Measurement-Based Design Series

Reexamining the Limits for Ultrahigh Speed on Copper

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ABSTRACT

Processors, together with high performance communication chips, continue to be powerful drivers for the need for increased serial speeds at low cost. The switched fabric architecture is providing its own impetus to increased data rates on backplanes and cables. In order to reassess the limits for serial communication data rates on copper, the impediments that seem to limit high speed are identified and examined. This appraisal is done in the light of new measurements of loss and dispersion, new means for simulation of **signal conditioning**, the emergence of new **high performance interconnection technologies** as well as the availability of new tools and methods to characterize, measure, analyze and simulate high data rate transfers in this imperfect environment. It is shown that with state-of-the-art resources and the predictable emergence and maturing of improved components and tools, the limits for data rate transfers on copper can also continue their upward trend, no less abated than processor speeds. Tradeoffs between backplane trace lengths of several feet and rates as high as **12.5 Gb/s** are considered. The presentation consists of in depth discussions of issues, numerous examples of **test and measurements** with accompanying simulations, numerous case studies of varying degrees of complexity, a focus on high performance interconnections and a number of animated representations of critical effects. The effectiveness of **active and passive signal conditioning** in lossy and dispersive environments, such as circuit cards, backplanes and cables, is demonstrated live with design tools that support the required signal conditioning environment.