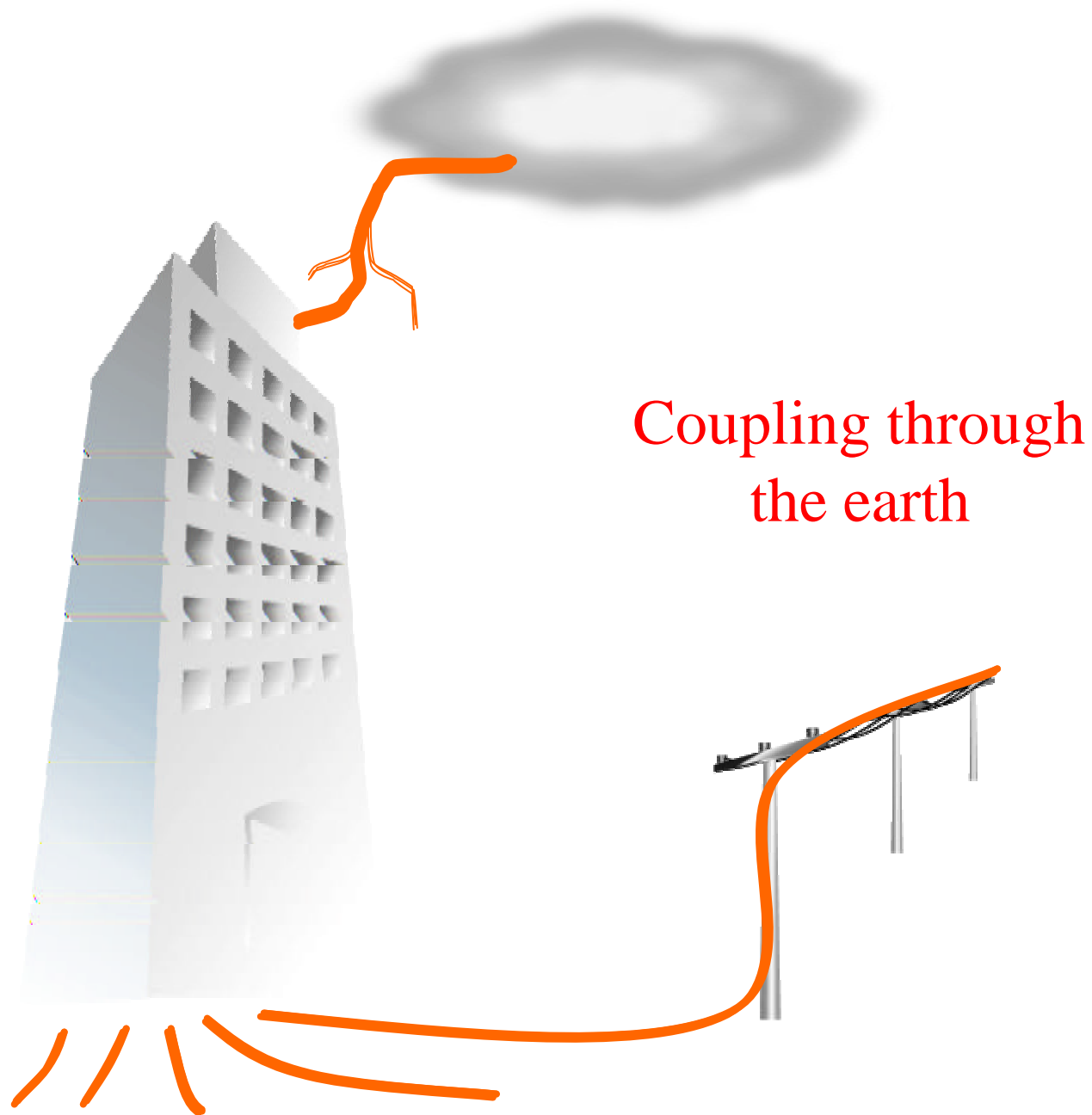
Workshop on: "EMC, safety and EMF effects in telecommunications"



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Coupling through
the earth

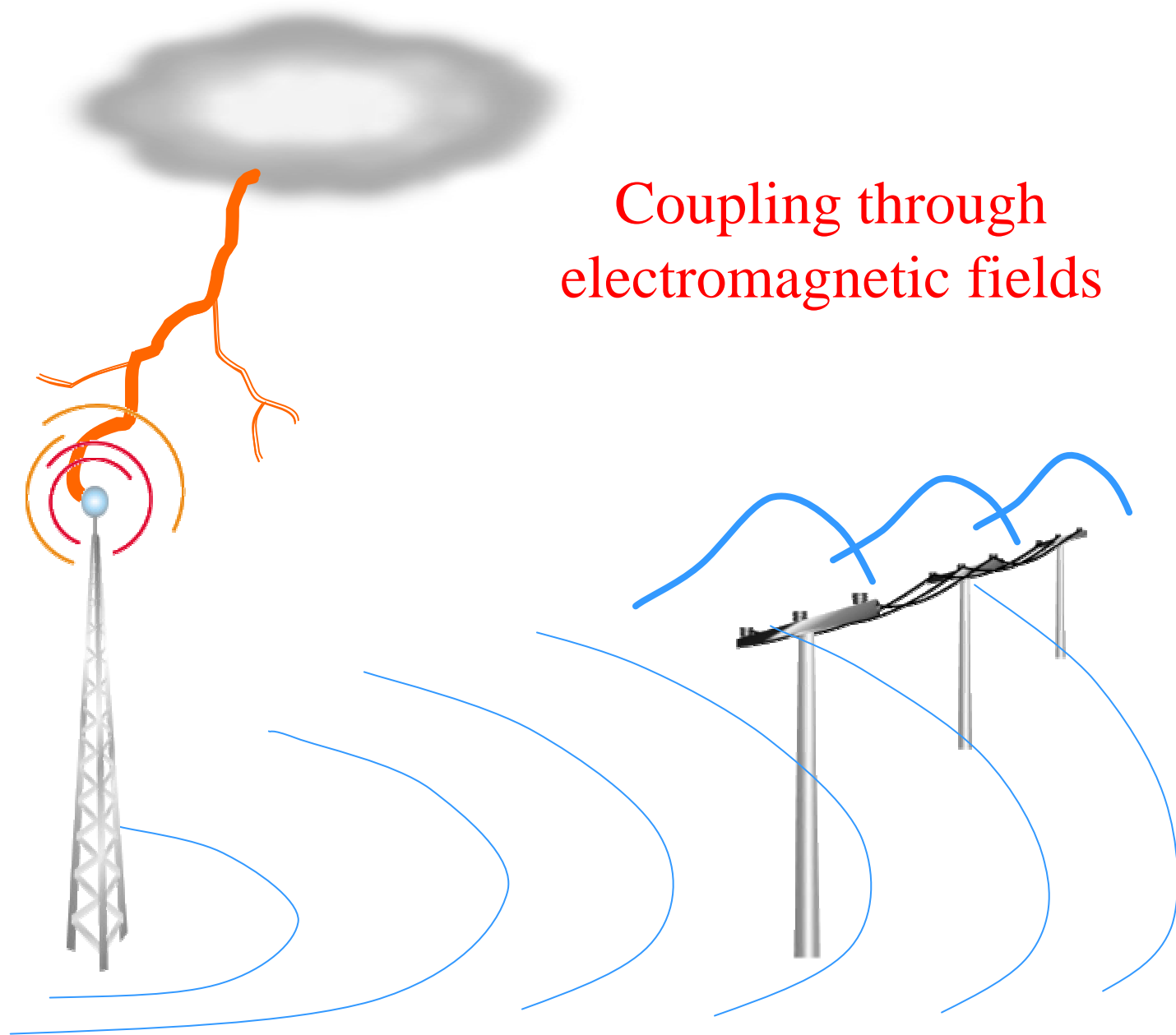
Workshop on: "EMC, safety and EMF effects in telecommunications"



