N°13 WhitePaper MMC MultimediaConnect

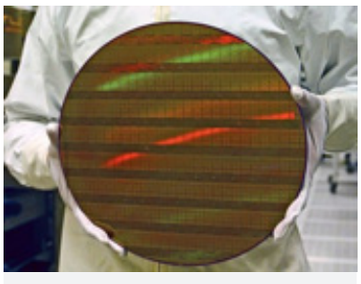
CAT 7A: TAKE-OFF OR DECLINE ?

MOORE'S LAW: DOES IT STILL HOLD TRUE FOR THE IT INDUSTRY?

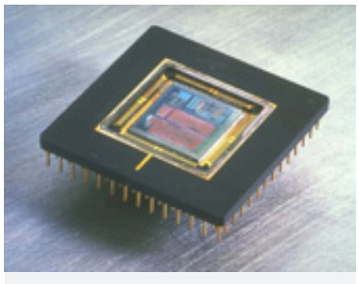
Office work in 2012 bears little resemblance to that undertaken in the 90s, or even at the turn of the century.
New technology is now a feature of our everyday life both at work and at home: video calls, touch screen tablets, remote working, etc.

This new way of working is rendered possible by increasingly powerful devices fitted with increasingly faster microprocessors. Indeed, these tiny parts act as the central nervous system in today's devices (PC, tablet, smartphone), enabling ever more advanced functions.

In 1965, Gordon Moore invented what would become known as "Moore's law": a law predicting that the number of transistors present on a microprocessor would double every two years.



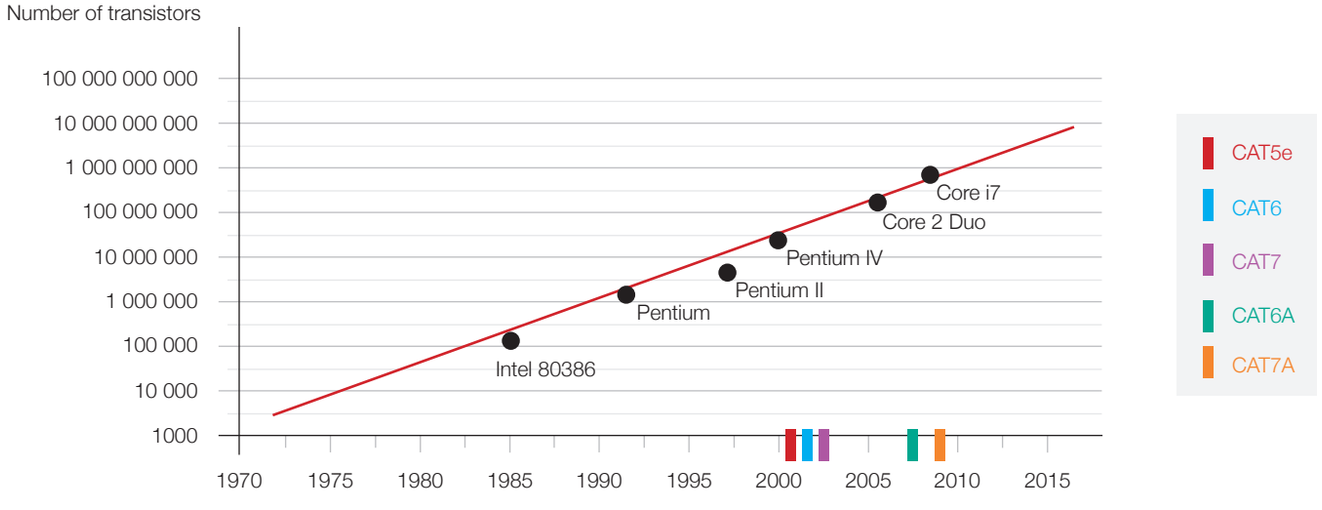
silicon wafer



microprocessor

Transistors are miniscule silicon parts, and modern microprocessors may count over 2bn of them. Moore's law and the exponential increase in the number of transistors on a "microchip" continues to hold true.

