

CORNING

Automotive displays may serve as the lead application for automotive optical fiber connectivity

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Agenda

- High resolution video will drive the need for data rates of 25Gb/s +
- Link capacities over 100 Gb/s·m typically favor optical fiber
- Corning plans to support optical fiber-based automotive networks

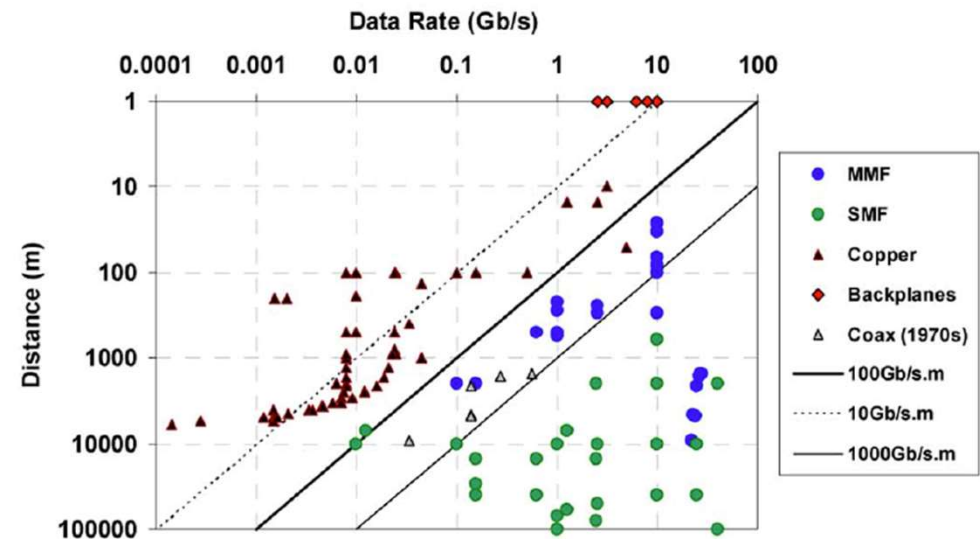
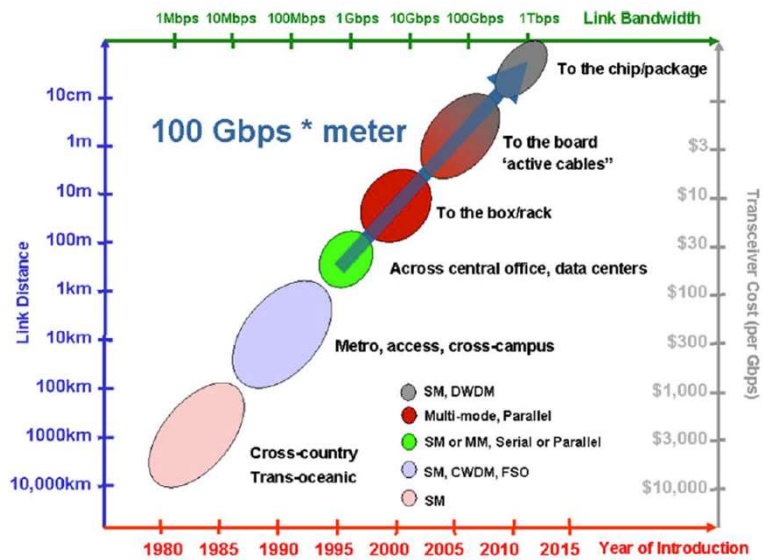
Consumers are transferring digital experience expectations into the automotive market and data rates are growing rapidly

Auto Display Roadmap* & Uncompressed Data Rates

- Size of automotive displays is growing
- Resolution growing faster than size
- Uncompressed data transmission to panel results in rapidly growing data rates
- See eric_OMEGA_01_0919.pdf for additional discussion of data requirements vs bit depth / image quality

Intro year*	Display resolution**	columns	rows	Frame rate	Color bit depth	Datarate, Gb/s	
>2023	6K	6144	3160	120	10	69.89	100 G
	6K	6144	3160	60	8	27.96	
	4K	3840	2160	144	12	43.00	50 G
	4K	3840	2160	120	10	29.86	
	4K	3840	2160	60	10	14.93	25 G
2022	4K	3840	2160	30	10	7.46	10 G
	4K	3840	2160	120	8	23.89	
	4K	3840	2160	60	8	11.94	
	4K	3840	2160	24	8	4.78	<5 G
	2K	1920	1080	120	12	8.96	
2020	2K	1920	1080	60	10	3.73	
	2K	1920	1080	30	8	1.49	
	2K	1920	1080	24	8	1.19	
<2020	HD	1280	720	240	12	7.96	
	HD	1280	720	120	10	3.32	
	HD	1280	720	60	8	1.33	
	HD	1280	720	30	8	0.66	

Fiber has been adopted for data links when rate-distance reaches $\sim 100 \text{ Gb/s}\cdot\text{m}$ across many applications



