

XC-Lab1-Cabling

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Communication media

- **Wired**
 - Conductor. Copper, silver, gold, etc.
 - Optical. Use optical fiber.
- **Wireless**
 - Use radio transmission
 - 802.11 → Wireless LAN

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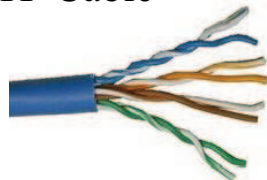
Copper medium

- Coaxial (BNC connector)
 - Ethernet 10Base5 (thicknet)
 - Ethernet 10Base2 (thinnet)
- Twisted pair (RJ45 connector)
 - UTP (Unshielded Twisted Pair)
 - STP (Shielded Twisted Pair)
- Wire pair (RJ11 connector)
 - Local loop (ADSL)

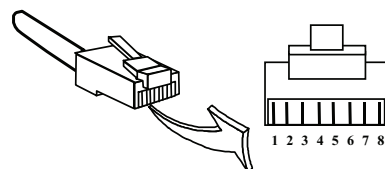
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UTP Cable (Unshielded Twisted Pair)

UTP Cable



RJ45 Connector
(Registered Jack)



Pinout:

Pair	wire	Color
1	1	white/blue
	2	blue
2	1	white/orange
	2	orange
3	1	white/green
	2	green
4	1	white/brown
	2	brown

UTP Cable Pairs

Pin	Pair	Wire	Color
1	3	1	white/green
2		2	green
3	2	1	white/orange
4		2	blue
5	1	1	white/blue
6		2	orange
7	4	1	white/brown
8		2	brown

EIA/TIA-568A Pinout

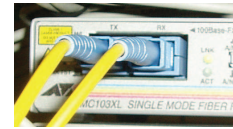
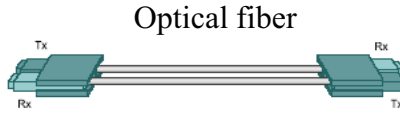
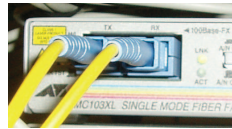
Pin	Pair	Wire	Color
1	2	1	white/orange
2		2	orange
3	3	1	white/green
4		2	blue
5	1	1	white/blue
6		2	green
7	4	1	white/brown
8		2	brown

EIA/TIA-568B Pinout

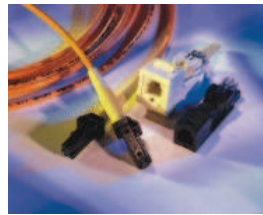
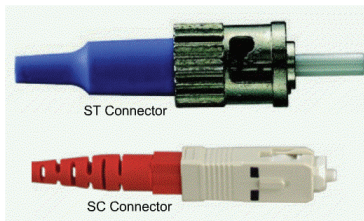
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Optical Fiber

Tx: LED or laser / Rx: Fotodiode



Connectors

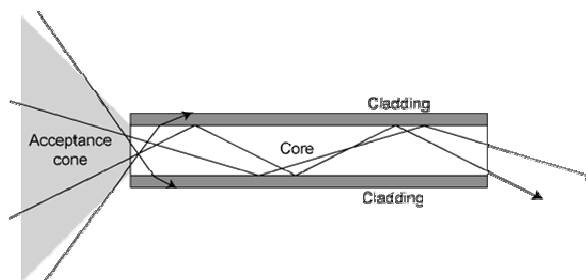


MT-RJ: same size
than RJ45,
duplex (two OF)

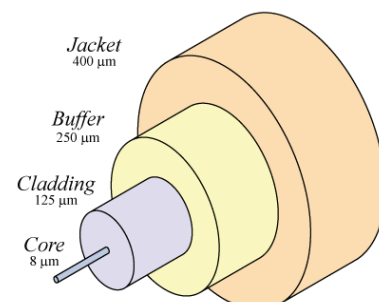
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Optical Fiber



- *jacket*: mechanical resistance.
- *buffer o coating*: protects the cladding and core.
- *cladding*: fiber with refraction index higher than the core (behaves as a mirror).
- *core*: fiber where the light propagates.