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Coupling through
electromagnetic fields

Workshop on: "EMC, safety and EMF effects in telecommunications"



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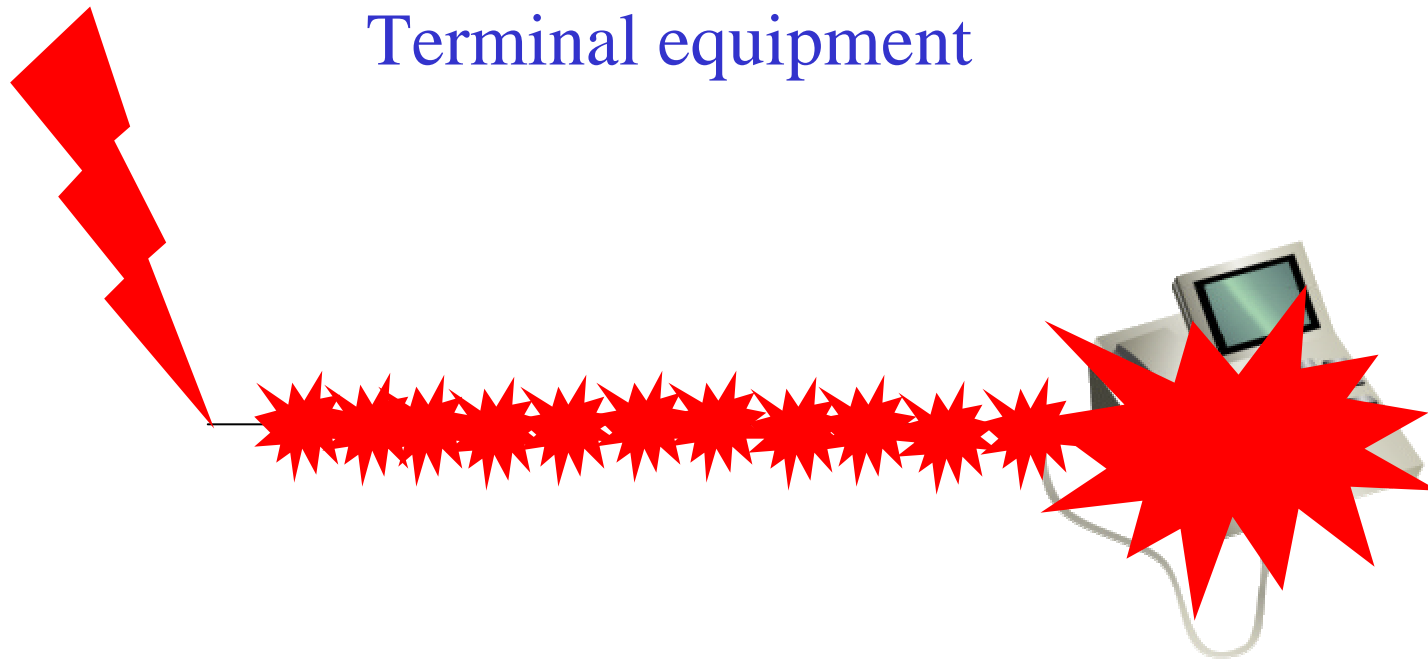
If adequate protection is missing,
the lightning surges can be very
dangerous to telecommunications
systems, threatening ...



