

FACEBOOK

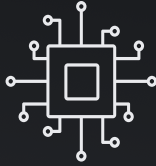
Co-Packaged Optical Interconnects

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Optical Technology Strategy, Facebook



TOPICS



**Interconnect
BOTTLENECKS**



**Power
EFFICIENCY**



**Co-packaged
Optics**

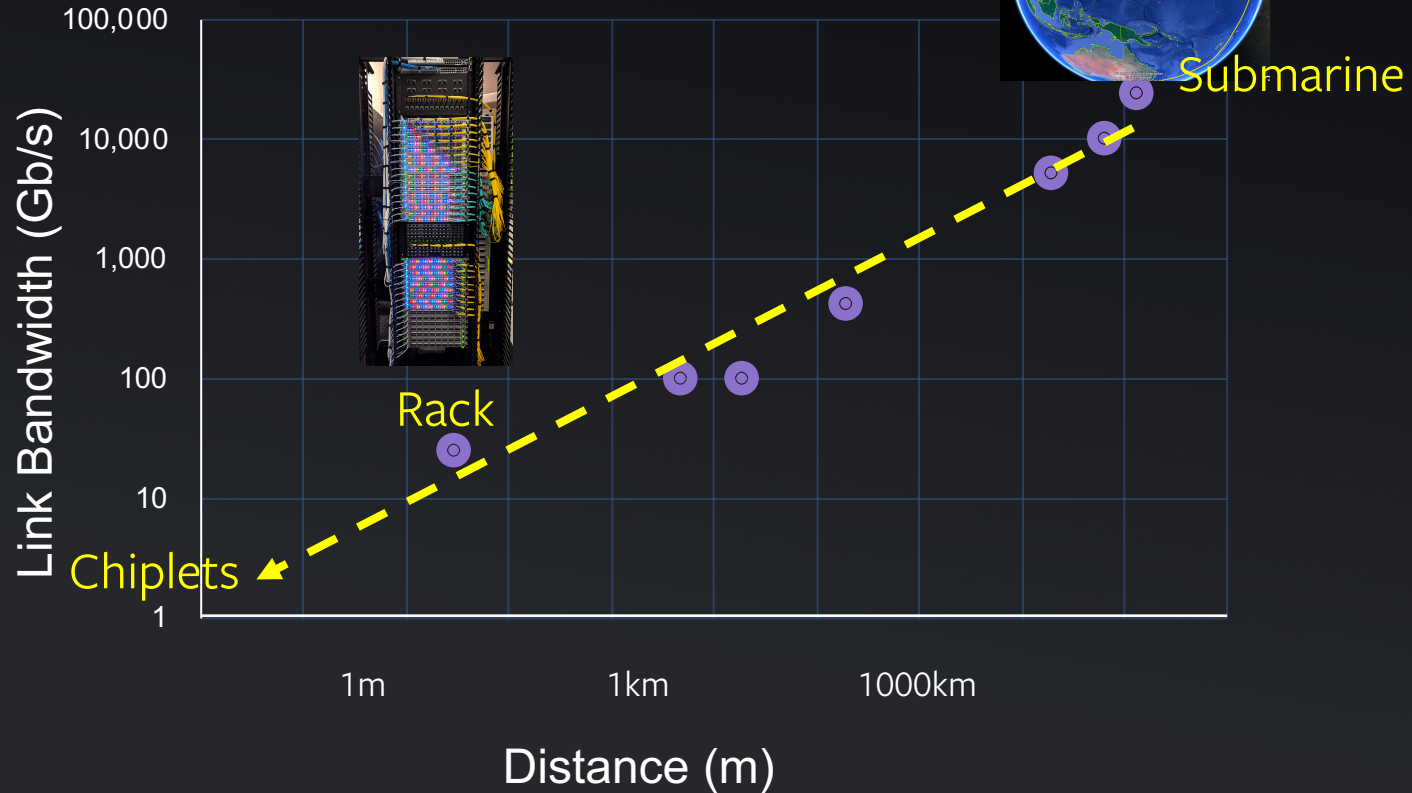
Interconnect BOTTLENECKS



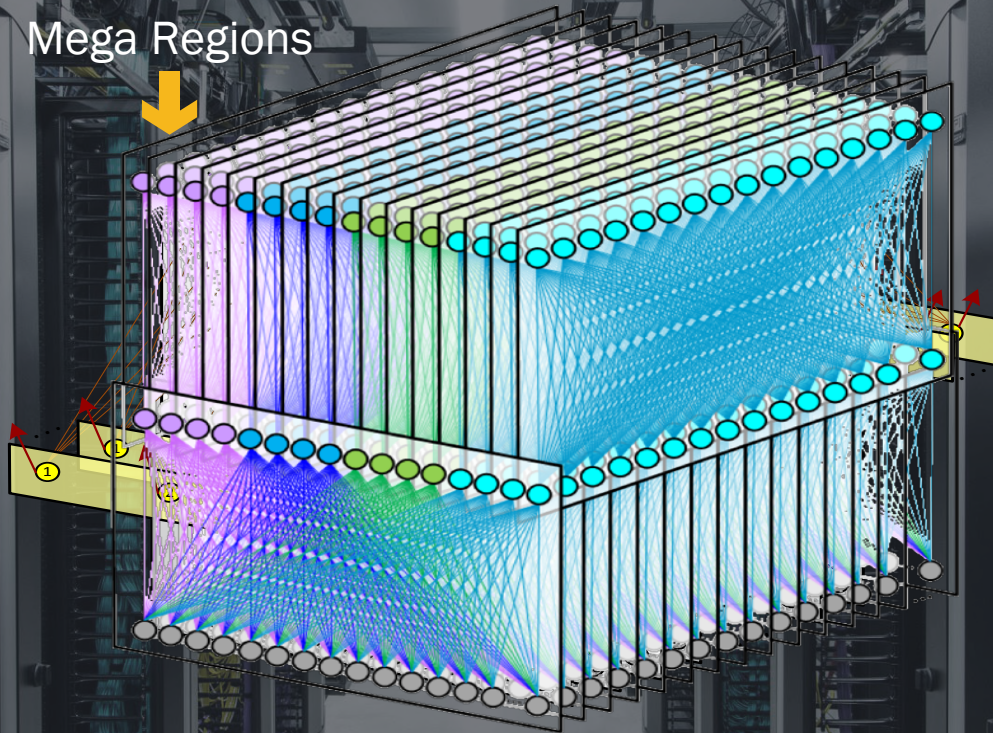


Give people the power to build community and