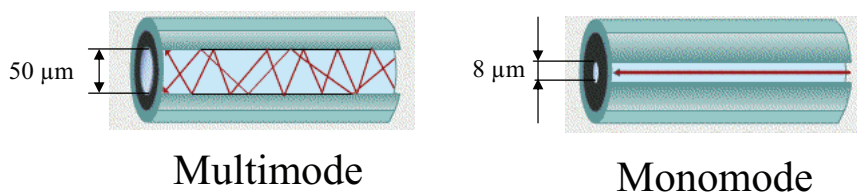


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Optical Fiber

OF Types:

- *multimode*: core with diameter 50 or 62.5 μm and cladding of 125 μm (50/125). Maximum distance: 2 km.
- *single or monomode*: core with diameter 8; 9 or 10 μm and cladding of 125 μm . Higher transmission rates and longer distances than multimode.



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Optical Fiber

Light devices:

- LED: infrared light with wavelength 850 or 1310 nm. Economical but do not admit transmission rates higher than 600 Mbps. Used typically with multimode OF.
- Laser: Infrared light with wavelength 1310 or 1550 nm. Transmission rates much higher than LED. Typically used with monomode OF.
- VCSEL (*Vertical Cavity Surface Emitting Laser*): economical laser targeted to replace LED in Gigabit ethernet lines.

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Networking Devices

Application	
Presentation	
Session	
Transport	
Network	→ Router
Data Link	→ Bridge, Switch
Physical	→ Repeater, Hub

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Terminology

- DTE (Data Terminal Equipment)
 - Host (PC) and router
- DCE (Data Circuit termination Equipment)
 - Hub, switch, modem or network termination
- Straight-through Cable
 - DTE ↔ DCE
- Crossover Cable
 - DCE ↔ DCE or DTE ↔ DTE

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Connexions

- Straight-through

DTE ↔ DCE

Router-Hub	Router-Switch
Switch-PC	Hub-PC

- Crossover

DCE ↔ DCE, DTE ↔ DTE

Router-PC	PC-PC
Switch-Switch	Hub-Hub
Router-Router	Switch-Hub

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crossover UTP

- Some standards (e.g. ethernet 10BaseT and 100BaseTX) uses only 2 pairs (pairs 2 and 3). To build a crossover cable sometimes it is used a 568A and 568B pinout in each end.
- For 4 pairs standards (e.g. ethernet 1000BaseT) it is needed to cross the 4 pairs:

RJ45 - end 1 (568B)				RJ45 - end 2			
Pin	Pair	Wire	Color	Pin	Pair	Wire	Color
1	2	1	white/orange	1	3	1	white/green
2		2	orange	2		2	green
3	3	1	white/green	3	2	1	white/orange
4		2	blue	4		2	white/brown
5	1	1	white/blue	5	4	1	brown
6		2	green	6		2	orange
7	4	1	white/brown	7	1	1	blue
8		2	brown	8		2	white/blue

Cable 568B with the 4 pairs crossed

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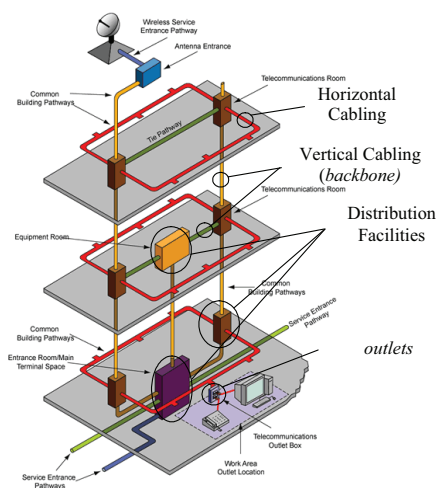
Structured Cabling