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Terminal equipment

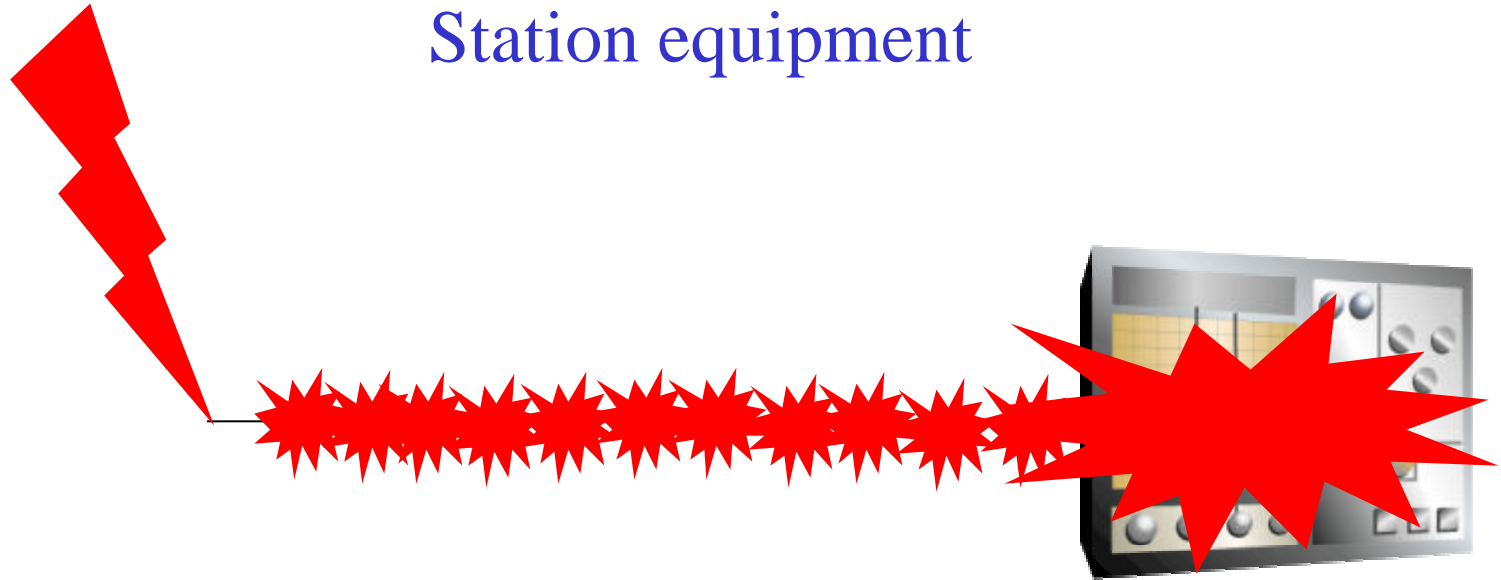




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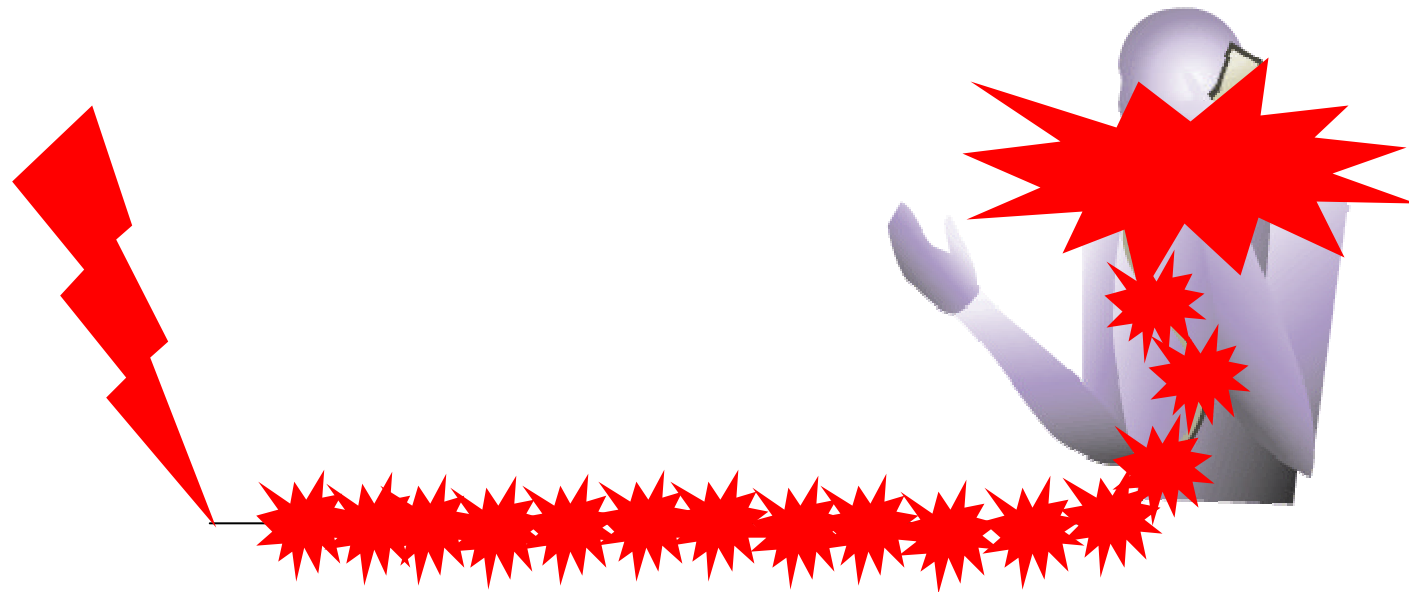
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Station equipment





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And even human beings



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In order to protect the telecommunications systems against the effects of lightning discharges, the ITU-T SG-5 produced a Handbook and a set of Series K Recommendations:



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Lightning Handbook:

“The protection of telecommunication lines and equipment against lightning discharges”

- Texts of tutorial nature covering the lightning phenomena, its effects on telecommunications systems and the philosophy of protective measures.
- Divided in 10 chapters.
- It's under revision during the actual study period.





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Series K Recommendations related to the protection against lightning discharges

- Texts with requirements, methods and procedures in order to protect the telecommunication systems and the associated people from the effects of lightning discharges.
- There are 6 of such Recommendations in force and 2 under development.





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Series K Recommendations related to the protection against lightning discharges in force:

- K.11: Principles of protection against overvoltages and overcurrents.
- K.25: Protection of optical fibre cables.
- K.39: Risk assessment of damages to telecommunication sites due to lightning discharges.
- K.40: Protection against LEMP in telecommunications centres.
- K.46: Protection of telecommunication lines using metallic symmetric conductors against lightning induced surges.
- K.47: Protection of telecommunication lines using metallic conductors against direct lightning discharges.



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Series K Recommendations related to the protection against lightning discharges under development:

- K.rbs: Protection of radio base stations against lightning discharges.
- K.coax: Protection of telecommunication lines using coaxial conductors against lightning discharges.





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Example of application of
ITU Recommendation K.46

“The Protection of Telecommunication Lines
Using Metallic Symmetric Conductors
Against Lightning Induced Surges”



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The ITU Recommendation K.46

provides a procedure to define
WHEN and WHERE

to install surge protective devices (SPD)
on telecommunication lines

based on ...



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- Line length
- Metallic shield of cables
- Type of area: urban, suburban, rural ...
- Lightning activity
- Soil resistivity
- Resistance of earthing systems
- Type of cable installation (aerial, buried)
- Type of equipment (switch, terminal, ...)



