

# Which networks do we need in the 2020s`?

## Selection criteria for structured copper cabling

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# Prysmian Group

 PRYSMIAN

 Draka

 General Cable

Utilities

T&I

Industrial

Energy Projects

Telecom

50 COUNTRIES

112 PLANTS

30,000 PEOPLE

> 11 €B  
SALES

25 R&D CENTRES

# Agenda

- Development of the Datacom market
- WLAN, the 10GBase-T application
- Influence of Power over Ethernet (PoE)
- 25GBase-T via Cat.7A
- Comparing copper technologies & Conclusion

# Coexistence of copper and fibre cabling

## LAN Horizontal

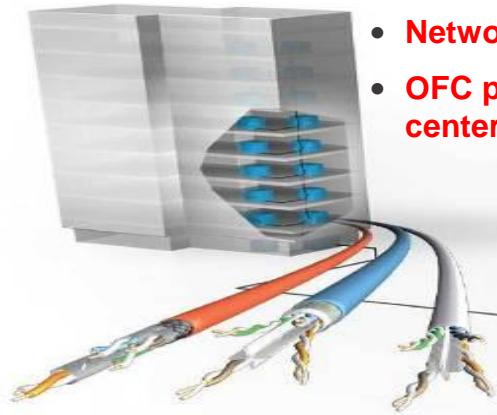
- 2011: 98% CU - 2% OF
- 2018: 96% CU - 4% OF

## Data center

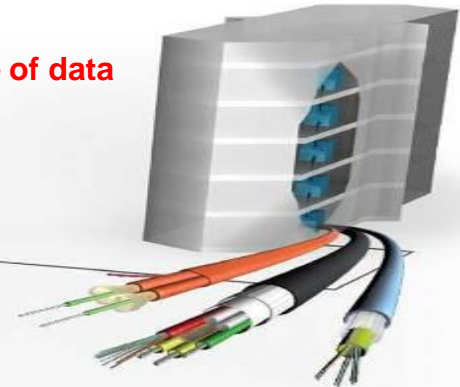
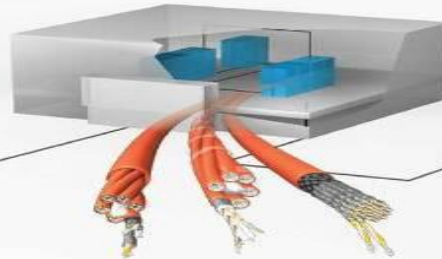
- 2011: 49% CU - 51% OF
- 2018: 45% CU - 55% OF

## LAN Backbone

- 2011: 1% CU - 99% OF
- 2018: 0% CU - 100% OF

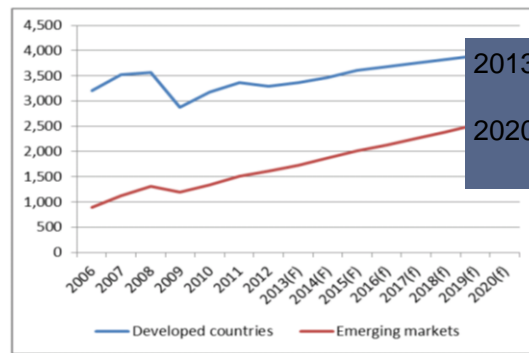


- **Networks exist of 80% copper and 20% OFC cable**
- **OFC proportion rises to 25% in the future because of data center growth**

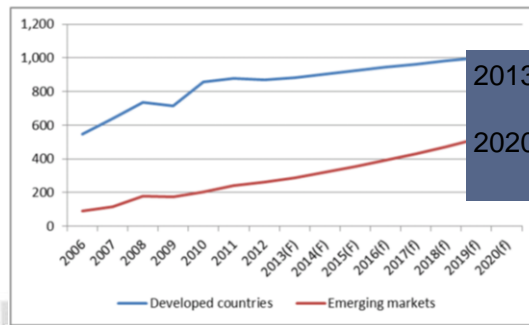


# Worldwide cabling 2020

- The global structured cabling market is expected to grow from \$ 6 billion in 2012 to \$ 8.3 billion in 2020, with an annual growth rate of 4%.
- Cabling in data centers in 2012 at approximately \$ 1.1 billion or 19% market share and is expected to increase to \$ 1.6 billion by 2020 (19% market share). Wiring in LAN will grow from \$ 4.9 billion to 6.7 billion in 2020.



