Characteristics of Installed Backplane Channels

Howard Frazier, Vasu Parthasarathy and Ilango Ganga

IEEE 802.3

100 Gb/s Backplane and Copper Task Force

September 13, 2011

Chicago, IL

Contributors & Supporters

Matt Brown – AppliedMicro

William Bliss – Broadcom

Rich Mellitz – Intel

Kent Lusted - Intel

Marek Hajduczenia – ZTE

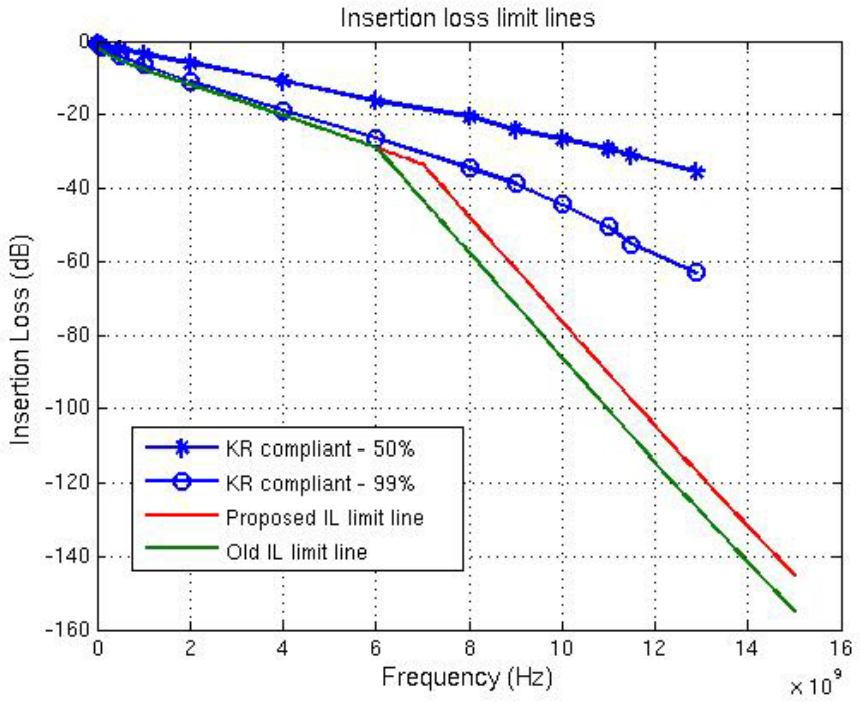
Outline

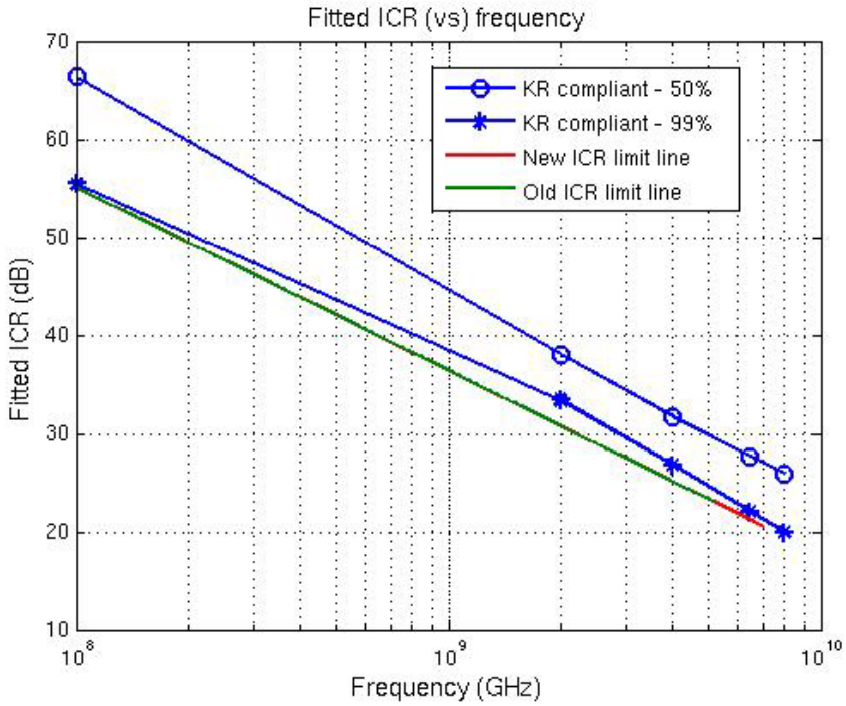
- Provide ILD and RL characteristics of 10GBASE-KR/40GBASE-KR4 channels
- Provide updated blade server connection forecast
- Observations and Conclusions

