# Re: Speed

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"w2aew" <w2aew@xxxxxxxxx> wrote in message
news:1142006332.378574.236700@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

> It's not really possible to directly relate datarate (like Mb/s) to signalling speed (like MHz) without including the type of encoding or format of the data. The datarate refers to the rate of transmission of the actual "information", while the signalling speed refers to the signal rate or speed in the media.
>
> For example, consider unencoded NRZ data transmission. NRZ data means non−return−to−zero. In other words, it means that each bit stays at its value (1 or 0) for the duration of the bit interval. The highest frequency of signalling is when you're sending a 1010101010 pattern. At 100Mb/s, each bit interval is 10ns. The transmitted signal will look like a square wave with a period of 20ns (a 1 followed by a 0). Thus, the frequency of the square wave is 50MHz. However, since it is a square wave and not a sine wave, there are odd harmonic frequencies present too (150MHz, 250MHz, 250MHz, etc.)
>
> RZ signalling is where each bit returns−to−zero at the middle of the bit time. Thus a 1 is transmitted as a 1 level or 1/2 the bit time, then it goes to 0 for the 2nd half of the bit time. A 0 is transmitted as a zero for the entire bit time. In this format of signalling, the highest frequency is present in the transmission of a continuous string of 111111's, because this will be a transmitted as a squarewave at 100MHz if the datarate is 100Mb/s.
>
> The above examples show that even unencoded data, sent at the same datarate, result in dramatically different signalling rates in the transmission, depending on the format of the data.
>
> There are many, many encoding schemes that are used to transmit digital data, and each of them transform the spectrum of the data signal into a different spectrum for the transmitted signal. In general though, you don't get anything for free. This means, that the faster the "information" rate or data rate, the more bandwidth or speed of signalling will be needed.

yeah, but encodings are variable and will almost always increase the "Bandwidth".... but are they used to increase the numbers? i.e. is a 10Mb/s connection 10Mb/s raw or based on some encoding scheme? (I would expect raw cause if you sent already compressed data then the throughoutput would be drastically lower than what "they" say it is).

> The difficulty in achieving high speed digital data transmission is directly related to the "media" which is used to carry it − i.e. twisted pair wires, coax, printed circuit traces, fiber optic cable, RF signals, etc. Each type of media has its own advantages and limitations when it comes to its use for data transmission.
>
> AoE is a little out of date with respect to this − but you have to take into account the context of where the statement was made. If they were talking about driving much greater than 100Mb/s on twisted pair over long distances − yeah, that's not trivial but it is done everyday. However, 100Mb/s is child's play for fiberoptics for great distances. Serial fiber optic transmission is commonly done at 10Gb/s. Many such 10Gb/s signals can be put onto the same fiber simultaneous (at different optical wavelengths, or "colors"), thus achieving overall throughput that's much greater. Single channel transmission can also be done at many hundreds of Gb/s on fiber too − but there isn't really much widespread use of that yet − since much of the ulta high speed fiber transmission is standards based, and there aren't popular standards out there for too much beyond the 10's of Gb/s per channel, yet...

But are these raw speeds(non encoded?) or are they avg speed for some ideal signal? Cause it still makes me wonder how one could get up to 100Gb/s as that translates into 50Ghz or so for the same example you talked about above... what kinda devices can do this? is it just very specialized transistors like GaAs that can do up to 18Ghz or so?

The basic point I was getting at is frequency = 1/datarate?

So a 1TB/s is basicaly working with a period of 1ps per "bit" which gives a frequency of about 1Thz if we are using 1 cycle as a bit? Ofcourse depending on your scheme you could reduce this to whatever you want.

So the point is how can they even handle 1Thz? What new techniques are there that can do stuff like this? Is it just all a matter of optimization and efficiency or are there new components to handle this?

Like in AOE they go in and talk about techniques to increase the bandwidth/speed of transistors and such(the Millner effect or whatever) but its still based on the original transistors design... he does mention GaAs but that only gets to 18Ghz or so.... is there some new materials that can

do 1Thz or are these just modifications of something that has already
existed for awhile?

Thanks,
Jon

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