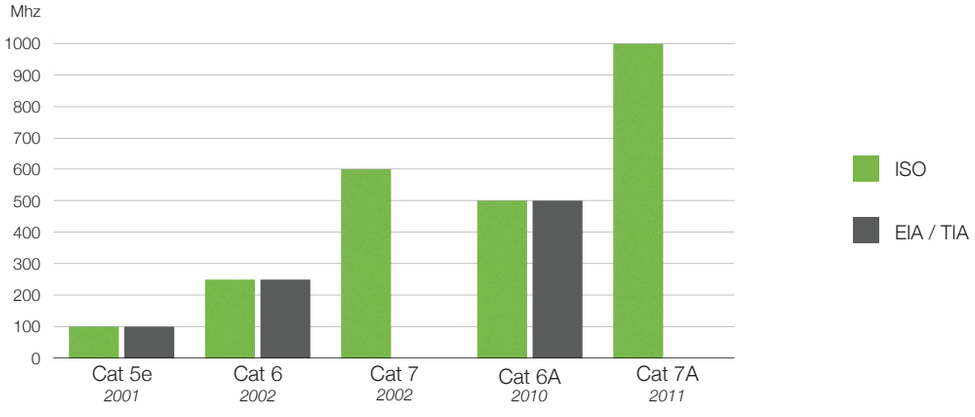
Has structured cabling kept pace with the development of microprocessors, and how does it fit Moore's law?



A HISTORIC STEP BACKWARDS?

This is where the comparison with Moore's law ends, as cabling standards have not strictly followed the pattern of exponential growth, and have even taken a small step backwards.
In 2002, the ISO standardisation committee approved Category 6, with Category 7 following suite with a bandwidth of 600MHz. Unlike earlier categories, Category 7 did not rely on standard RJ45 connectors, and would have enabled throughput of 40Gb/s.
In 2009, we were forced to take a step backwards. Indeed, when the 802.3an and 10Gb/s standards were approved, a new cabling category was required that used IEC 60603-7 standard RJ45 connectors, and so Category 6 Augmented was born.
With the perspective gained in the past three years, we are able to confirm that this step backwards proved fatal for the Category 7, which never really took off, mostly owing to the proprietary connectors and the difference in the minimum Shannon capacity (Cat6 bandwidth: 500MHz and Cat7 bandwidth 600MHz).

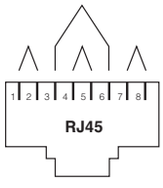
So does the same fate await the Category 7A, which also uses proprietary connectors? There is legitimate cause to question the future of Category 7A as a "system".



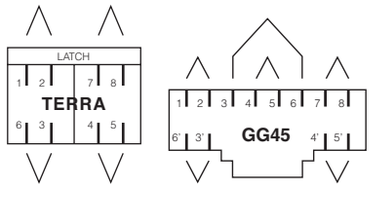
A REGULATORY REALITY…

In anticipation of throughputs in excess of 10Gb/s, Category 6A was followed by a new cabling category: Cat 7A, with a bandwidth of 1Ghz, and theoretically support throughputs of up to 100Gb/s.
Like its "little sister", the Cat 7, the Cat 7A uses proprietary connectors rather than a universal RJ45 connector, described in IEC 60603-7

Cat5e, Cat6 et Cat 6A



Cat7 et Cat7A



Influenced by certain industrialists, the ISO committee approved this category in 2009.
This standard was developed to meet larger throughput needs, especially in data centre environments or in 40Gb backbones.
However, while ISO approved standard ISO11801 amd 2 which gave birth to the Cat 7A, the EIA/TIA standardisation committee refused to acknowledge the category.
Across the Atlantic, UTP cabling solutions are used. The Cat 7A solution, with its maximum operating frequency of 1GHz, wire requires shielded cabling. This is why the American EIA/TIA committee chose not to use the Cat 7A, instead remaining with Cat 6A.