bring the world closer together

Optical Interconnects



Mega Regions



Disagg Services

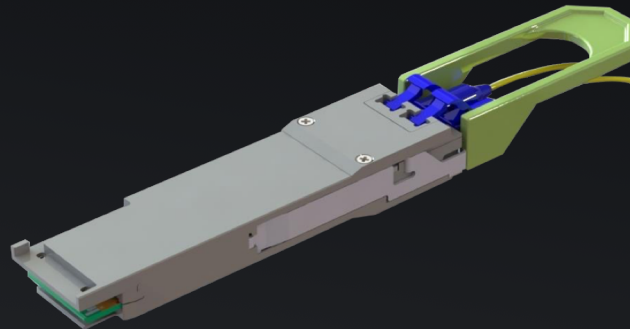
100G-CWDM4-OCP



OPEN
Compute Project

For switch interconnects

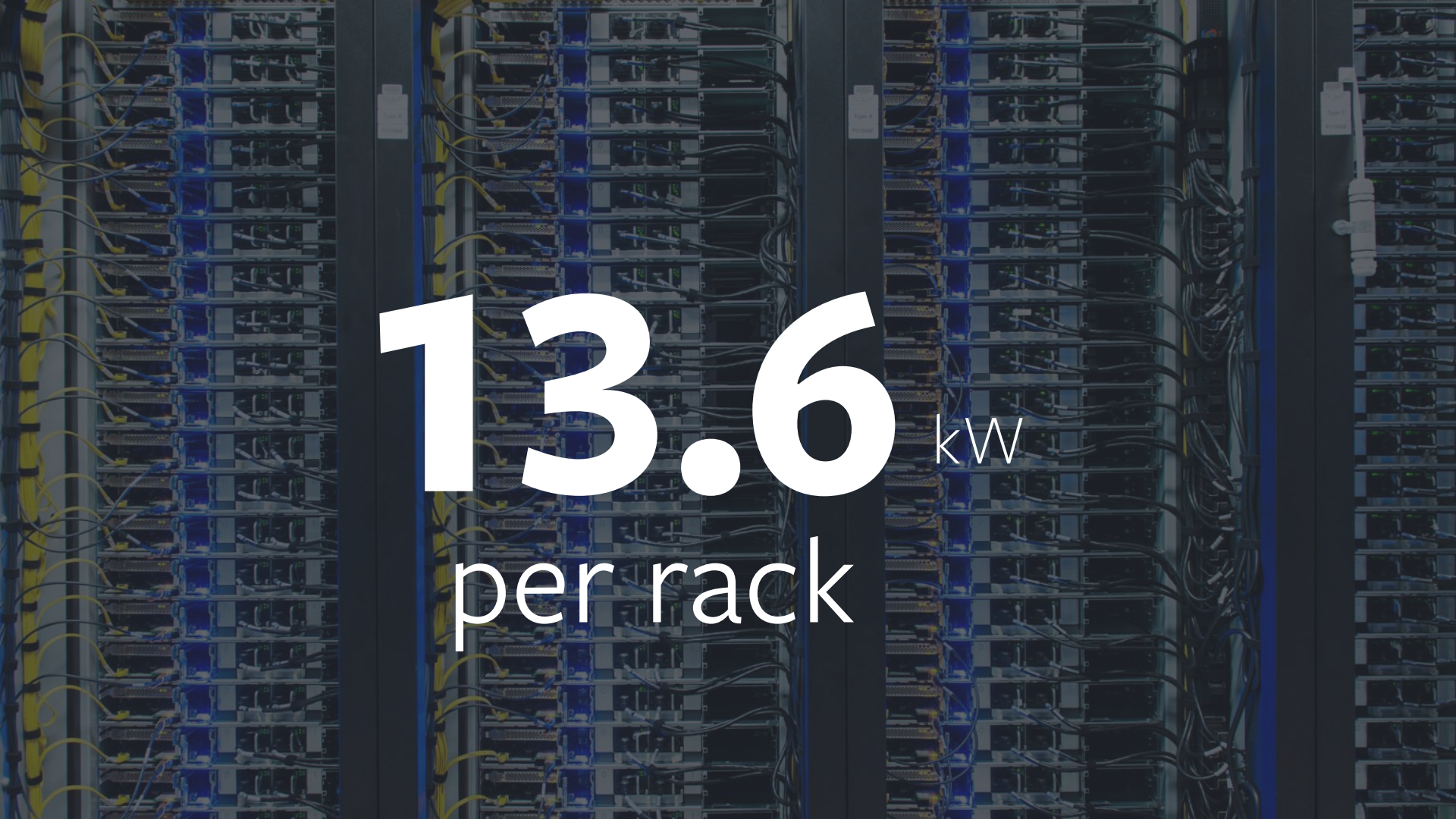
- Duplex single-mode fiber
- 4 wavelengths ~1310nm
- Shorter reach (<500m)
- Lower operating temperature range (15-55 °C)
- Shorter deployment lifetime (<5 years)