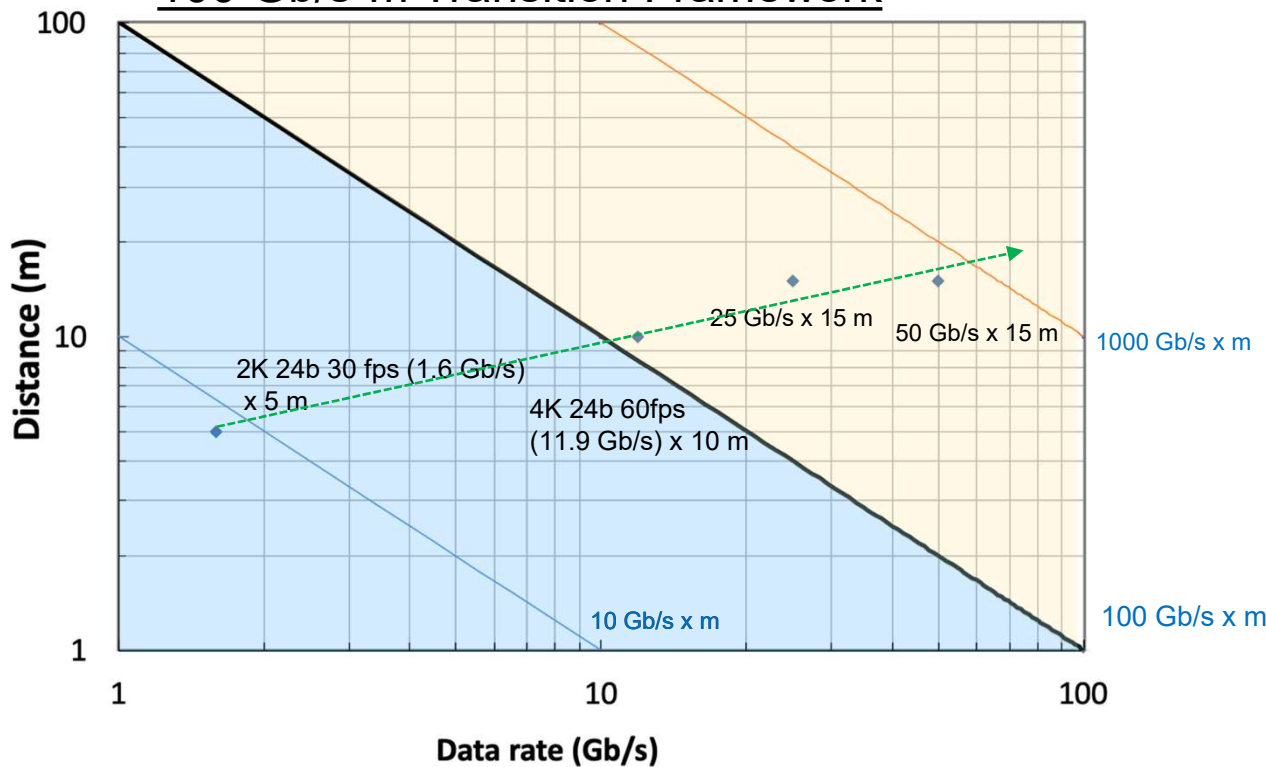
A. V. Krishnamoorthy et al., "Progress in Low-Power Switched Optical Interconnects," IEEE J. Select. Topics Quantum Electron., vol. 17, no. 2, pp. 357–376, Mar. 2011

Glass fiber provides several benefits beyond link capacity along

Feature of glass fiber link	Impact on in-vehicle network
Reach at high data rate	Flexibility to locate sensors, displays, ECUs in optimum locations
Cable size and flexibility Connector cross section	Increased mechanical flexibility of harness Easier installation and routing of cable ends
Lower cable weight	Fuel efficiency
Upgrade path	Cable does not require cable upgrade for future higher data rates
Glass fiber does not work harden	Glass fiber resists repeated bend and vibration without breakage
Reduced EMC issues	Glass fiber provides galvanic isolation, EMI resistance
Lower power consumption	Battery life during storage and use Improved thermal management
Link availability and reliability	Reduced risk of EMI issues over time due to aging of shielding
Total system cost	Above data rate threshold, cost premium of optical transmitters is offset by design flexibility, ease of handling, reliability

Auto displays and HD cameras are pushing link capacity to the range where copper interconnects face significant trade-offs

100 Gb/s·m Transition Framework



- 25 and 50 Gb/s Ethernet being used now in auto
[kadry_3B10GAUTO_01_0120.pdf](#)
- 25 Gb/s enables:
4K, 10 b/clr, 60 Hz
- 50 Gb/s enables:
6K, 8 b/clr, 60 Hz
4K, 12 b/clr, 144 Hz

Corning intends to support multi-gig in-vehicle optical networks

Industry experience

- Leader in fiber-based optical communications for over 40 years
- Broad range of technologies supporting advances in automotive industry: display technology emissions control, performance glazing
- Experience designing and testing optical components for harsh environments including aerospace and consumer

Standards support

- Active participant in fiber industry standards for telecom, access, LAN, datacenter

Our goal

- Create an ecosystem that supports in-vehicle networking adoption
- Optimize trade-off among needs of automotive industry: cost, performance and robustness
- Contribute passive device technology and facilitate active components to enable a full connectivity solution