Cabling Standards

- ANSI/TIA/EIA-568-B *Commercial Building Telecommunications Cabling Standard*: It specifies the design installation and testing. It is referred to as *structured cabling*.
- It can be purchased in: <http://www.tiaonline.org>

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Structured Cabling



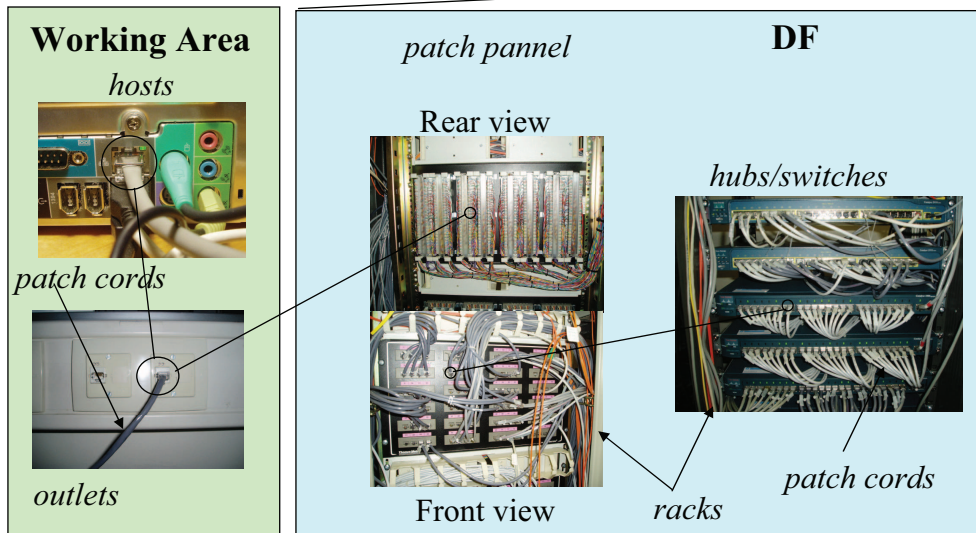
Cabling Elements:

- *outlets*.
- *work area*: covered by a set of outlets.
- *telco. room, TR; distribution facility, DF or cross-connect, CC*.
- *Service area*: covered by a DF.
- *patch pannels*: Facilitate the connection between the outlet cables and the intermediate devices (hubs or switches) using *patch cords*.
- *distribution or horizontal cabling*: Connect the outlets with the patch pannels.
- *backbone or vertical cabling*: connect different DFs.

