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Advanced Components

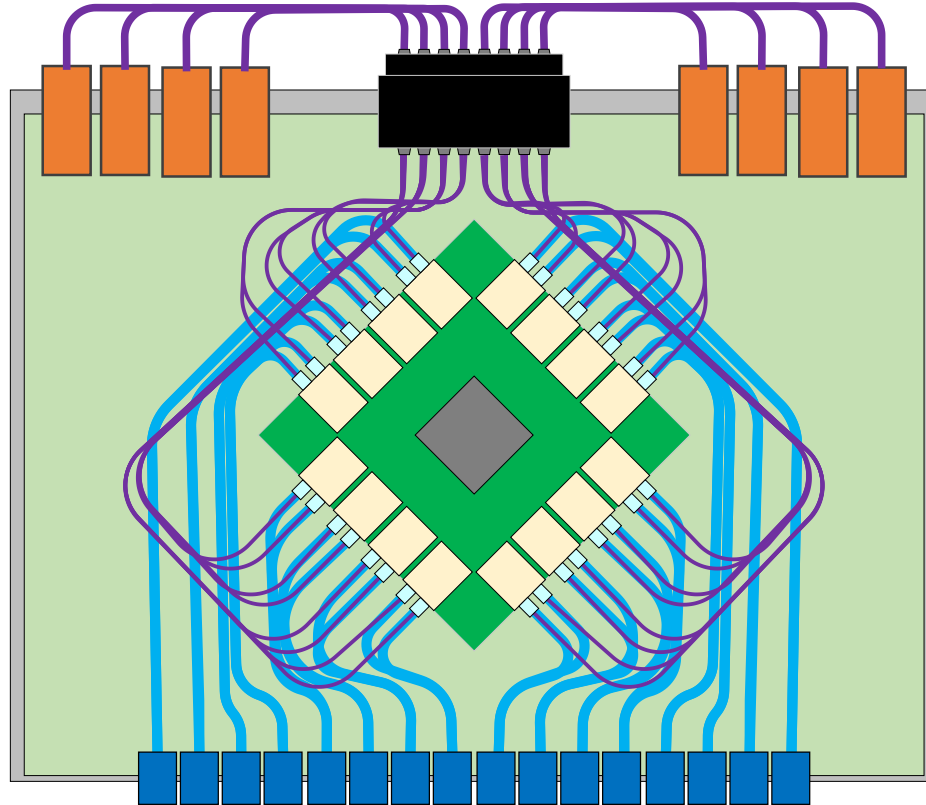
Your Source for Optical Interconnect Solutions

DESIGN • TEST • MANUFACTURE

Multi-Core Fibers and Co-Packaged Optics

Tiger Ninomiya (Tiger.Ninomiya@senko.com)

Inside Co-Packaged Optics Switch Example

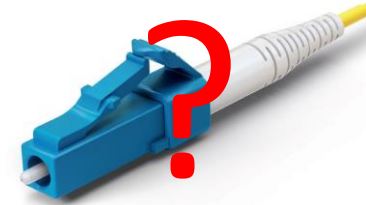
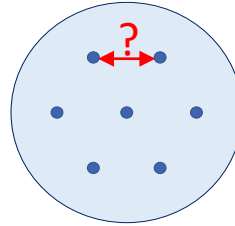
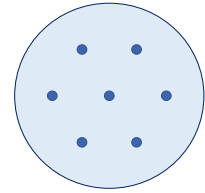
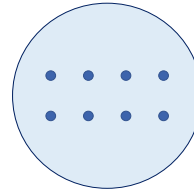
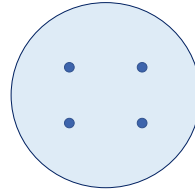
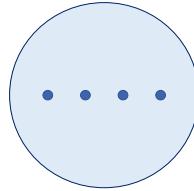


Multi Core Fiber

- Types of multi core fibers

 - Various core-count types

 - ✓ 4, 2x4, 7, 12, 19... etc

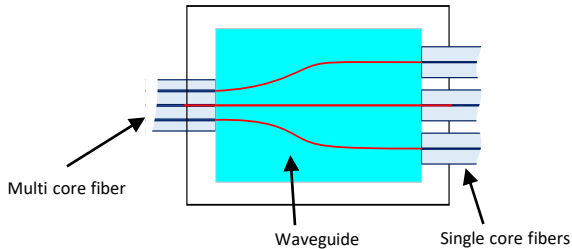


- No standard as of now

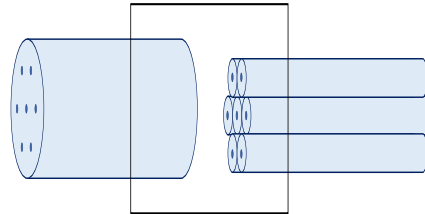
 - IEC: connectors and fibers are under discussion to be standardized, but no consensus yet

- Fan out options (break out to single core fibers)