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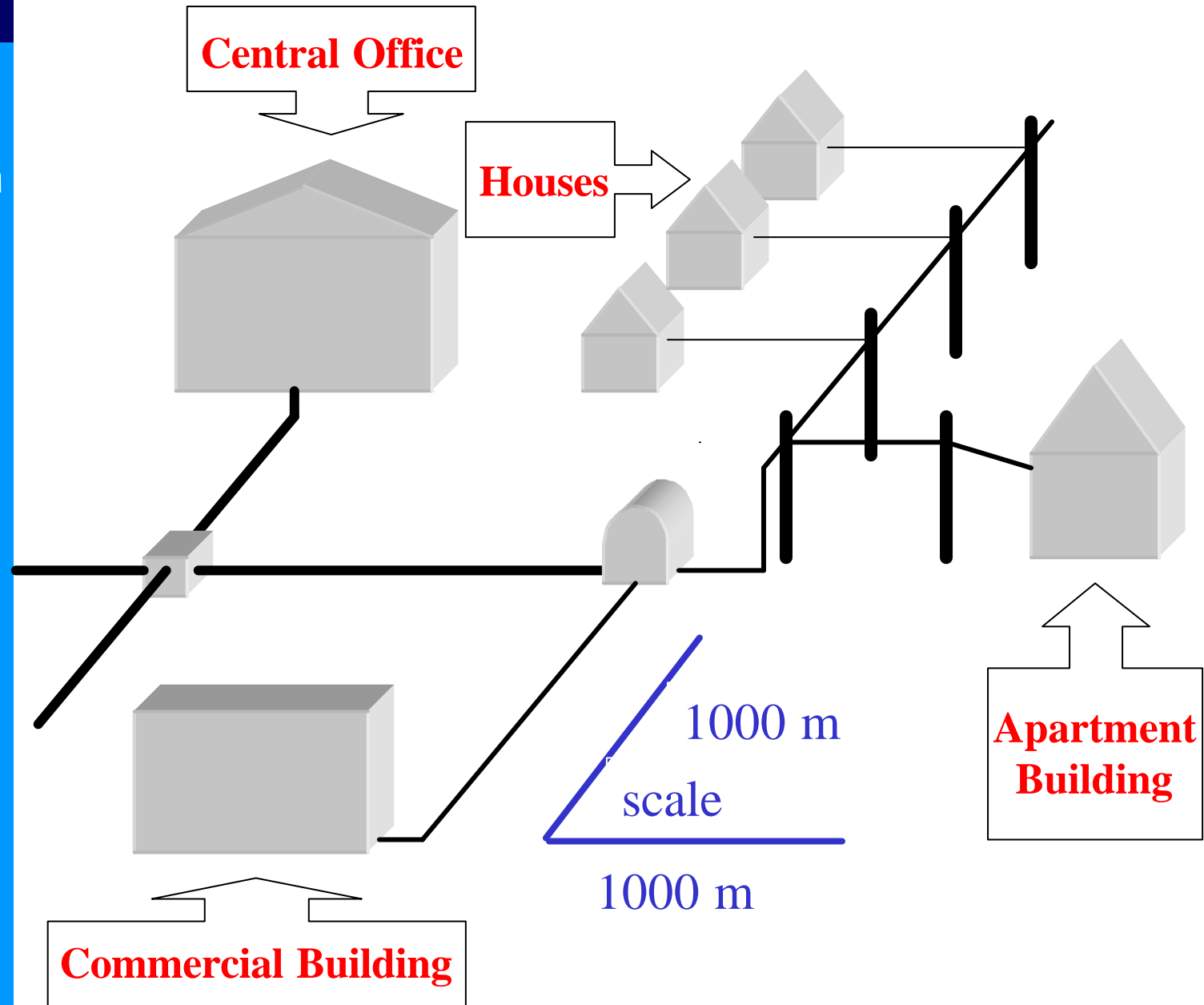
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In order to demonstrate the
application of the Recommendation K.46
let's consider the following
local area network ...