<https://code.facebook.com/posts/1633153936991442/designing-100G-optical-connections/>

Power EFFICIENCY





13.6^{kW}
per rack

Network Switch Evolution

YEAR	THROUGH PUT	SERDES	IDEAL OPTICAL SPEED	IMPLEMENTED @SCALE	SYSTEM POWER
2016	3.2T	25G	100G	100G	
2018	6.4T	25G	200G	100G	
2019	12.8T	50G	400G	100G	

Scale-Up and Scale-Out



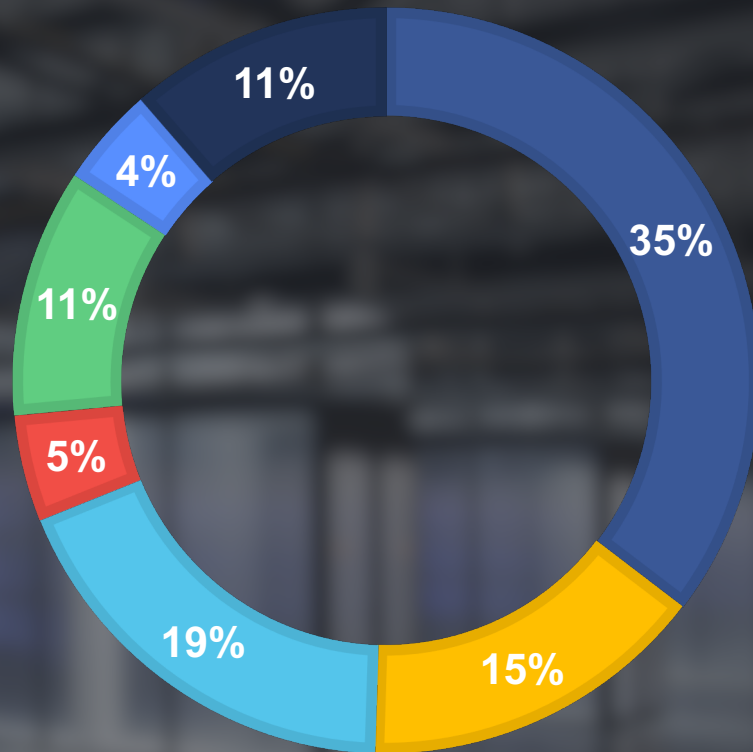
Wedge 100: 3.2Tb/s total, 128 electrical lanes at 25Gb/s



