

Networks

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In particular, Cat 5e is at the edge of supporting 1Gb and bad installs can easily cause problems, dropping the speed to 100Mb. Cat6 has more “headroom”

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Reports say that 80% of Cat 6 (and higher) cables (even expensive ones) on sale do not meet the relevant standard; many even fail the Cat 5e test

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Physical Ethernet

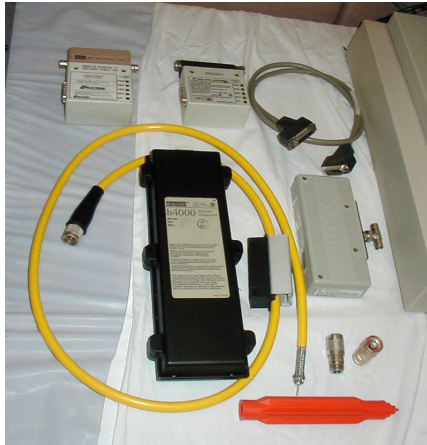
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The higher speeds and more expensive cabling is usually found only in specialist installations like data centres, HPC and Internet exchanges

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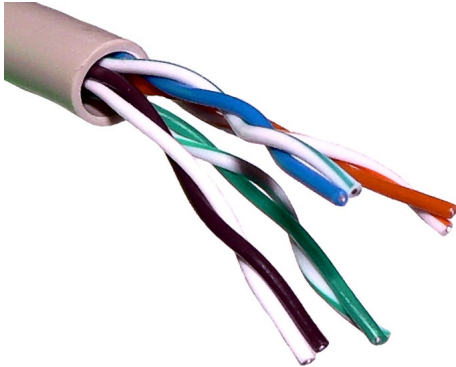


10Base5 Transceivers

By Robert.Harker at English Wikipedia, CC BY-SA 2.5, <https://commons.wikimedia.org/w/index.php?curid=9891521>

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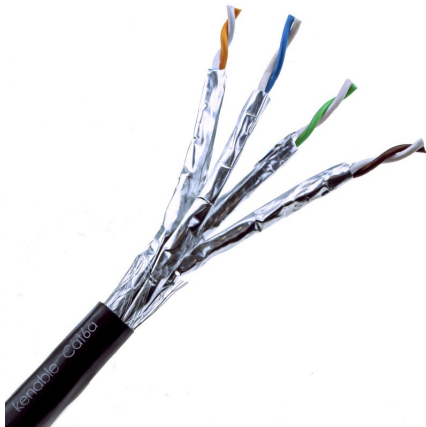
Ethernet



UTP cable (Wikipedia)

Networks

Physical Ethernet



Screened Shielded Cat 6a (Kenable)

Networks

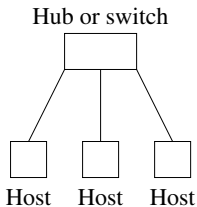
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Hosts connected using a hub or switch

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The available bandwidth is shared amongst all the hosts

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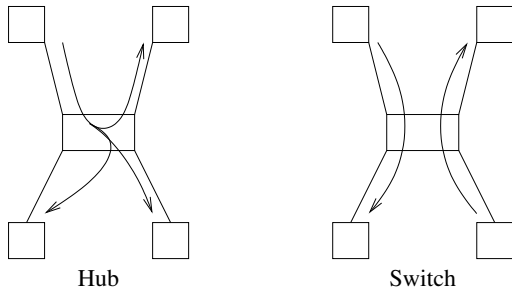
Ethernet

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Hub vs Switch

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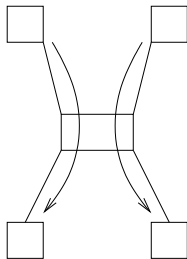
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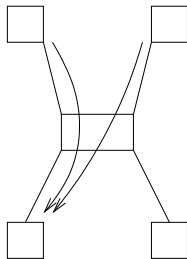
Collisions only if two hosts send to the same destination simultaneously

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Ethernet



No collision



Collision

Collisions in switches

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So the switch can send a jamming signal on an input to get it to back off and resend later: thus still using CSMA/CD

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No collisions are possible between opposing traffic as inward and outward traffic runs over different twisted pairs (below 1Gb)

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But it's not just a case of increasing the frequency of the signal, there are other complications to get around the electrical limitations of the cables (discussed later, if we have time)

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Not likely to be seen in the home for many years!