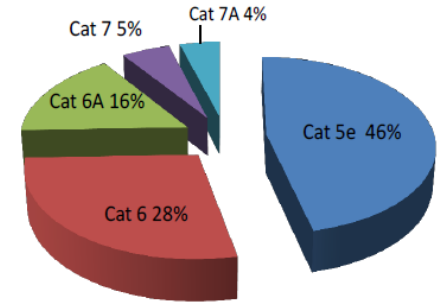
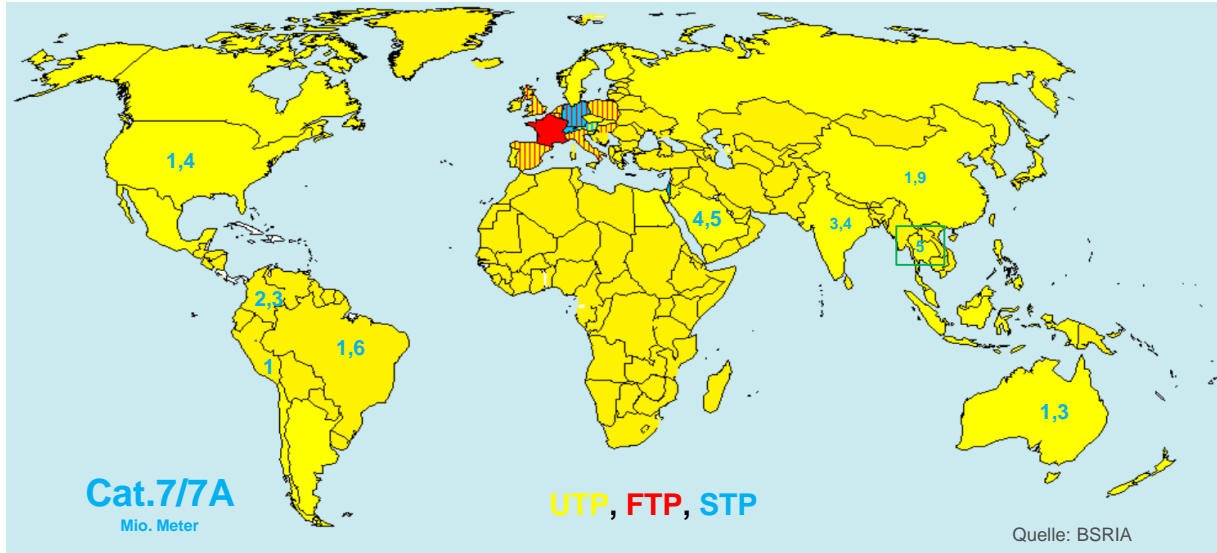
Global cabling installed in LAN, 2006 – 2020, US\$ million



