![LIGHTCOUNTING]

AI Clusters, Data Centers, Optical Networks

Publication Profiles & Subscription Packages
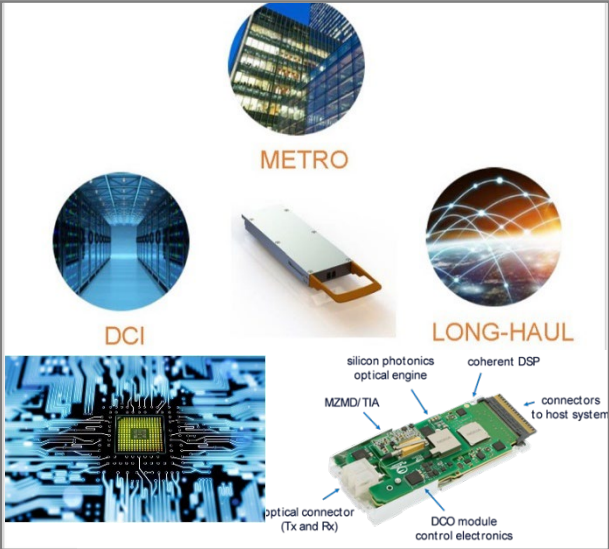
2024

20 YEARS

Two decades of unwavering dedication and commitment to the industry we proudly serve.

Reports Overview

LightCounting has proudly served our industry for 20 years with reports and services designed to help executives plan and run their businesses. We support decision-making based on our data, expert analysis and trusted forecasts. Our research spans the entire supply chain of the global communications industry.

This brochure summarizes our coverage of AI Clusters, Data Centers and Optical Networks with in-depth analysis of the market for optical transceivers, including the optical and electronic chips used in these modules.

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2024 Research Publication Calendar

JANUARY
- NEW: Optics for AI Clusters
- Vendors and Markets for Optics in China

FEBRUARY
- PAM4 and Coherent DSPs

MARCH
- Ethernet Optics
- Quarterly Market Update

APRIL
- Market Forecast
- Ethernet, InfiniBand and Optical Switches for Cloud Data Centers

MAY
- Silicon Photonics, Linear Drive Pluggable and Co-packaged Optics
- Optical Vendor Landscape

JUNE
- Quarterly Market Update
- Telecom Network Transformation

JULY
- Mega Data Center Optics

AUGUST

SEPTEMBER
- Ethernet Optics
- Quarterly Market Update

OCTOBER
- Market Forecast
- Ethernet, InfiniBand and Optical Switches for Cloud Data Centers

NOVEMBER
- Access Optics: FTTx and Wireless
- Optical Sensors

DECEMBER
- Quarterly Market Update
- AOCs, DACs, Linear Drive Pluggable and Co-packaged Optics

Data collection and publications flow

Quarterly and Semi-annual Reports

3-month cycle

Quarterly Data Collection

Quarterly Market Update
March, June, September, December

6-month cycle

Market Survey:
January and July

Ethernet Optics
March and September

Market Forecast
April and October

Ethernet Switches
April and October
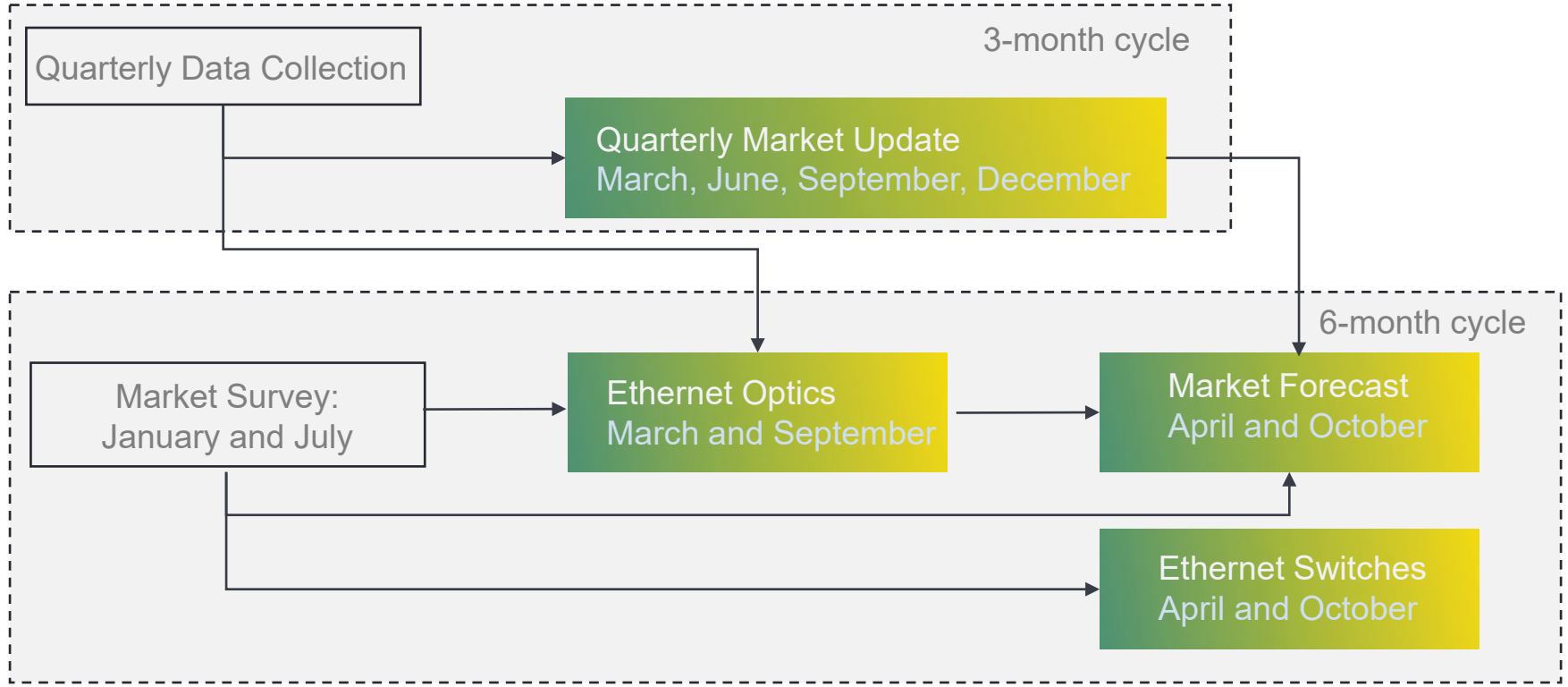
Optics for AI Clusters