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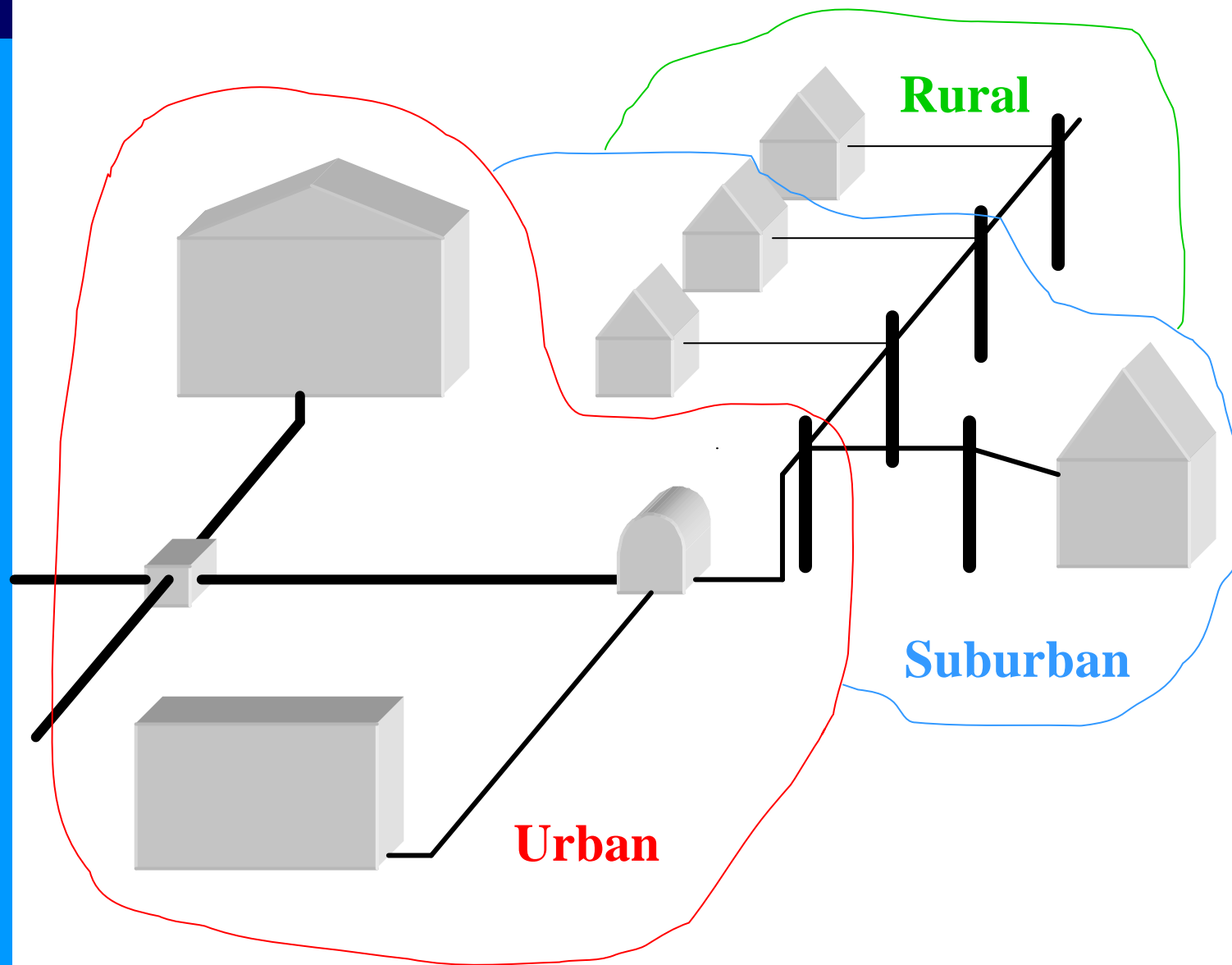
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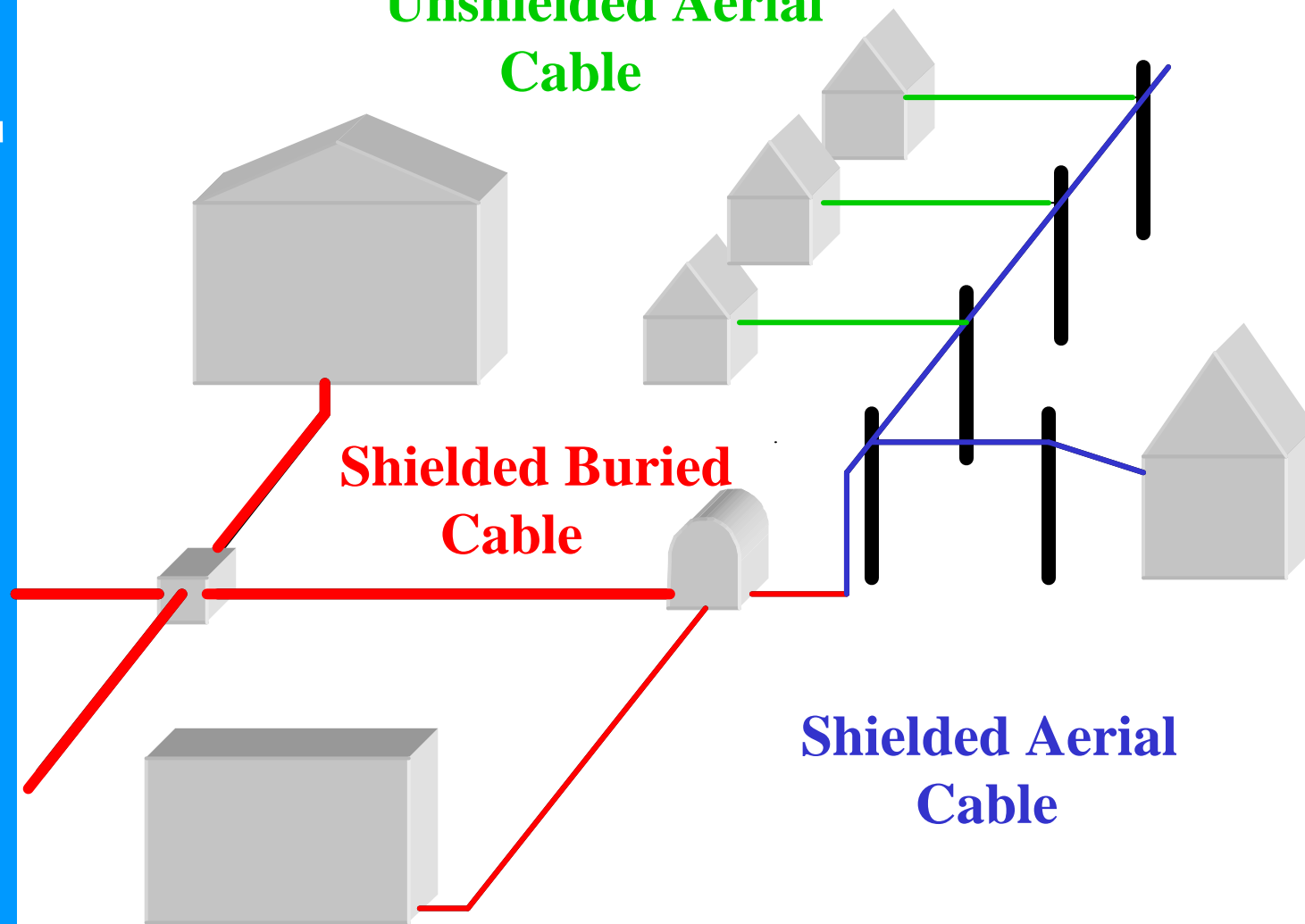
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Unshielded Aerial Cable