Global cabling installed in data centres, 2006 – 2020, US\$ million

Source: BSRIA

# Design Preferences Cu Data

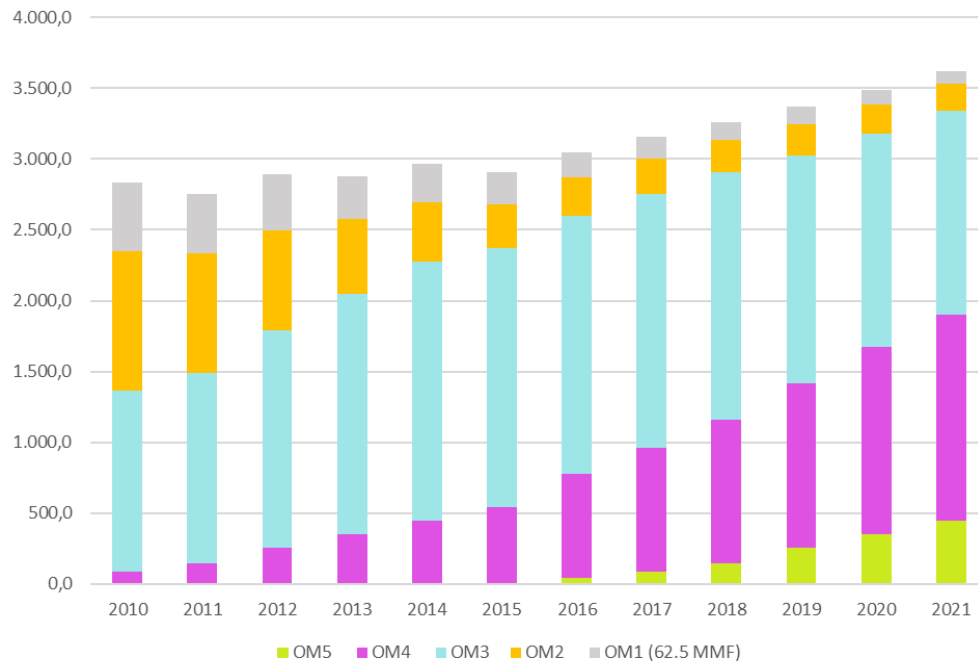


**Source:** Cabling Installation & Maintenance survey of readers (Feb 2014) for installed outlets in USA enterprises and data centres

Designs	current		trend	
U/UTP	Cat.5e	➡	Cat.6	Cat.6 <sub>A</sub>
U/FTP	Cat.6	➡	Cat.6 <sub>A</sub>	
S/FTP	Cat.7	➡	Cat.7 <sub>A</sub>	

# Multimode Market Development Global

MM Fiber Volume Trend; WW





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# WLAN – Growth



**YouTube & Co.**

Watch a short YouTube video  
50 hotel guests look over Sky Go Champions League  
500 passengers Check in  
50,000 football fans download the latest results

>>>> 50 Megabit traffic  
>>>> 280,000 megabits of traffic  
>>>> 20,000 megabit traffic  
>>>> 2,800,000 megabit traffic



## Free Wi-Fi in the hotel area

Over 90 percent of European hotels now offer free Wi-Fi.



## Growth for Wi-Fi

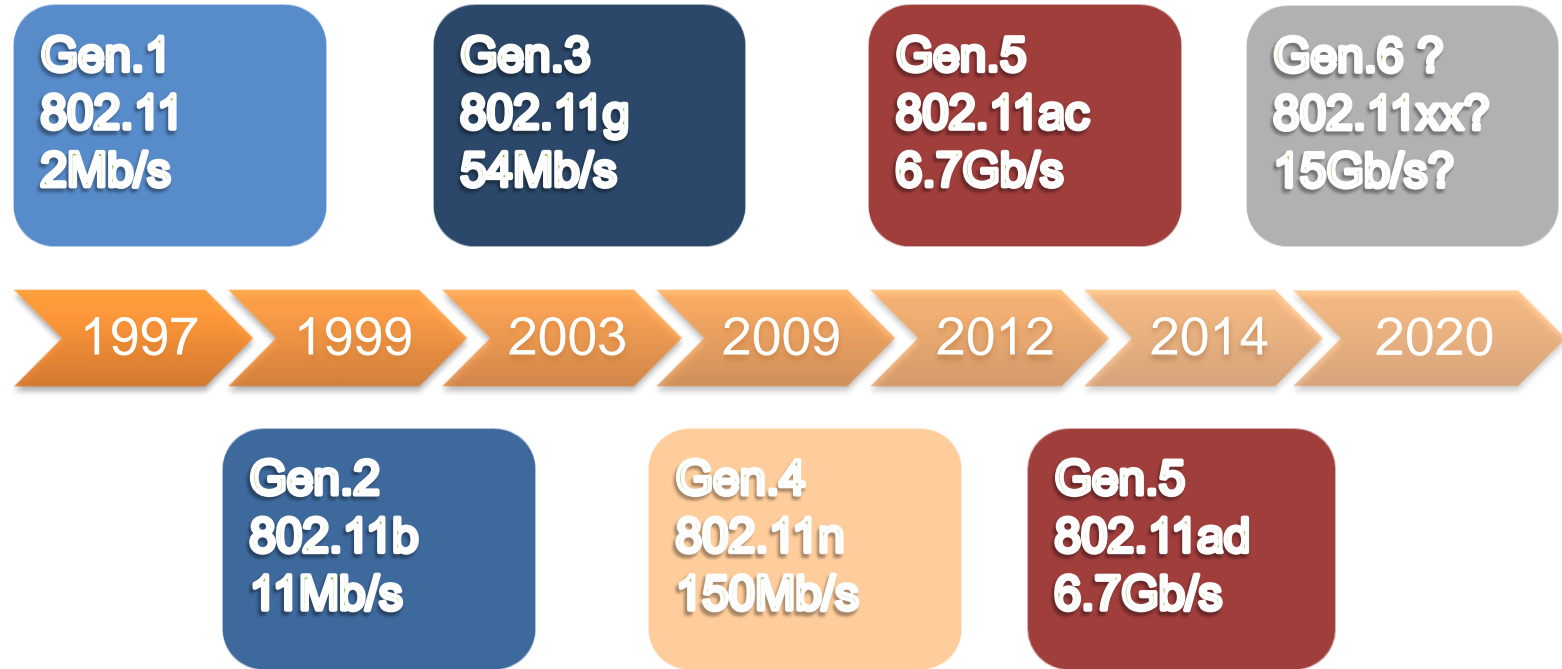
One study comes to 60 percent growth per year.