51Tb/s total, 512 electrical lanes at 100Gb/s

Network Switch Power Per Function

- Switch Functions
- Switch IO
- Optical
- Optical IO
- Fan Tray
- CPU
- Misc



Component INTEGRATION



The Case for Integrated Optics



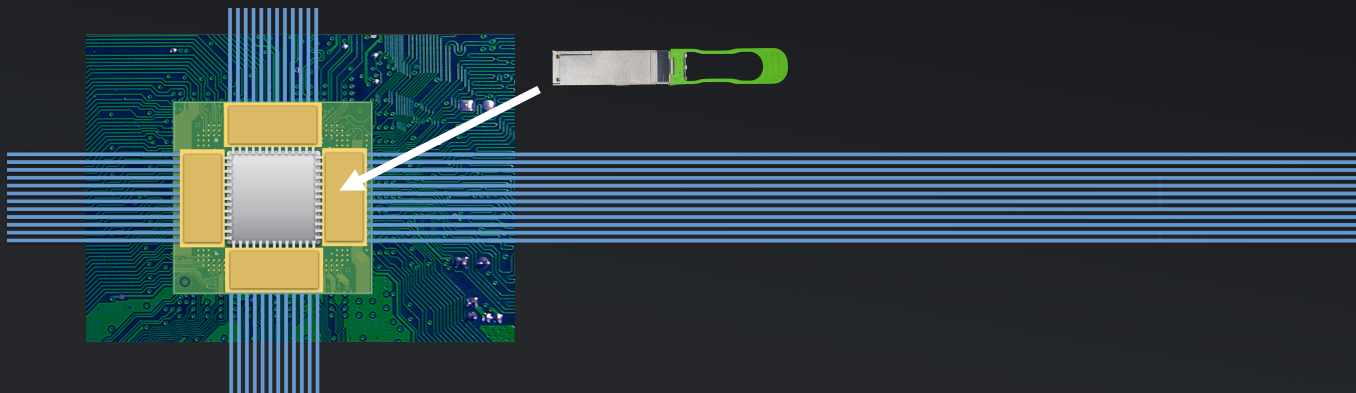
Can save over 200W in a 51T switch using XSR vs. LR SERDES