Backplane channel database

- Broadcom has collected a significant amount of backplane data over many years
- Backplane traces are from various customers all over the industry
- Backplane traces include FR4, Nelco and Megtron material
- S-parameters of traces provided by customers or in other cases measured at BRCM
- Only those traces that meet the 10GBASE-KR/40GBASE-KR4 specifications are considered in this study

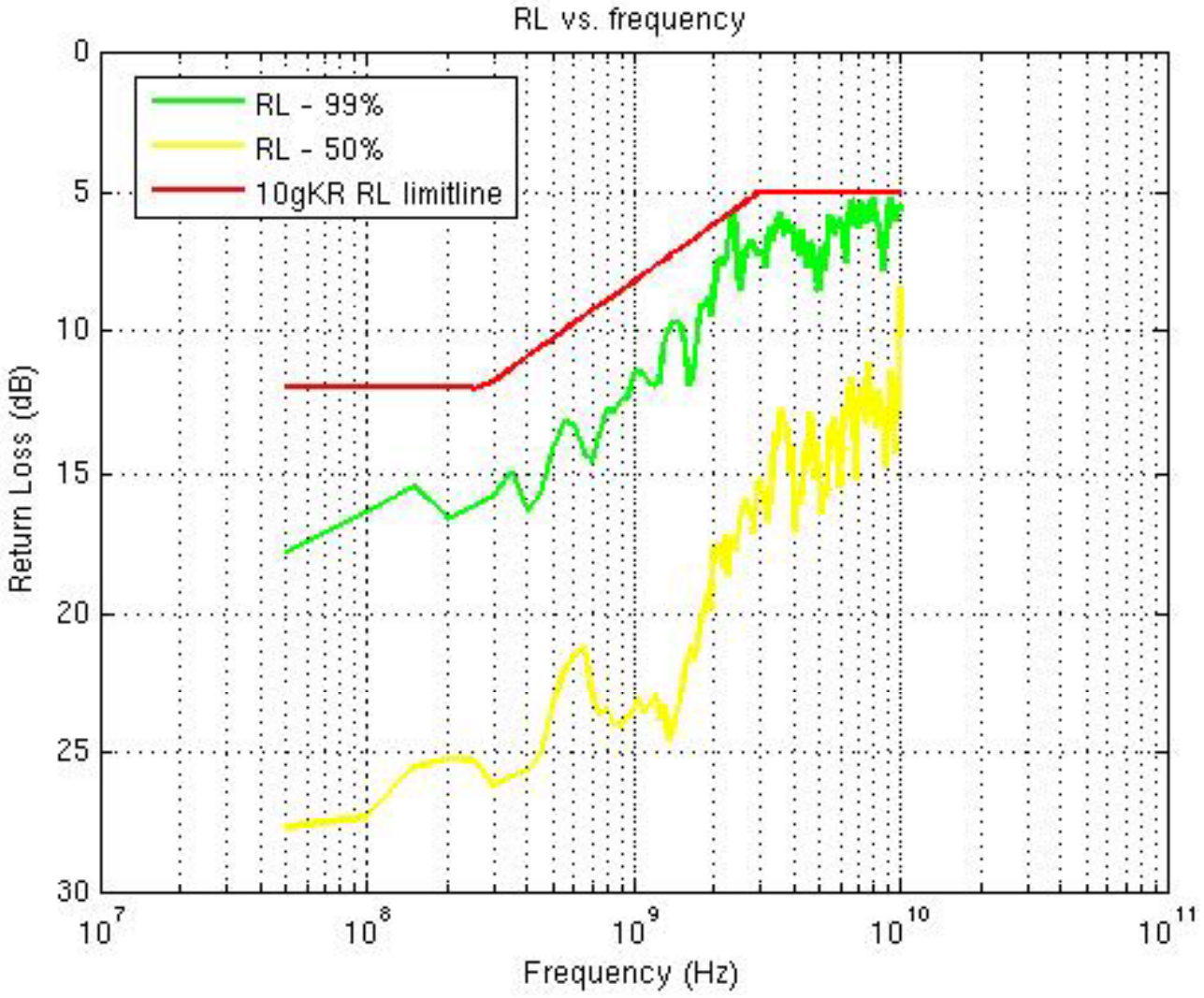
Previously presented IL and ICR[1]