## Mobility

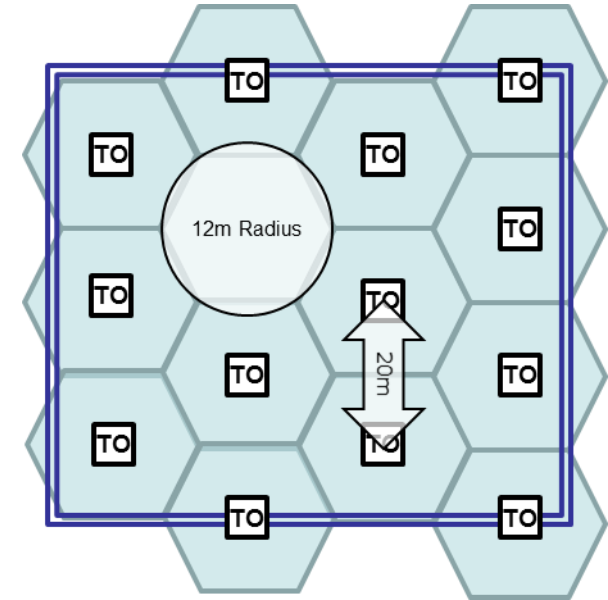
Never before have so many mobile data been sent back and forth. "An end to the growth rates in mobile data traffic is not in sight."

# Wi-Fi 802.11 generations



# Integration of WLAN in LANs according to EN50173

- ISO / IEC TR 24704 (2004)
- Recommendations for the minimal configuration and topology of WLAN structures in a LAN according to ISO / IEC 11801.
- TR 24704 recommends a dense cell structure similar to a honeycomb. Each cell has a working radius of 12 m and is connected to at least one class D terminal (TO) in the center of the cell. The recommended distance of the connections is 20 m.
- TIA TSB-162-A (2014) advises Cat6A cabling.!



# Integration of WLAN in LANs according to EN50173

## Summary

- Both standards recommend a close-coupled radio cell structure with a range of no more than 12m (also 3-dimensional)
- Both standards require a multiple 10Gbit-capable connection to the LAN
- This makes WLAN 802.11ac the first volume application for 10GBase-T in a desktop environment!



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# Basics PoE

Power over Ethernet (PoE) is a technology for remote powering network devices via an existing data cable.