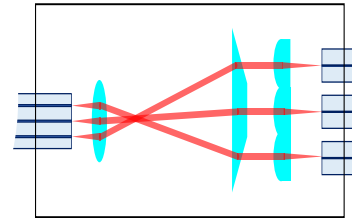
Waveguide



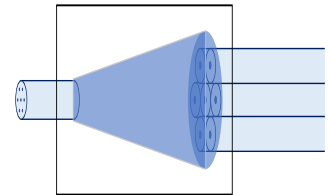
Fiber bundle



Free-space optics



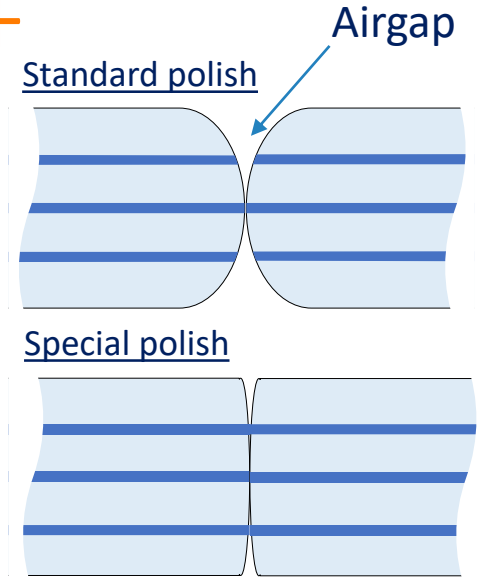
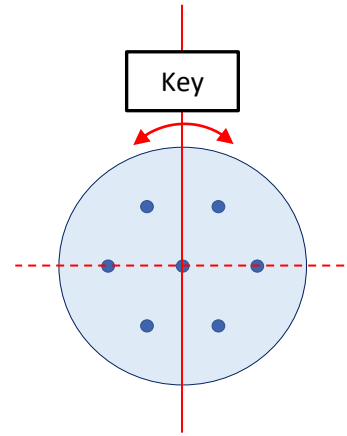
Stretch fusion splice



Connectorization of MCF

Terminating MCF in connectors

- More accurate alignment is required
 - ✓ $\pm 1.00^\circ$ for $IL < 0.85\text{dB}^1$
 - ✓ $\pm 0.65^\circ$ for $IL < 0.20\text{dB}^2$
- Polishing process to make physical contact for all cores



Connector types

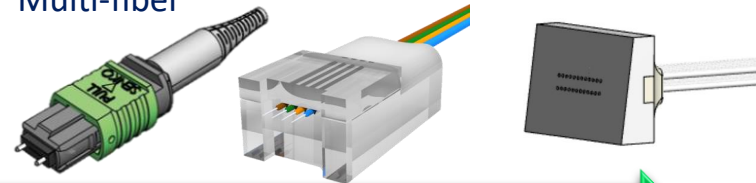
Simplex



New duplex



Multi-fiber



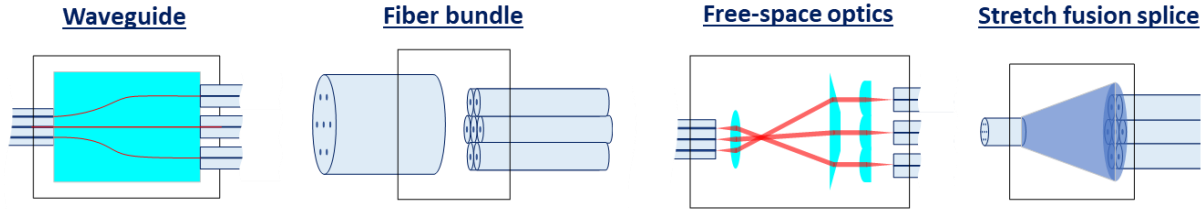
Higher density but more challenging to terminate

1) Kengo W., et al. "MPO Type 8-Multicore Fiber Connector With Physical Contact Connection," J. Lightwave Technol. 34, 351-357 (2016)
2) Kota S., et al. "Multicore Fiber Connector with Physical-Contact Connection" IEICE TRANSACTIONS on Electronics Vol.E99-C No.2 pp.242-249 (2016)

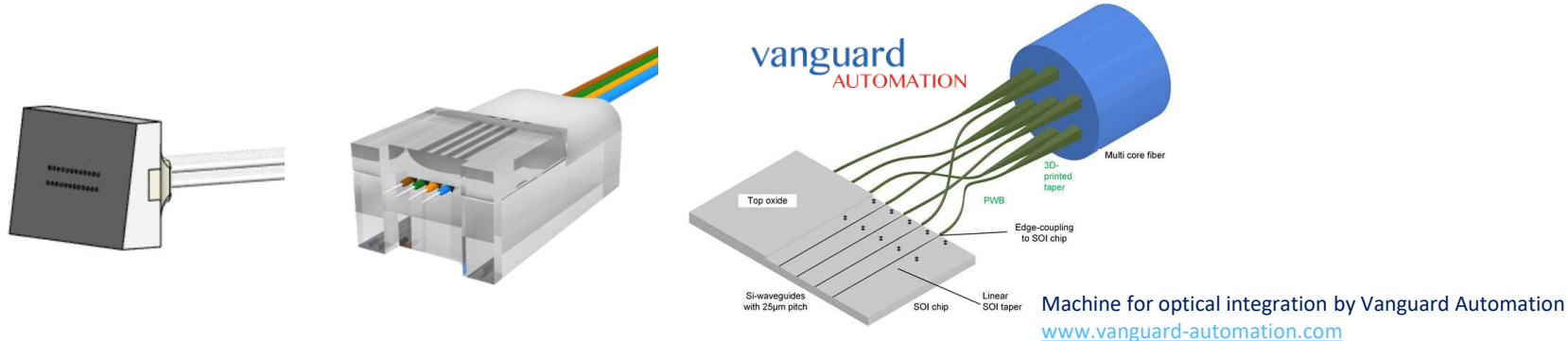
Questions

- How MCF to be used in Co-Packaged Optics applications?

➤ Is fan out required? Or use multicore fibers for entire network?



- How to couple to SiP chip? Active alignment or wire bonding?





Growing Together

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