Evolution of Optical Interconnect

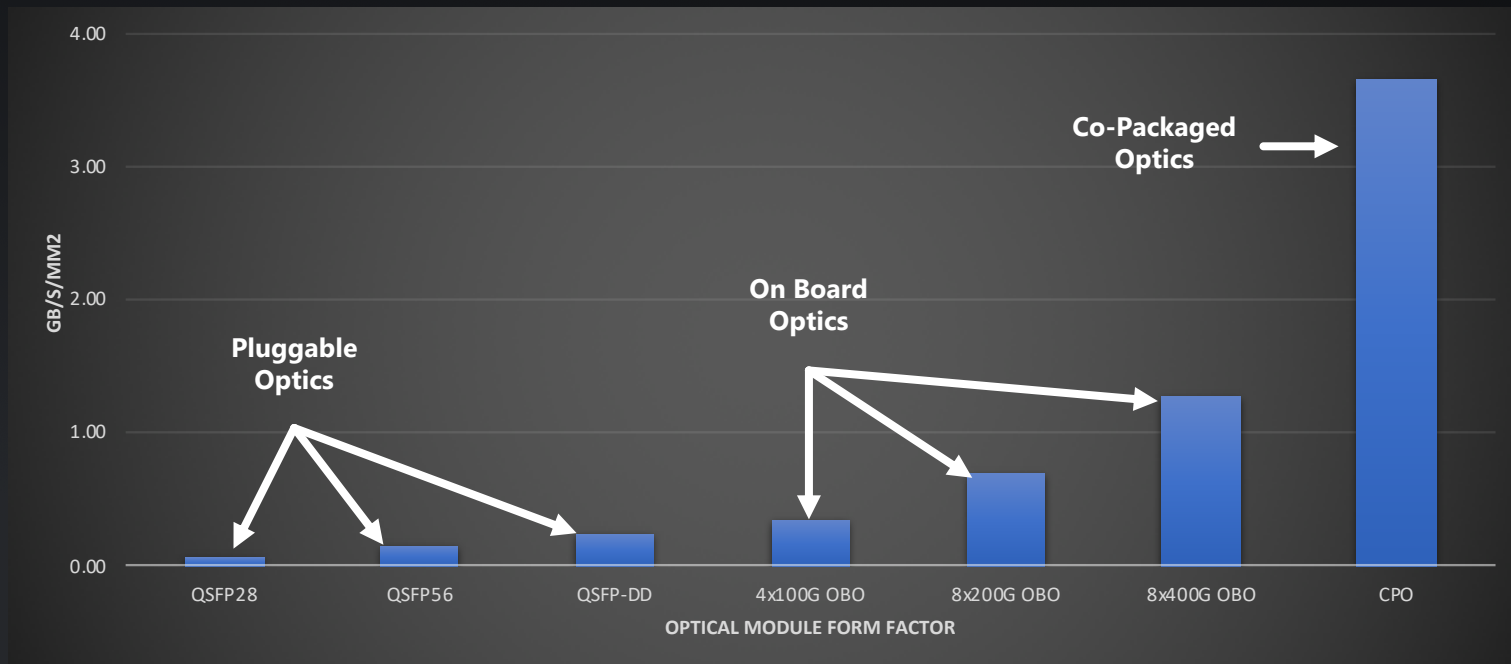
Optical
Transceiver



Co-packaged
Optics

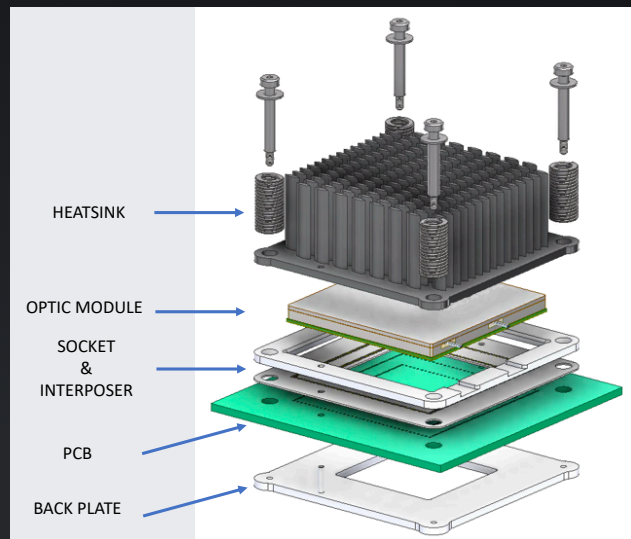


Bandwidth Density Comparison

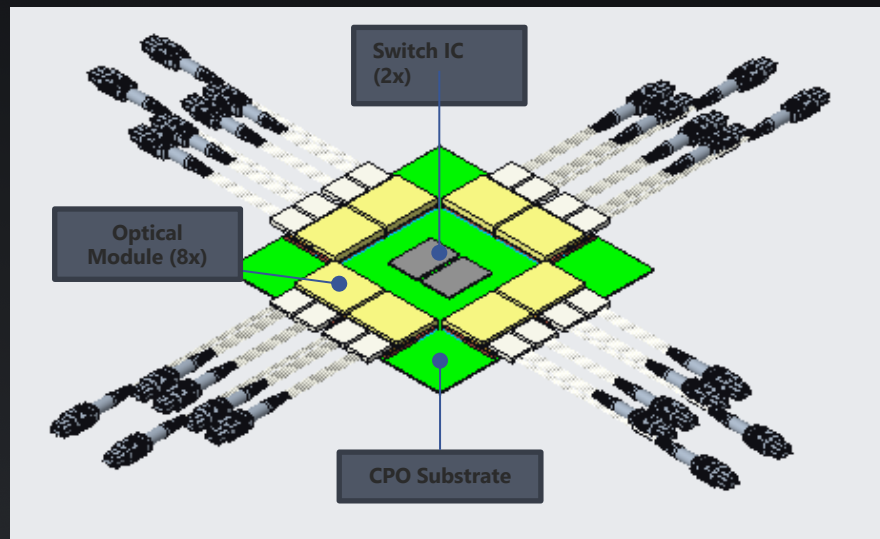


~30x increase in BW density required for first-gen CPO!