## At PoE there are:

- Energy supplier PSE = Power Supply Equipment
- Energy consumer PD = Powered Device

## Variants of the energy supply:

- Spare pair procedure (only the free pairs 4/5 and 7/8 are used for the power supply)
- Phantom power (all wire pairs are used for power supply)

## Standards:

- IEEE 802.3af-2003 (PoE) / IEEE 802.3at-2009 (PoE Plus) over 2 pairs
- IEEE 802.3bt (PoE) over 4 pairs (Standard, 27.09.2018)

# IEEE 802.3bt – 4Paar PoE

## PoE Types & Classes

Standard	Type	Class	V <sub>PSE (min)</sub> Supply voltage	Max. current / pair	P <sub>PSE</sub> max. power of the supplier	P <sub>PD</sub> Max. Power to the device	Pairs
802.3af	Type 1	Class 1	44V	350mA	4W	3.84W	2
		Class 2	44V	350mA	7W	6.5W	2
802.3at	Type 2	Class 3	50V	600mA	15.4W	12.95W	2
		Class 4	50V	600mA	30W	25.5W	2
802.3bt	Type 3	Class 5	50V	500mA	45W	40W	4
		Class 6	50V	500mA	60W	51W	4
	Type 4	Class 7	52V	720mA	75W	62W	4
		Class 8	52V	860mA	90W	72W	4

PSE = Power Supply Equipment

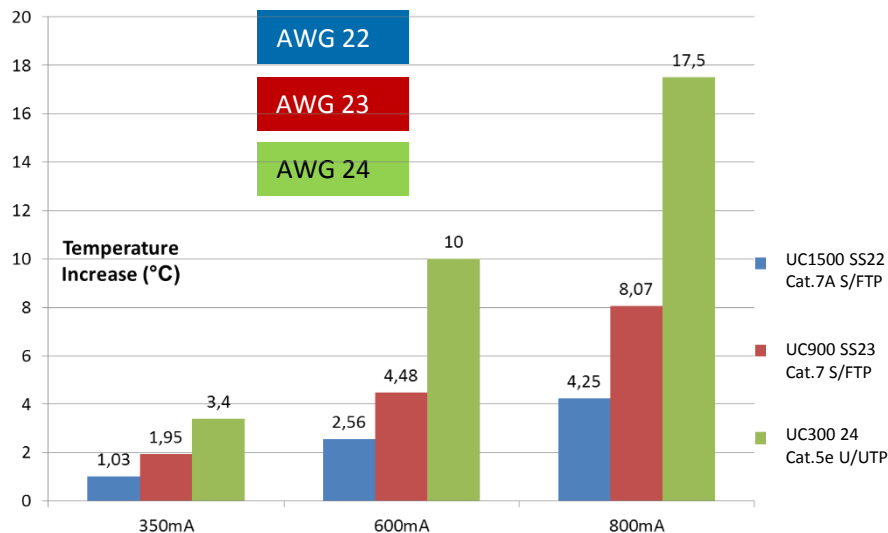
PD = Powered Device



# PoE markets

Markt	Applikation	Leistung
WLAN	Dual-band Aps, 802.11n Aps, Outdoor APs	20-30W
Security	Netzwerkcameras	15-20W
IP Telefonie	Videotelefonie	15-25W
Neue Märkte	RFID readers/access control	up to 25W
	802.16base stations	15-60W
	Workgroup switches	up to 50W
	Residential gateways	20W
	Industrial sensors	1-30W
	Thin clients	up to 70W

# Draka study on cable heating



- Conducted in accordance with IEC / PAS 61156-1-4
- Thermal insulation of the cables has great influence
- Conductor diameter and cable shield are strongly correlated with the maximum temperature increase

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# IEEE 802.3bq 25GBase-T

- Up to min. 30m
- Limit frequency 1.25 GHz
- Data rate 2,000 Mbaud
- Backwards compatible with 10GBase-T
- Supported Cabling: Class I / Category 8.1, Class II / Category 8.2 according to ISO / IEC 11801 3rd Edition
- Alternative: 30 m / class F<sub>A</sub> / category 7<sub>A</sub>

# ISO/IEC TR 11801-9905

- 25GBase-T via symmetrical copper cabling
- Provides guidelines for using installed cabling to support 25GBase-T
- Channel requirements defined up to 1,250 MHz
- 30m channel with Cat.7<sub>A</sub> components
- Backwards compatible with 10GBase-T
- GHMT certified channel according to DTR 11801-9905
  - Certified UC1500 SS22 Cat.7A 25GbE Cable
  - Certified METZ CONNECT 25Gmodul
- "Cat.7<sub>A</sub> S / FTP AWG22 cables have the technical potential for distances up to 100m (Shannon-Hartley law)"