Shielded Buried Cable

Shielded Aerial Cable





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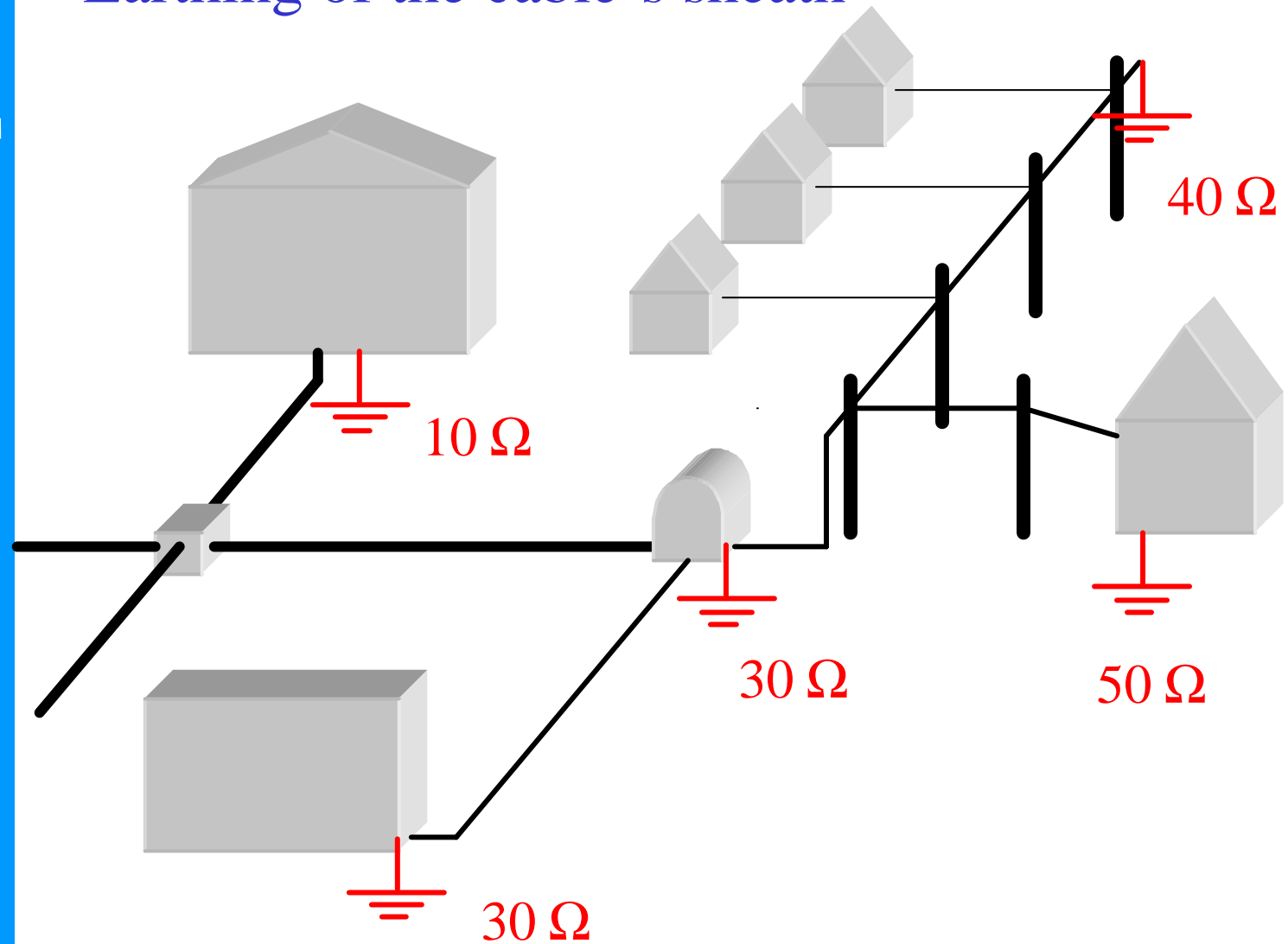
Paper insulated buried cable: 400 pairs
conductor diameter: 0.40 mm
shield resistance: 1.1 Ω / km



Plastic insulated aerial cable: 50 pairs
conductor diameter: 0.40 mm
shield resistance: 2.9 Ω / km



Earthing of the cable's sheath





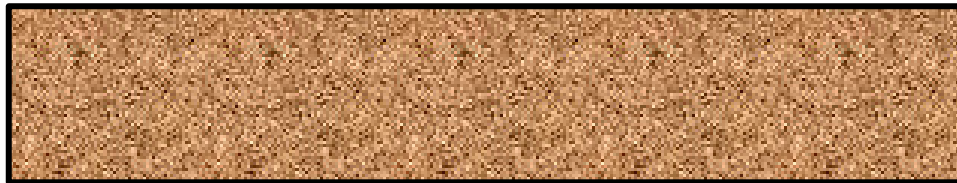
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LET'S CONSIDER:

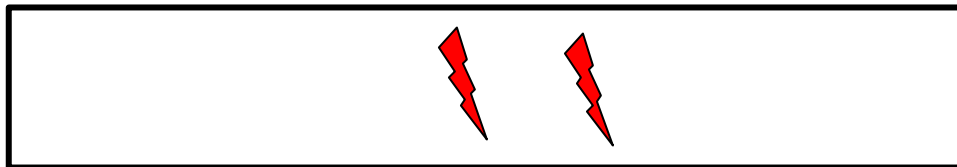
Soil resistivity:

$$r = 100 \Omega.m$$



Lightning activity:

$T_d = 20$ thunderstorms days per year



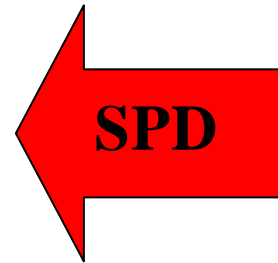


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At the given conditions

the ITU Recommendation K.46 will indicate the
installation of surge protective devices (SPD)



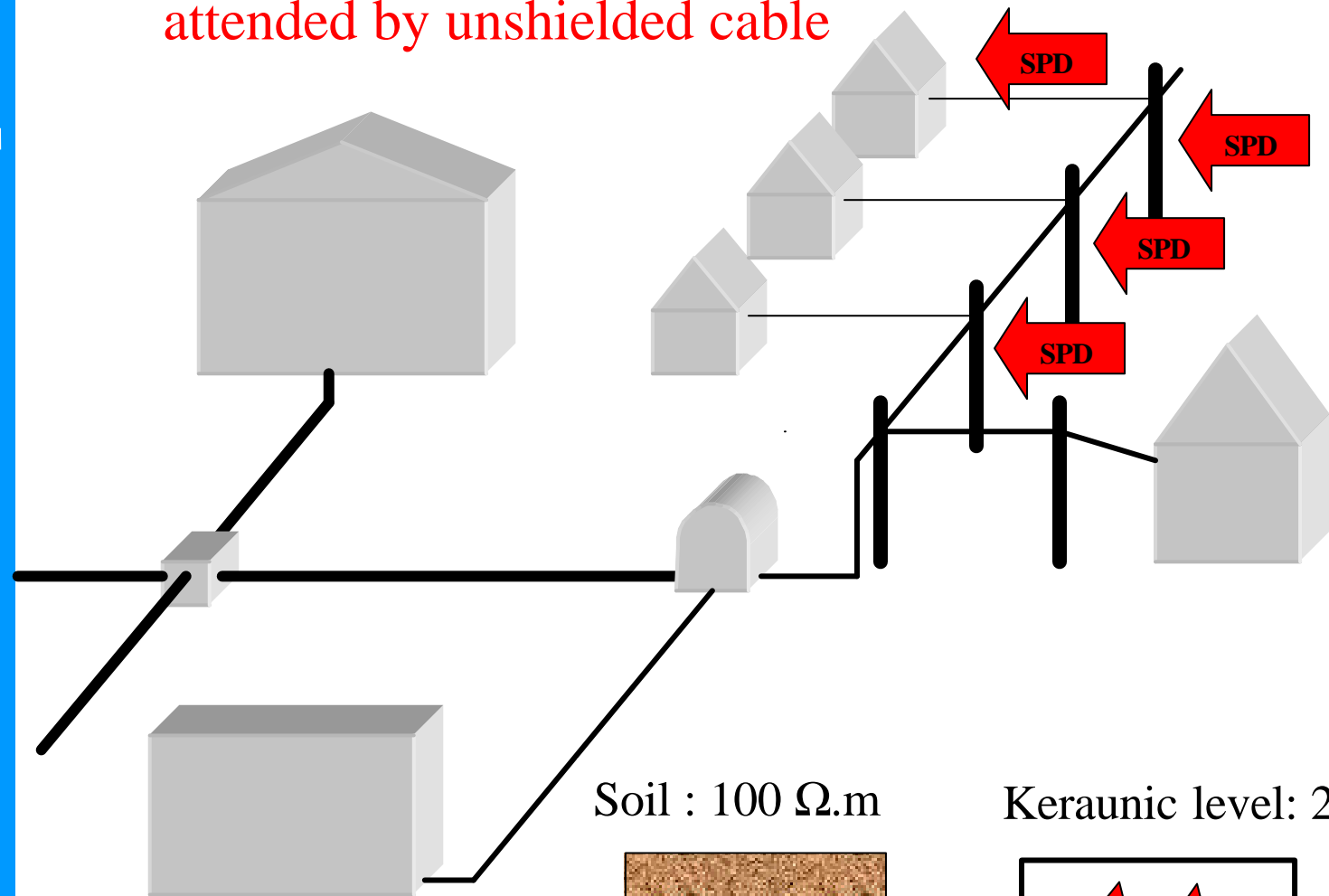
at the following points ...