Integrated Optic Form Factors



On-Board Optic (OBO)



Co-Packaged Optic (CPO)

Co-Package Optics (CPO)



Co-Packaged Optics (CPO)

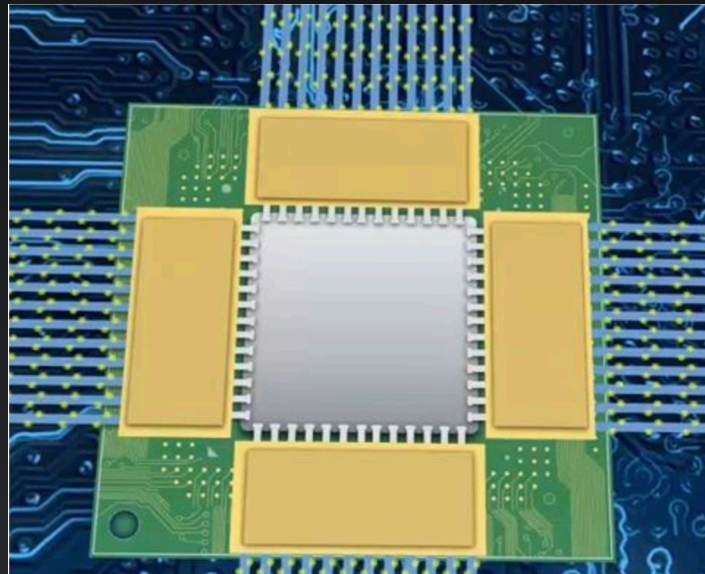
Build ecosystem to enable innovation

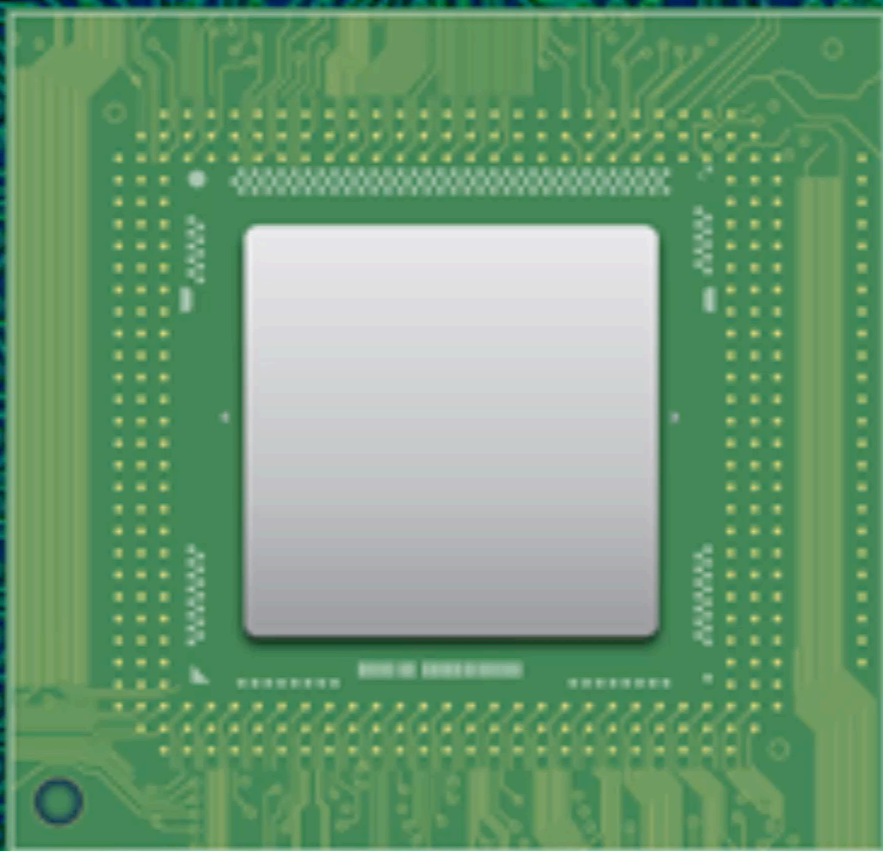
JDF Collaboration with Microsoft

Three discussion documents:

- Optical Module (Released)
- Optional External Light Source
- Co-Packaged Optics Assembly

<http://www.facebook.com/CoPackagedOpticsCollaboration>





Chiplet Optical Interconnects

Reduce power through chip-level integration

Co-packaging is becoming a viable solution

Collaborate to build the ecosystem

Thank you

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