# Information theory: Shannon-Hartley law

## Channel capacity as a measure of the upper limit of the achievable transmission rate

Creates correlation between capacity, bandwidth and signal-to-noise ratio

## Higher channel capacity can be achieved

With more bandwidth **B**

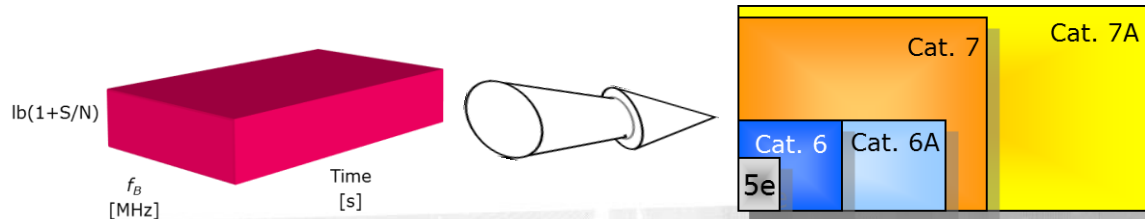
- Strikes physical limits in cable systems

By more signal **S**

- Is counterproductive in cable systems, because at the same time the N is raised

Due to less noise **N**

- High-quality interference suppression forms cost / benefit optimum in cable systems

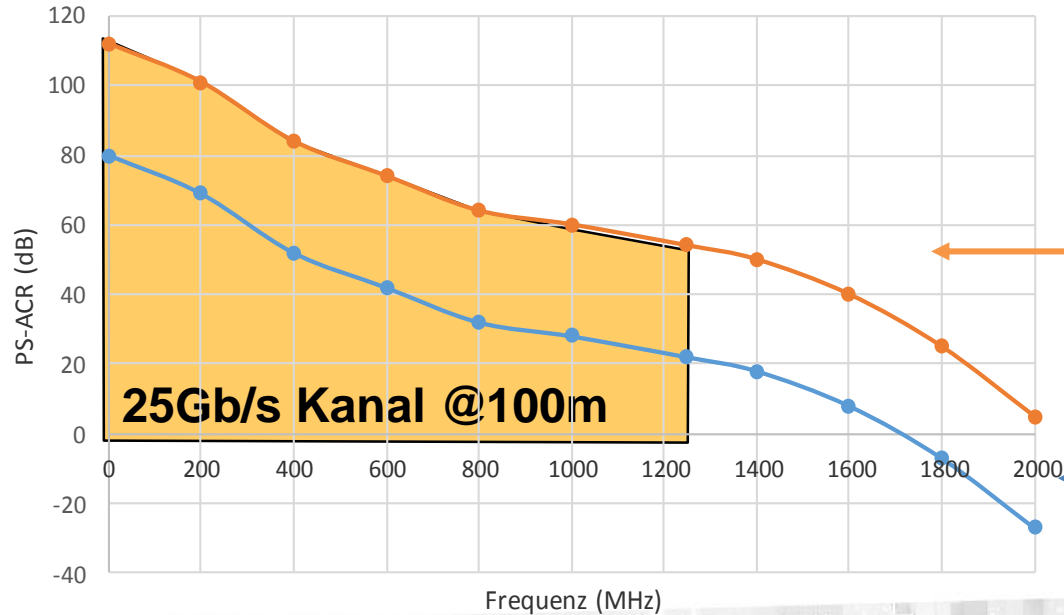


Channel capacity is like a hole in the wall through which the information cuboid has to be conveyed