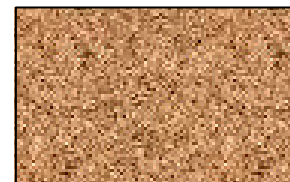
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Rural subscriber
attended by unshielded cable

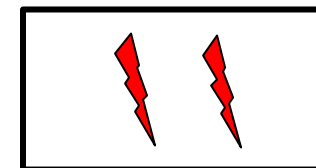
Distribution boxes



Soil : 100 Ω .m



Keraunic level: 20





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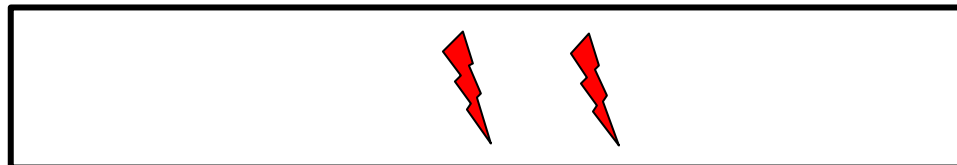
IF THE SOIL RESISTIVITY
WAS HIGHER:

$$r = 1000 \Omega.m$$



AND THE LIGHTNING ACTIVITY
REMAINS THE SAME:

$$T_d = 20 \text{ thunderstorms days per year}$$



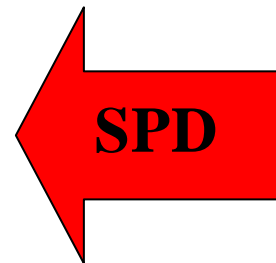


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At these new conditions

the ITU Recommendation K.46 will indicate the
installation of surge protective devices (SPD)



at the following points ...