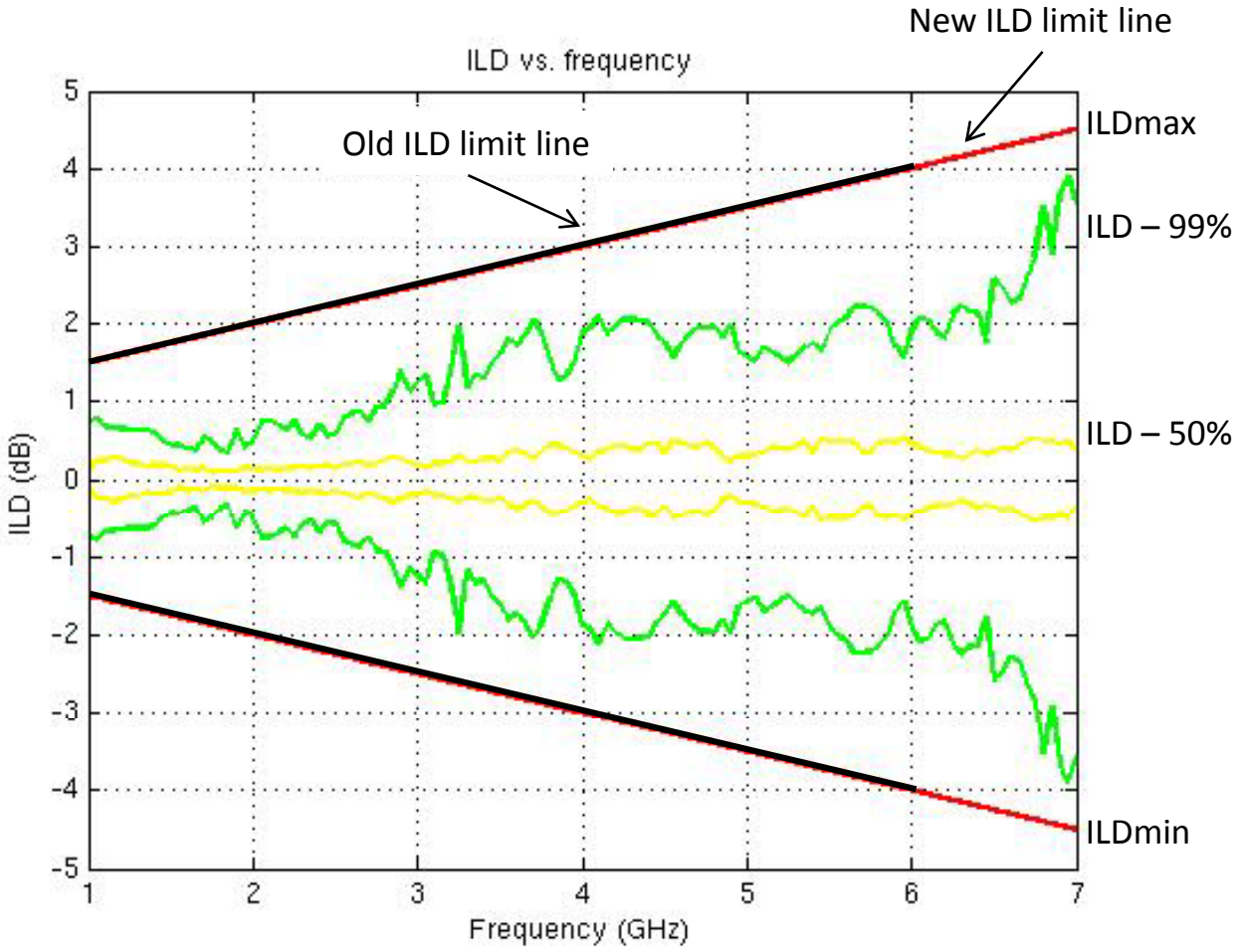


[1] Rich Mellitz and Vasu Parthasarathy, *Rough channel targets for 4 x 25 Gb/s operation on existing backplanes*, IEEE 802.3 100 Gb/s Backplane and Copper Cable Study Group, May 2011