# Cat.7<sub>A</sub> channel capacity at 25GBase-T

Shannon Kanalkapazität

$$C = B \log_2 \left( 1 + \frac{S}{N} \right) \text{ [bit/s]}$$



	Bandwidth	NEXT compensation
Cat.7 <sub>A</sub> AWG22	1250 MHz	22 dB

Without interference suppression



# Agenda

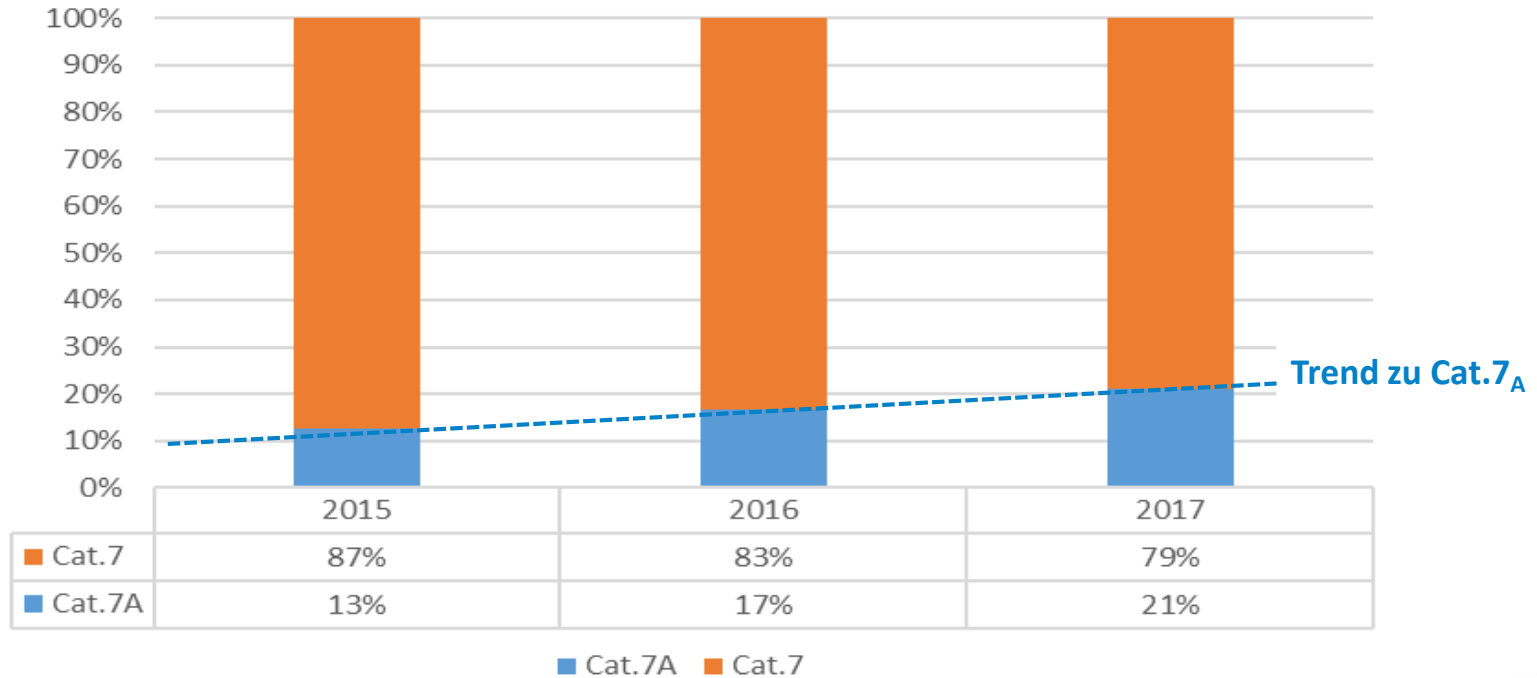
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# Copper technologies compared

	Cat.5e & Cat.6 U/UTP AWG23-24	Cat.6A U/FTP AWG23	Cat.7 S/FTP AWG23	Cat.7 <sub>A</sub> S/FTP AWG22
WLAN 802.11ac	●	●	●	●
PoE 802.3bt, Type 7 & 8	●	●	●	●
25GBase-T	●	●	●	●
EMC Performance	●	●	●	●
Total score	2	4	5	8
Ranking	4	3	2	1

- 2 points
- 1 point
- 0 points

# Cabling in the DACH region



# Information theory: Shannon-Hartley law

- Cabling should always be considered as a long-term investment, regardless of its short-term use
- Cat.6<sub>A</sub> & Cat.7 offers no reserves and covers the current demand up to 10Gbit
- Use of Cat.7<sub>A</sub> provides future-proof and investment protection, with the coverage of:
  - WIRELESS INTERNET ACCESS
  - PoE
  - 25GBase-T applications in the classic LAN

# Contactgegevens

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