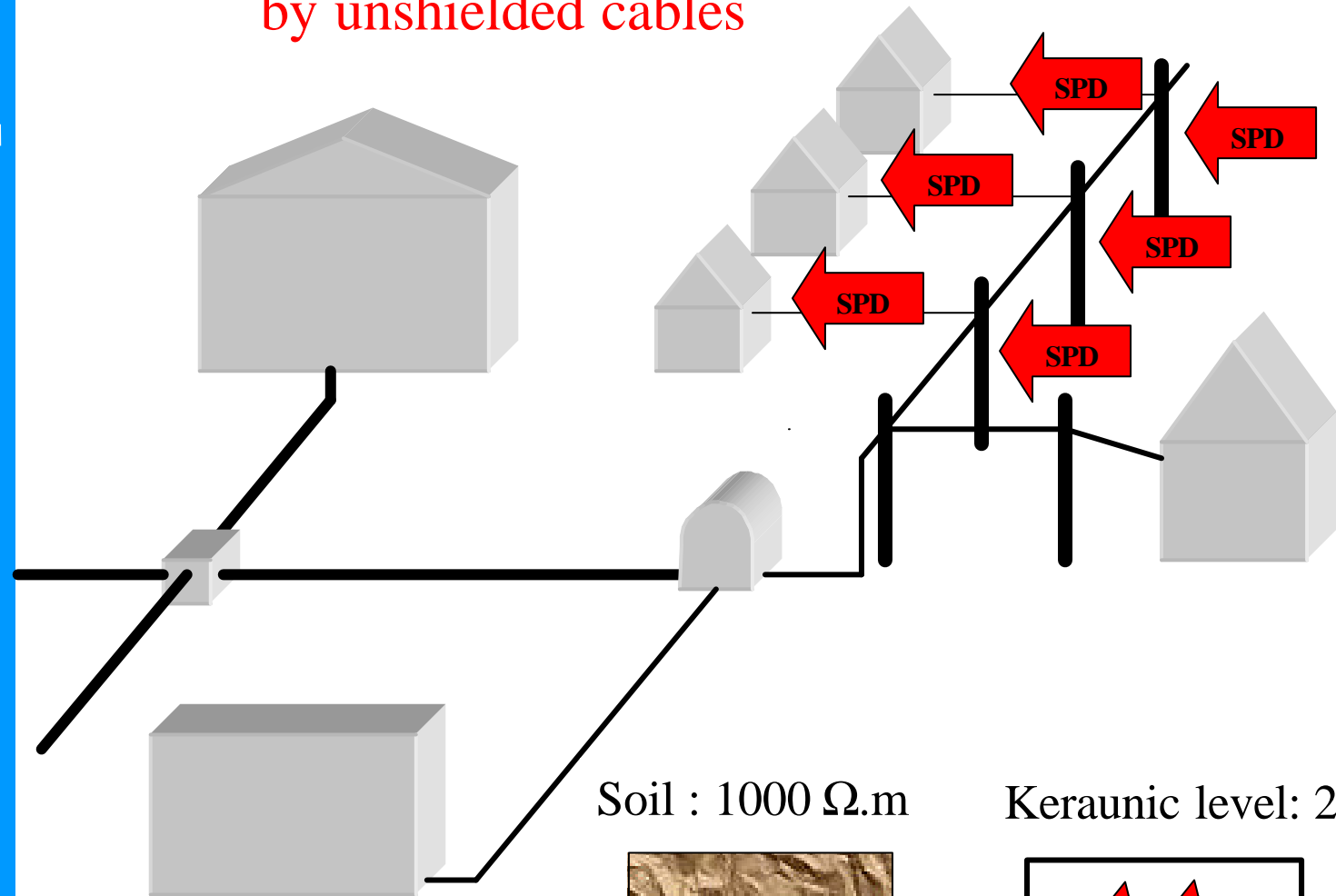


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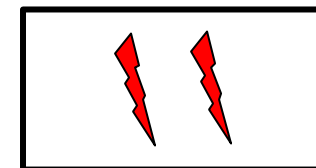
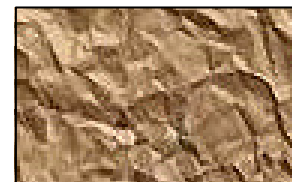
Subscribers attended by unshielded cables

Distribution boxes



Soil : 1000 Ω .m

Keraunic level: 20





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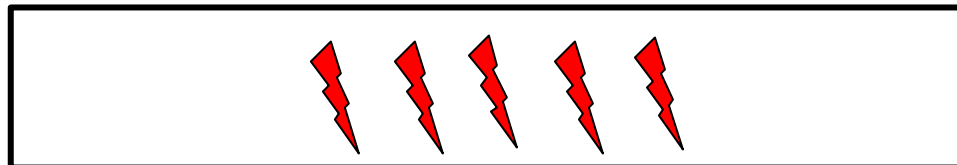
IF THE SOIL RESISTIVITY
WAS HIGHER:

$$r = 1000 \Omega.m$$



AND THE LIGHTNING ACTIVITY
WAS ALSO HIGHER:

Td = 60 thunderstorms days per year



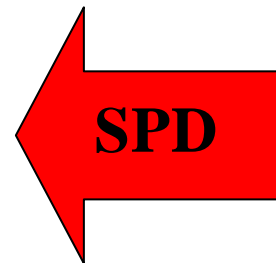


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At these new conditions

the ITU Recommendation K.46 will indicate the
installation of surge protective devices (SPD)

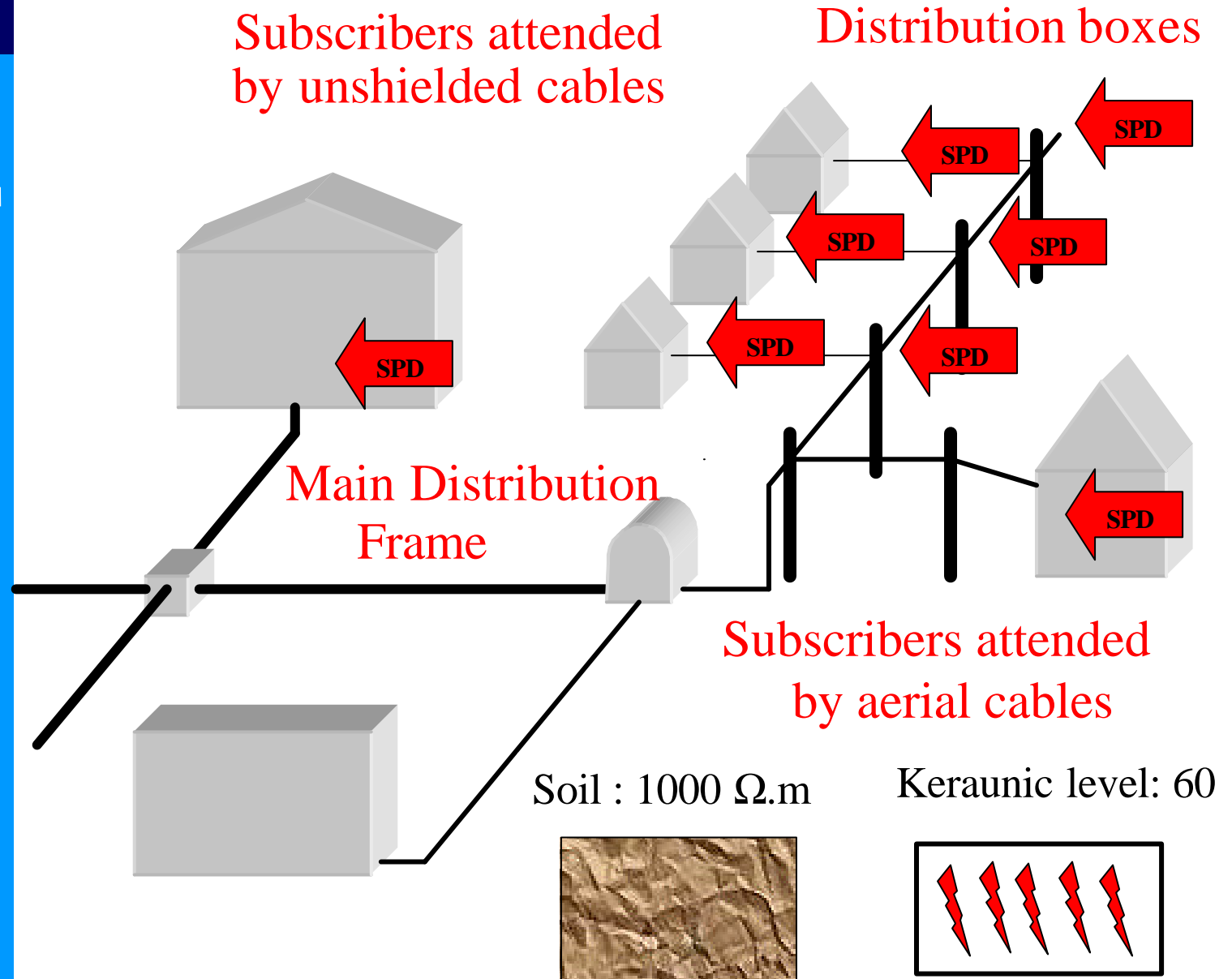


at the following points ...



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CONCLUSION

The ITU Handbook and Recommendations provides knowledge and procedures in order to achieve a cost effective protection for the telecommunications systems against lightning discharges.

