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Know your Cat 5-6-7 Unshielded Twisted Pair (UTP) Network Cables

 [Rajesh K](#)  [November 11, 2010](#)

The Cat x UTP (Unshielded Twisted Pair) Cables are the back bone of TCP/IP Computer Networks. So we thought, why not dedicate a separate article that summarizes some important points about the network cables?

Did you know that the twisted pair cables were invented by Alexander Graham Bell in 1881? In fact, twisted pair cables have found a lot of applications in the telecommunications industry before getting popular in the computer networking industry.

So, the UTP cable stands for 'Unshielded Twisted Pair' cable. They have four pairs of copper conductors enclosed within an insulation outer bracket and use RJ-45 Connectors (mostly) at the ends to terminate on the network hardware equipments. Each pair supports full-duplex communications and they are twisted around each other in order to cancel out the EMI (Electromagnetic Interference) and to reduce the cross talk between the pairs.

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A Cat x UTP system is made of the following four components ('x' can be 5,5E,6,6A,7,7A) :

- Cat x UTP Copper Cable
- Cat x Jacks
- Cat x Patch Panels
- Cat x Patch Cords

Its better if all the above components are pertaining to the same level of 'x' version for best operation. However they can also be different and from multiple vendors as they are generally standards based and inter-operable. Cat x cables are also backward compatible – Cat 6 Cables can work with Cat 5 patch cords and other passive components, but the performance might be limited to the lowest of all the versions working together.

The connectors used in Cat x cabling system use RJ-45 Jacks and [T568A or T568B pin assignments](#) for category 5/5E/6 interfaces. For higher category levels, the interfaces [may be different](#). Both ends use straight through wiring mostly where the pair is between 1&2, 3&6, 4&5, 7&8 pins.

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Data sent over the copper UTP cables are encoded, and hence it is possible to push more data with limited bandwidth. For example, 100Base-T transmission would require a minimum of 31.25 Mhz and 1000 Base-T would require a minimum of 62.5 Mhz.

So, what is this 1000 Base-T?

- The number 1000 represents the theoretical maximum transmission speeds in Megabits per second (Mb/s).
- BASE is the short form of Baseband which is used to describe signals and systems whose range of frequencies are measured from close to 0 Hertz and a maximum upper cut off frequency levels. Each signal has full control of wire on a single frequency and there are no frequency modulation techniques applied.
- T refers to copper media/ interfaces.

What are the various types of Cat x cables?

The commonly found Category (Category is the full form of Cat) x cables include Cat 5, Cat 5E, Cat 6, Cat 6A, Cat 7, Cat 7A. All the cables differ in the amount of bandwidths/ frequencies they can support, distance for which they support such bandwidth, ^

meters patch cord distance.

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Cat 3 Cable – Supports 10 Base-T Standard for bandwidths up to 10 Mbps over a maximum distance of 100 meters. They support frequencies in the range of 0-10 Mhz.

Cat 5/5E Cable – Supports 100 Base-T Standard for bandwidths up to 100 Mbps over a maximum distance of 100 meters. They support frequencies in the range of 0-100 Mhz. Cat 5E cables can support 1000 Base-T as well.

Cat 6 Cable – Supports 1000 Base-T Standard for bandwidths up to 1000 Mbps over a maximum distance of 100 meters. Cat 6 standard can support frequencies in the range of 0-250 Mhz. They also support 10GE bandwidth over limited distances.

Cat 6A Cable – Supports 10G Base-T standard for bandwidths up to 10 Gbps over a maximum distance of 100 meters. Cat 6A standard can support frequencies in the range of 0-500 Mhz.

Cat 7 Cable – Supports 10G Base-T standard for bandwidths up to 10 Gbps over a maximum distance of 100 meters. Cat 7 standard can support frequencies in the range of 0-600 Mhz. It offers better performance and improved cross talk suppression over the Cat 6A cables.