… BUT FAR FROM AN ECONOMIC REALITY

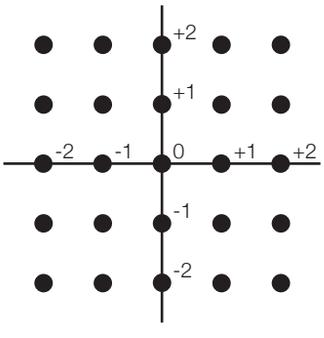
While the Cat 7A is now a regulatory reality, it cannot really be said to be a market reality.
Cable manufacturers are unanimous in the belief that Cat 7A cable is a solution:
Manufacturing a Cat 7A cable with a 1GHz bandwidth is a technical reality, as today it is the only cable able to transmit UHF (800MHz) along a twisted pair, and will reduce noise thanks to its S/FTP shielding. However, as of yet few manufacturers are keen to invest in Cat 7A connectors. Erring on the side of caution?
Perhaps not. If we compare the ranges of cabling solution manufacturers and equipment manufacturers, it becomes apparent that proprietary connectors are placed at a major disadvantage from the outset. Will Cisco, HP, Packard Bell and other hardware manufactures ever be tempted to create 100Gb switches with proprietary connectors other than the RJ45?

802.3AN AND BEYOND

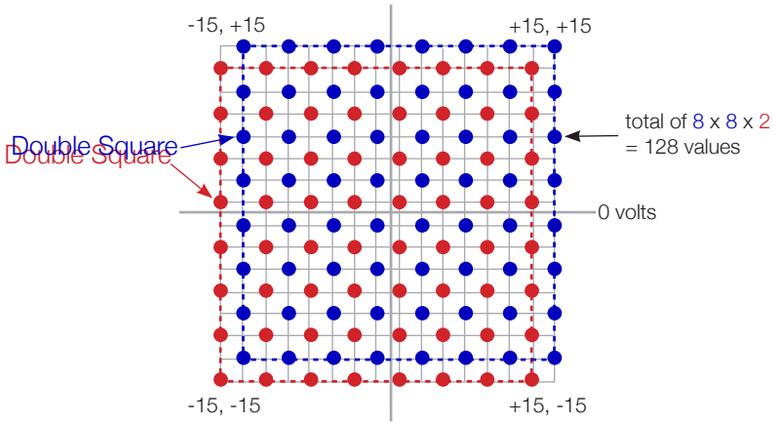
When 10Gb was approved in 2005, it led to new coding and modulation. Indeed, 1Gb/s required information to be coded across 5 levels: PAM5.
Creating a throughput 10 times faster meant that information coding needed to become increasingly complex.
The sensitivity of the signal to parasites, themselves with high throughputs, led to new coding: DSQ128. This code takes the form of a double constellation of 128 points, with 3 bit phase and amplitude modulation.
This new code gives modulation rates such as:

$$Tm = Xbit / 3bits = 2.5Gbit/ 3 = 833\ Mbaud/s$$

Or a Nyquist frequency of: 833/2 = 417MHz
This results in a maximum operating frequency of 500MHz for 10Gb (Nyquist frequency + margin for maximum spectral density)



PAM5



DSQ128

If we add in existing exogenous near-end crosstalk in CAT6A and a complex coding system, it becomes difficult to imagine sending 100Gb along a twisted pair. This will produce codes with 32 levels on 5 bits. However, the IEEE may develop a code able to transport this level of throughput.

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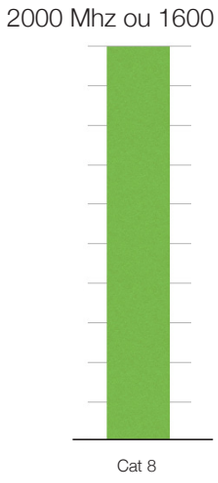
WHAT DOES THE FUTURE HOLD ?

Will a Cat7A RJ45 connector emerge?
The General Cabling Group committee, a pioneer in approving standards, is directing manufacturer R&D and is working on new trends.
Will the trend tend towards miniaturisation ?
Smaller plugs adapted to tablets and thinner wires ?
The small size of modern devices dictates research, and connectors used for data connections may significantly decrease in size.
The most recent trade show in Hong Kong showed that the miniaturisation of parts and connectors has not been ignored.
A mini-RJ45 may not yet be under consideration by the working committees, but a CAT8 connector may soon see the light of day.
Indeed, the different players in the standardisation committees seem to be working on a Category 8 that could support 40Gb over a distance of 50m.



But the most startling development in this category is that it will be backwards compatible with CAT6A, and so RJ45 connectors.
No doubt that this category will spell the end for CAT 7A and proprietary connectors.

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