

Optical Circuit Switching: Past, Present, Future

Hus Tigli
NuFund Venture Group

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My Background

CEO, Optical Micro-Machines (OMM) — 2000-2001
World's first Telcordia-qualified photonic switches
for telco networks
2D and 3D MEMS



CEO, CrossFiber — 2002-2014
Inventor and supplier of OCS for data centers
3D MEMS + out-of-band beam control



Since 2014: Advisor, Deal and DD Lead
for angel investments

OCS: The Past

Nomenclature was:

all-optical switch

photonic switch

OOO switch (vs. OEO)

OXC, PXC (optical cross-connect, photonic cross-connect)

- In 2000, there were 40+ photonic switch developers...

- OMM —> CrossFiber

- Glimmerglass —> Dicon —> ?

- Calient, Dicon survived

- Others vanished

- ROADMs widely deployed, not OCS

The OCS Landscape Today

Long-Timers

Global
Production and
Deployment
Leader

“Me Too”ers



Newbies

Long-Timers

	Main technologies	Max Radix
Polatis (Huber & Suhner)	Piezo	384x384
Calient	3D MEMS	320x320
Dicon	2D, 3D MEMS	600x600?
Telescent	Robotic	1008x1008
Agiltron	2D, 3D MEMS, opto-mechanical	168x168
GigaCom	Robotic	6192x6192
Wave2Wave	Robotic	2000x2000

Global
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Google

- Published groundbreaking paper at SIGCOMM 2022
- Popularized the term “OCS”
- Announced data center spine switches were now OCS
- Showcased physical 136x136 OCS at Google NEXT
- Announced in 2023: OCS now deployed in AI clusters

“Me Too”ers

Recent Market Entrants with Previously Owned Technologies

- Coherent —announced 300x300 in March 2024; liquid crystal-based
- Lumentum —announced 300x300 in March 2025; MEMS-based



Newbies

- iPronics —silicon photonics
- Salience Labs —silicon photonics
- nEye —MEMS + PLC
- ZigZag —wavefront shaping
- ?

Requirements for OCS for most data center applications

Musts:

Very low crosstalk: -60 dB or better

Upper operating temperature limit: 60 C or better

Repeatability in insertion loss: +/- 0.1 dB or better

Reliability for expected number of connections

Alarms/notifications in case of link failure in switch

Shock and vibration qualification

Key Requirements:

Low insertion loss, especially if cascading (CLOS)

Manufacturability in high volume

Desirable:

Short switching time

Low cost

Market Perspective

- Only hyperscalers can do the “heavy lifting” in software:
 - implications for OCS developers?
 - implications for new networking companies?
- Who will conquer the enterprise market? How?

The Future

... with the warning of Yoga Berra in mind:

“I never make predictions, especially about the future!”

- Established OCS technologies (MEMS, piezo) likely to dominate medium term
- Perhaps: liquid crystal, if no insertion loss issues at high radix
- Silicon photonics likely to be limited to some (niche?) applications, unless scaling challenges can be overcome
- Non-mechanical solutions offer the most intriguing potential