FREQUENCY: ANNUAL ● DATE: JANUARY

NEW

This report explores the evolving role of optics in AI Clusters, covering both connectivity and switching. It features data for the sales of optical switches, transceivers and active optical cables (AOCs) for High Performance Computers (HPCs) and AI Clusters in 2019-2023 with a forecast for 2024-2029.

Importantly, the forecast includes detailed models for the deployment of optics in AI Clusters (back-end networks) at Alibaba, Amazon, Google, Meta and Microsoft, to illustrate the differences from the optics used in compute nodes (front-end networks). A detailed analysis of the pivotal role being played by optical connectivity including NVlink and CXL/PCIe in the implementation of AI Cluster architectures is central to this report.

Emerging AI/ML Clusters

DATA CENTER NETWORK
NDR IB or 400GbE
Up to 4 Tb/s per server
100's meters

MoR and EoR Switches
All-to-All connectivity
Placed further away if
rack-power limited

H100 Server
8x H100 GPUs
24 TB/s memory BW

GPU-GPU FABRIC
3.6 Tb/s per GPU
28.8 Tb/s for 8x GPUs
256 GPUs per cluster
10's meters (cluster scaling)

Scaling Dependencies:
1. Increasing BW per GPU
2. Power density (rack and server)
3. Larger GPU-GPU domains
4. MoR and EoR Switching
5. Any-to-Any Latency

COMPANIES PROFILED

Alibaba, Amazon, Google, Meta, Microsoft
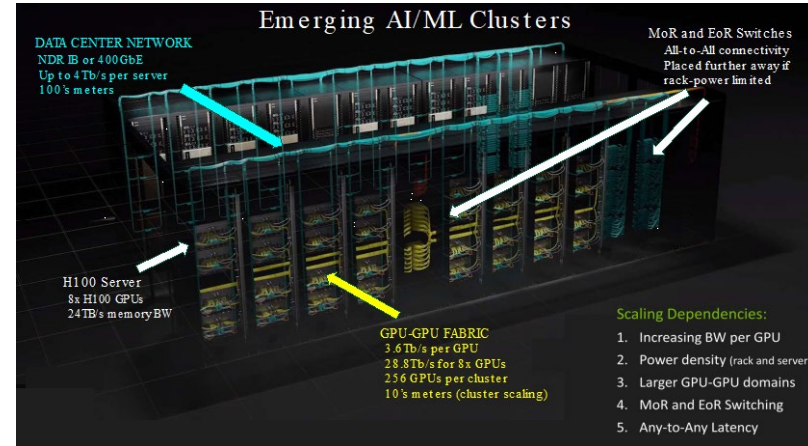
Vendors and Markets for Optics in China

FREQUENCY: ANNUAL ● DATE: JANUARY

Chinese suppliers of optical components and modules surprised the industry in the years 2010 through 2022. Their early success was enabled by massive deployments of FTTx systems and optical fronthaul in the access markets. Over the last 5 years, sales of optics to Cloud companies and telecom service providers around the world propelled Chinese vendors to new records.

This report includes the latest financial data reported by the leading Chinese suppliers of optical components and modules and offers detailed profiles of the companies. The report comes with a companion spreadsheet containing a 5-year history and 5-year forecast for shipments, pricing and sales of optical components deployed in China and compares those with the global market.

It also profiles Chinese suppliers of optical modules, components and IC chips.

COMPANIES PROFILED

ICPs: 21Vianet, Alibaba, Baidu, Bytedance, Ctrip, Face++, JD.com, Ksyun, QingCloud, Tencent, Vipshop, Ucloud

CSPs: China Mobile, China Telecom, China Unicom

Equipment suppliers: FiberHome, H3C, Inspur, Huawei, Lenovo, ZTE

Module and component vendors: Accelink, Accelight, APAT, ATOP, Broadex, CIG, Cloudlight, Eoptolink, Gigalight, HG Genuine, Hyper photonix, Moduletek,Hi-Optel, Hisense, Innolight, Linktel, O-Net, Opway, QXP, Superxon, Taclink, Tanlink, Trilight, Wandtec, XGIGA, San-U, Surinno, YOFC, ZKTel

Semiconductor chip vendors: AmpliPHY, Aluksen, Aroptics, Elite Optotronics, EOChip, