A COMPARISON: COAX VS. UTP FOR VIDEO SIGNAL TRANSPORTATION

This is a brief technical discussion that explores the subject of video signal transportation. It focuses on a comparison between using coax and UTP (Unshielded Twisted Pair) transmission lines. The discussion also provides some information about the UTP-based MultiView™ Series systems. The document is written for anyone who is confronted with the need to transport high-resolution video over moderate distances. There is some technical content to help establish a baseline, but much of the document focuses on the practical elements of implementation.

The need for video signal transportation

Video display equipment seems to be showing up everywhere. Looking up in a mall or an office building nowadays often reveals a large plasma display. It's probably showing weather reports, local interest stories and some "active billboard" advertisements. This is just one of many applications where it is desirable to locate the display some distance from the source. Courtrooms, information kiosks, transportation terminals, schools and sports arenas are examples of some other applications where the source and display are being separated.

The rationale behind equipment separation

Separating the source and display makes a great deal of sense, since it places the source (usually a computer or media generator) in an easily-accessible central location.

Computer and software technology has come a long way since the inception of Windows, but we continue to be burdened by the occasional need to reboot the machine.

Imagine for a moment: if an overhead display were to be located together with the signal source, someone would need to climb a 10-meter ladder every time the machine needed a boot! Locating the "machines" together in an environment designed to support them makes a great deal of sense from many standpoints. Access to clean power and cooling capabilities as required, lower dust content, access to network hardware, access to structured cable, telco and CATV equipment are all benefits that are derived from this philosophy. Physical upgrades become much easier to implement, and for critical applications where security is a concern, the choice is clear.

Signal skew

While transporting VGA or other multi-component video signals over any significant distance, another issue becomes important: the physical length of each individual cable must be closely matched. Failure to match cable lengths results in color fringing. This effect is caused by a skew in arrival time of the individual signals. In 1280 x 1024 resolution VGA with an 85Hz refresh rate, the pixel duration is typically 9.7 nanoseconds. For coaxial cable, the propagation velocity is approximately 66 % of the speed of light. This equates to a cable propagation rate of 198 mm per nanosecond. For every 1.6 meters of cable mismatch, the image fringe will grow by one pixel. High quality UTP cable exhibits very predictable signal skew since the pairs run parallel in the same jacket. Skew compensation is still needed for long runs of certain types of UTP, but is not required when using skew-free cable (available from Belden Wire).

Another issue often overlooked while contemplating VGA transmission is the digital sync signals. A computer resident, VGA card typically generates these signals along with the video. Most VGA card designers assume that the signal will only be driving a couple of meters of VGA cable and will ultimately be met by some fairly high terminating impedance. This is acceptable for native terminal implementation. VGA cards are not designed however, to drive TTL level (5 Volt) signals over long runs of coax, where the terminating impedance must match the impulse impedance of the cable to eliminate reflections. To do so would require circuitry that could drive 10V p-p signals into the 75 Ohm environment. To use the output of an ordinary VGA card, active electronics are again required to effectively manage the sync signal fidelity issue. The transmission line must be driven by and be terminated at the characteristic impedance, usually 75 Ohms.

In the MultiView system environment all of the required sync management technology is built right into the compact transmitter and companion receiver. Rather than "brute forcing" the sync signals through the UTP, MultiView employs a pulse coding scheme where the incoming sync signal is analyzed and converted into a word. At the receiver, the word is received and the true sync conditions are reconstructed. This process preserves the original source's sync polarity and provides excellent overall sync signal fidelity. The sync output is identical to the input and the heavy drivers employed ensure that virtually any load can be driven. This is very important because there is no true standard for the TTL input impedance of VGA displays.

This exploration has revealed the following facts:

- The demand for video transport is real and justifiable
- VGA and multi-component video is displacing composite video for demanding applications
- To transport video over moderate distances, active electronics must be employed regardless of cable type, i.e. UTP or coax
- Coax is a physically cumbersome solution for VGA transportation
- Coax does not "fit" into the structured cable environment
- UTP provides a technically sound video transportation solution that is embraced by the architects of today's connectivity plants
- The MultiView system is a high performance, "Plug and Play" solution designed to exploit the advantages of employing structured cabling for high-resolution video transportation
- The cost of pulling and terminating a CAT 5 cable is 1/5 the cost of doing the same with 5 coaxes, or less depending upon the existing infrastructure

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