

Reach objective proposal for 100G-SR4

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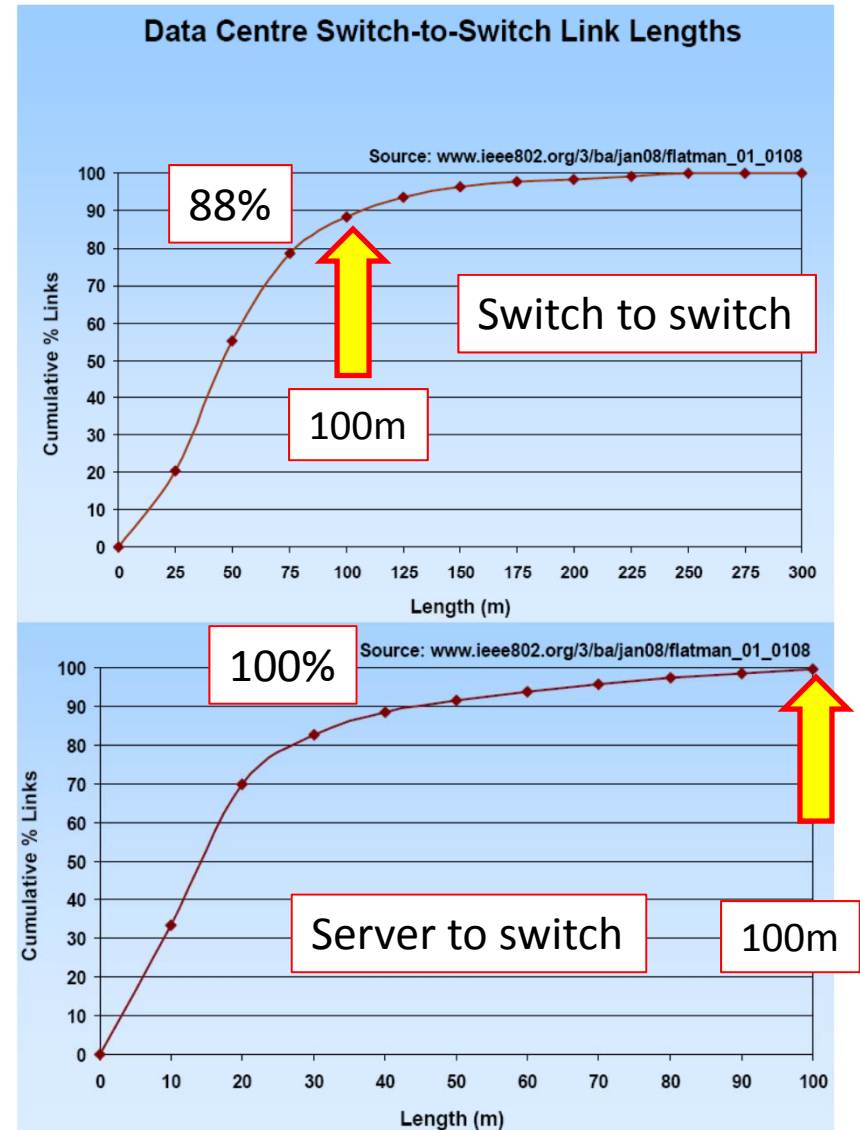
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Supporters and contributors

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The application

- Data Center link lengths
 - 100 m covers ~90% of switch to switch links, 100% of server to switch links
 - Flatman_01_0911
 - Kolesar_01_0911 : showed good agreement for single link length distribution
 - Fiber Channel objective : 100m on OM4
 - Higher rate, but single channel
 - Mark Nowell : “... at least 100 m on latest multi-mode fibre”
 - Q&A after presentation of Nowell_01_0911



Technical capabilities.... 1

- VCSEL performance

- Performance of high volume designs is yet to be published

- Anticipated performance for a fully retimed module

- without FEC: 70m to 100m on OM4

- with FEC: 100m to 150m on OM4

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- New multimode fibre with higher bandwidth:

- MMF with chromatic dispersion mitigation for VCSELs showing effective bandwidth up to 10,000 MHz.km

- ECOC 2011, Tu.3.C.3: “Chromatic Dispersion Compensated Multimode Fibers for Data Communications”, Denis Molin, Marianne Astruc, Pierre Sillard; Draka Communications, France

Technical capabilities.... 2

- If VCSEL performance comes in at worst case expectations, we have these low power (~30mW/channel) performance enhancements to fall back on inside the module:
 - Simple equalization in optical Tx chain
 - may enable 1 to 1.5 dB lower Tx penalties
 - Simple (fixed) Rx chain 'peaking' or CTLE)
 - may enable 1 to 1.5 dB of SRS improvement for worst case channel, depending on Tx characteristics

Proposed reach objective for 100G-SR4

- “Define a 4-lane 100 Gb/s PHY for operation over MMF with reach up to at least 100 m”
 - Meets requirements of the data center.
 - Consistent with Fiber Channel objectives.
 - Allows new fiber technology to be part of the solution.
 - Technically feasible, with several low power techniques available to achieve the distance.

Back up

FEC vs non FEC: 20 ps VCSEL rise time

Rate/FEC	Reach limit definition	OM4 reach	Typ. latency: 50m fiber + FEC	Max. latency: max reach + FEC	Notes
25.8 GBd, no FEC	power budget	70 m	250 ns	350 ns	~2.5 dB VECP
25.8 GBd, high latency FEC	power budget	155 m	550 ns	1075 ns	high ~4.5dB VECP
25.8 GBd, high latency FEC	3.6 dB VECP	125 m	550 ns	925 ns	1.7 dB margin for spec relaxation
25.8 GBd, high latency FEC	3.0 dB VECP	100 m	550 ns	800 ns	2.6 dB margin for spec relaxation
28 GBd, low latency FEC	power budget	140 m	280 ns	730 ns	high ~4.8 dB VECP !
28 GBd, low latency FEC	3.6 dB VECP	100 m	280 ns	530 ns	2.0 dB margin for spec relaxation

FEC vs non FEC: 16 ps VCSEL rise time

Rate/FEC	Reach limit definition	OM4 reach	Typ. latency: 50m fiber + FEC	Max. latency: max reach + FEC	Notes
25.8 GBd, no FEC	power budget	100 m	250 ns	500 ns	~2.2 dB VECP
25.8 GBd, high latency FEC	power budget	170 m	550 ns	1150 ns	high ~4 dB VECP !
25.8 GBd, high latency FEC	3.6 dB VECP	155 m	550 ns	1075 ns	1.2 dB margin for spec relaxation
25.8 GBd, high latency FEC	3.0 dB VECP	135 m	550 ns	975 ns	2.2 dB margin for spec relaxation
28 GBd, low latency FEC	power budget	160 m	280 ns	830 ns	high ~4.5 dB VECP !
28 GBd, low latency FEC	3.6 dB VECP	135 m	280 ns	705 ns	1.7 dB margin for spec relaxation