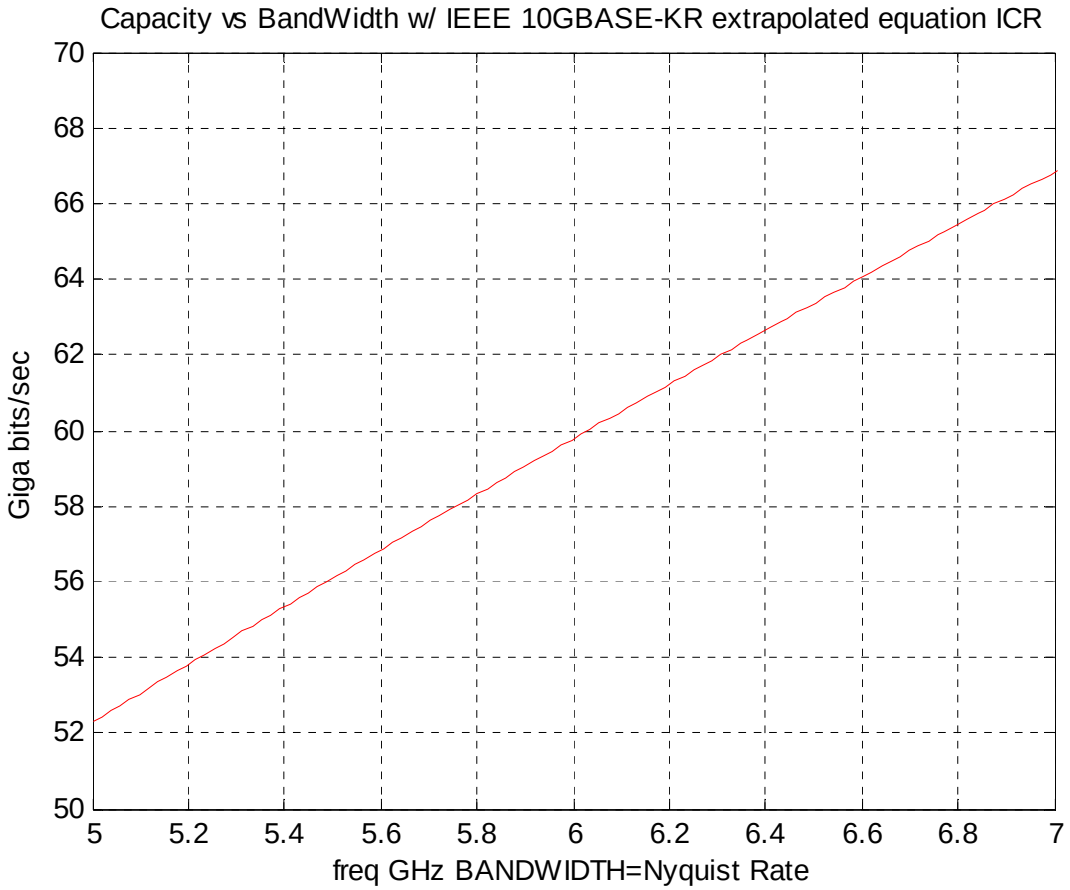
RL characteristics



ILD characteristics



IEEE 10GBASE-KR model, Extrapolate Equation ICR Capacity vs. BandWidth

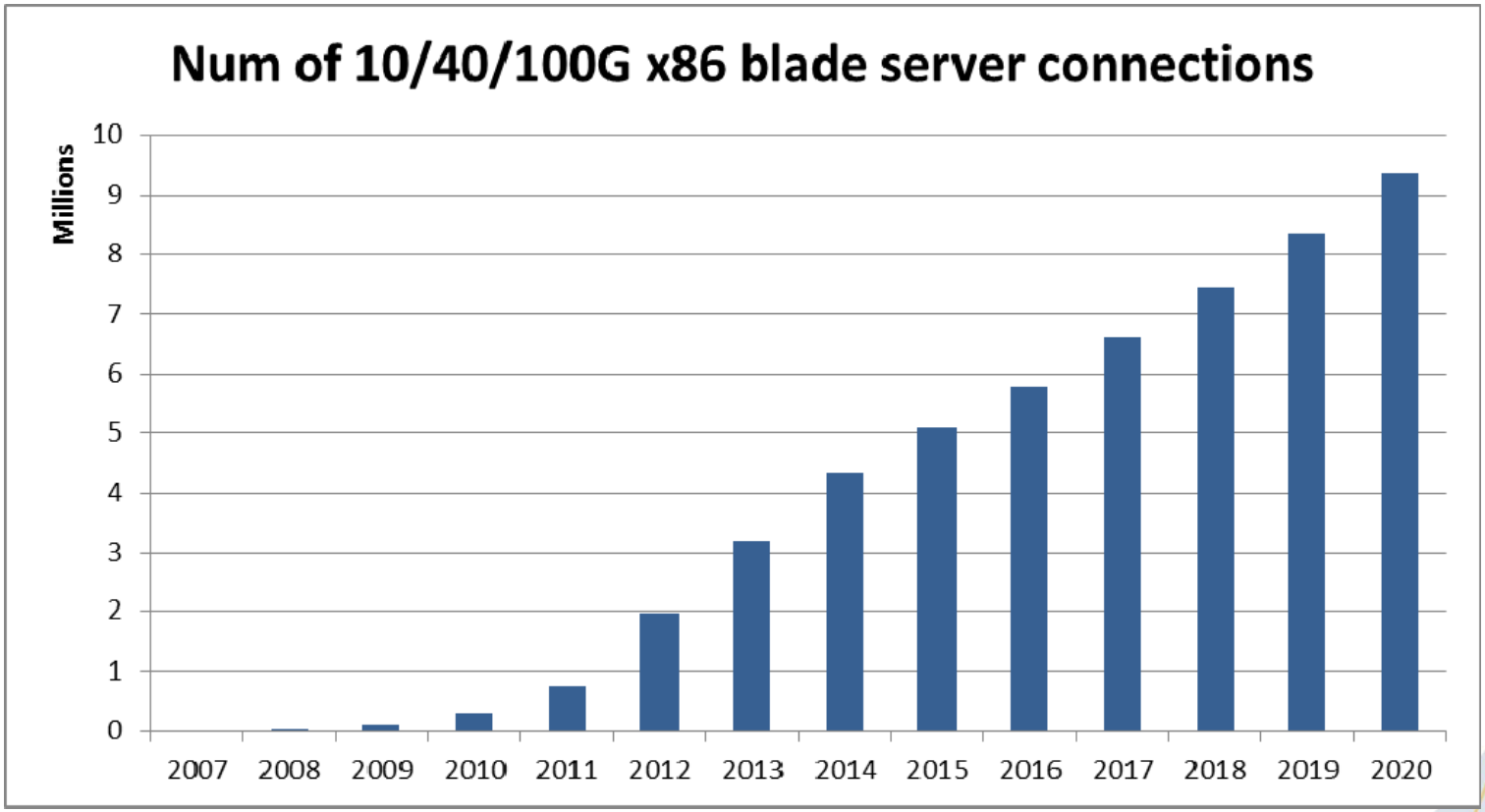


- Extending the ICR equation in the IEEE 10GBASE-KR specification from 5.15GHz to 7GHz increases capacity from 53 to 67 Gbps, a 25% increase

Observations

- 99% of channels that meet the IL limit in Annex 69-B also meet a “straight line” extension of the IL limit to 7 GHz
- 99% of channels that meet the ICR limit in Annex 69-B also meet a “straight line” extension of the ICR limit to 7 GHz
- 99% of channels that meet the ILD limit in Annex 69-B also meet a “straight line” extension of the ILD limit to 7 GHz
- 99% of channels that meet the RL limit in Annex 69-B also meet the RL limit at 7 GHz
- The extended channel characteristics provide a theoretical capacity of 67 Gb/s per lane

Blade server connection forecast



Source: Projections based on data from 100GbE Electrical Backplane / Cu Cabling Call-For-Interest slides 11 & 12 by Chalupsky. D & Flatman. A

Conclusions

- A complete characterization of the installed base was provided along with limit lines
- Preserving the characteristics of installed backplanes extends their life for another generation
  - Exploits channel capacity, provides an upgrade path and offers excellent return on investment
  - Promotes a go-green approach (less landfill)
  - Widely-used CMOS silicon and current PCB fabrication process assumed
  - Feasibility in current technology demonstrated using textbook signal processing techniques[2]
- The growing installed base of 10GBASE-KR/40GBASE-KR4 backplanes represents a broad potential market for 100GBASE-KR4

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[2] Howard Frazier, Vasu Parthasarathy and John Wang, *Feasibility of 100 Gb/s operation on installed backplane channels*, IEEE 802.3 100 Gb/s Backplane and Copper Cable Study Group, May 2011.