Cat 7A Cable – Supports 10G Base-T standard for bandwidths up to 10 Gbps over a maximum distance of 100 meters. In addition to this, they can also support 40 Gbps bandwidth for around 50 meters and 100 Gbps bandwidth for around 15 meters. They support frequencies in the range of 0-1000 Mhz.

UTP cables for 10 Gigabit (10 GE) Ethernet:

10 Gigabit Ethernet (10 GE) is supported by three types of UTP Cables –

Cat 6 Cables support 10 GE for 37 meters (with some good quality cables, this distance might be higher), Cat 6A and Cat 7/7A cables support 10 GE for 100 meters. For achieving this 10 GE performance, a UTP Cable must avoid alien cross talk (interference) ^

considered:

- Using Non-adjacent Patch Panel positions.
- Separating equipment cords and patch cords.
- Un-bundling or more loosely bundling the horizontal cables.
- Re-configuring the cross connect as the inter-connect.
- The un-twist at the termination point ought to be less than half an inch.
- Proper bend radius (minimum one inch) need to be maintained while laying the cables.

The above are intended for Cat 6 Cables to support 10 GE, however they can be implemented for higher category/ lower category cables as well, to enhance the performance of the UTP cables.

Shielded Twisted Pair Cables (STP Cables):

Some times, the normal UTP Cables may not fit perfectly for all types of applications (for example, a factory where there is significant amount of EMI emission). In such cases, Shielded Twisted Pair Cables could be used, to give better performance. Basically, in STP, there are individual shields around each twisted pair and there is an overall shield around all the pairs. In practice, there are multiple types of STP cables that have their own type of shielding. Of course, STP cables are slightly more expensive than their UTP counterparts.

There are multiple advantages of using STP Cables :

- Better Performance (Signal carrying capacity)
- Lesser Interference (Alien Talk) allowing cross cables to run alongside each other without much performance losses.
- Not much need for elaborate testing of cables post installation.
- Protection against Electro Magnetic Interference (EMI).
- Some STP Cables have smaller diameter than their UTP Cables, hence saving space.

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14 thoughts on “Know your Cat 5-6-7 Unshielded Twisted Pair (UTP) Network Cables”

Krishna

November 12, 2010 at 12:34 am

Excellent, Crisp & Clear!
Thank you.

Hakeem

November 18, 2011 at 10:27 pm

Superb. Crystal clear.
Except please add the fact that CAT6 & 7 are not approved standards. The best approved standard is CAT5e.

Carol

September 19, 2012 at 5:03 pm

Very helpful...Your answers are very excellent..Thanks.

Annie

October 13, 2012 at 10:34 pm

Good job !!

Network Cable Cat5e

November 30, 2012 at 5:22 am

Thanks for the information...
To the point information is usually not given....But you have explained everything in detail and that too without

Your points are very informative about copper system. Really usful, is it possible to put Optical Fiber in this same simple manner.

Engineer Ali

April 23, 2013 at 5:00 am

Thanks a lot

Favas

September 5, 2013 at 11:23 pm

successful
answer

Raja

February 24, 2015 at 3:06 am

very clear answer

Anonymous

March 5, 2015 at 11:30 am

What is a back bone and how it works during the communication

Piyush

April 5, 2015 at 11:31 am

thank you.your answer is very exelent.

Say, you got a nice post. Really thank you! Really Cool.

Denis

October 6, 2016 at 6:50 am

Incomplete and misleading.

"There are multiple advantages of using STP Cables".

Well.

Shielded cables are not always better. They are better versus EMI, but if you do not have a proper grounding on a connected devices (which is far from being rare), shielded cables may fail to work – and most times UTP will work the same place! Google yourself for horror stories "I installed STP everywhere and its not working!"...

Cat7 UTP... I think such thing does not exist. Cat7 mandates shielding around each individual twisted pair.

"FTP versus STP versus S/FTP" not explained.

Rajesh K

October 31, 2016 at 9:35 pm

Thanks for your feedback, I will try to update this article soon.

Comments are closed.