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Structured Cabling

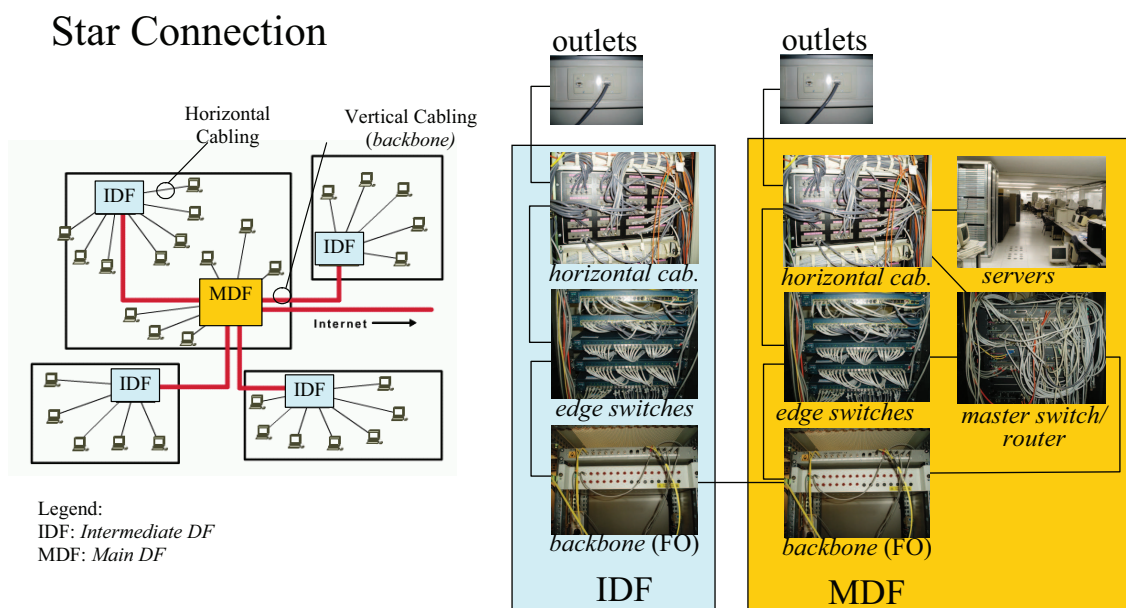
Example



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Structured Cabling

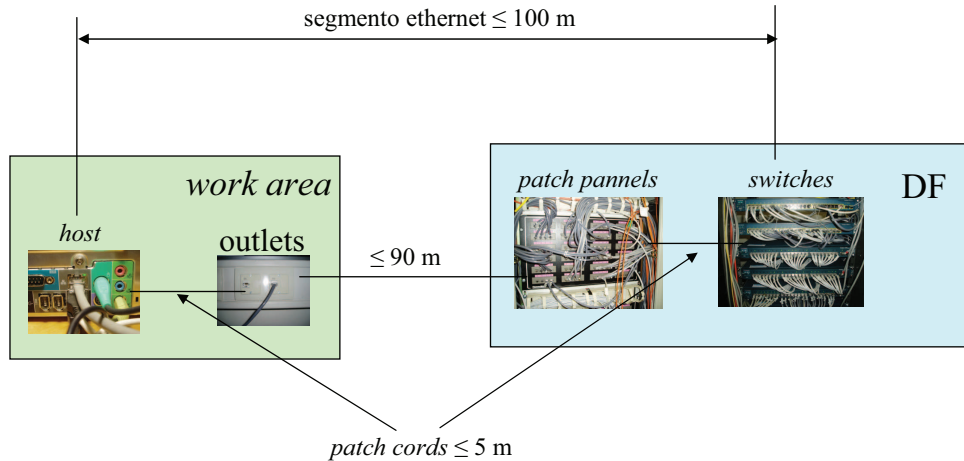
Star Connection



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Structured Cabling

Dimensioning the horizontal cabling:

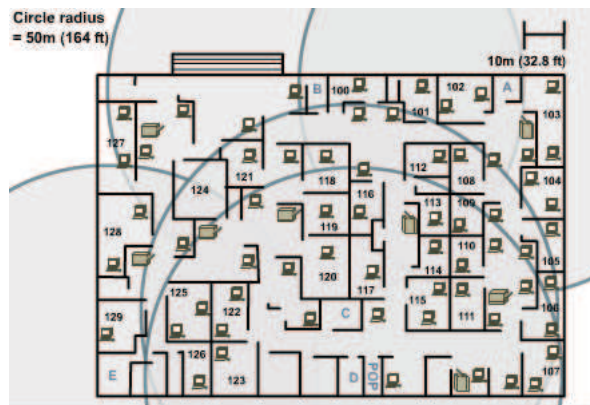


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Structured Cabling

DF positioning:

The horizontal cabling segment must be ≤ 90 m. Taking into account that the cables must go through walls, etc. it is considered that the DF coverage is 50 m:



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Structured Cabling Project

Question to take into account:

- The design must take into account future growing of the network and adaptations to new technologies.
 - Add additional outlets.
 - Redundant cables in the *backbone*.
 - Cabling that allow upgrading to new technologies
 - ...
- Uninterruptible power supply.
- Security regulations

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Structured Cabling Project: testing and certification

- Testing: Check that cables are properly connected, with no open nor short circuits.
- Certification: The installation must satisfy the parameters established by ANSI/TIA/EIA-568-B: frequency bandwidth, attenuation, interferences, delays, etc.



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