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These have quite different requirements from commodity Ethernet: in particular you don't always get to choose the physical layer. Sometimes you have to make do with whatever hardware is available

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The early Internet (Arpanet) ran over the existing analogue telephone network

Networks

Analogue

Exercise Read about the V series of modem standards

Exercise Read about *amplitude modulation*, *frequency modulation* and *phase modulation* and *Quadrature Amplitude Modulation (QAM) constellations*

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ISDN was the precursor to ADSL

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It uses many block of frequencies simultaneously — broadband — that avoid areas of the spectrum that have interference, and to make best use of areas of the spectrum that don't

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Which is what most home users want: a few clicks on a Web link (low bandwidth) resulting in a large page download (high bandwidth)

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Exercise ADSL is just one in a series of DSL standards, collectively called xDSL. Read about these

Fibre

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Exercise Find out what the current Government target is

The Last Mile Problem

This is part of *last mile problem*: how to bridge the gap between the local telephone exchange and the final user

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Also called the *first mile problem*

Fibre Hybrid

We would like *Fibre to the building/business* (FTTB) or *Fibre to the premises* (FTTP), where fibre comes to a building (business or multiple occupancy building); or *Fibre to the home* (FTTH) where fibres come to individual houses

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VDSL is used on the copper from the cabinet to the home: with an “up to 80Mb/s” downlink

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Exercise Read about the various distances, performances and frequencies used by these standards

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FTTH/P is sometimes marketed as “full fibre” to distinguish it from FTTC

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Openreach used to support G.fast, but now prefer to install FTTP

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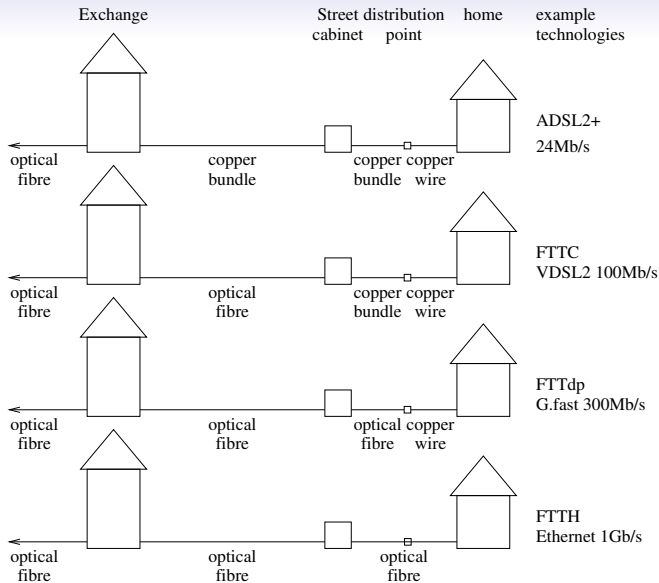
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Offering up to gigabit speeds: usually advertised as 900Mb/s so they can't be prosecuted for misleading advertising



Current common connections in the last mile

The Last Mile

In the UK we have:

5500 exchanges	ADSL	copper	24Mb
10,000s street cabinets	VDSL FTTC	fibre + copper	80Mb
1,000,000s distribution points	G.fast FTTdp	fibre + copper	300Mb
30,000,000 premises	Ethernet FTTP	fibre	1GB

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It can be wired/fibre or even wireless

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In the long run they want to remove the copper, but this means building fibre (or wireless) everywhere first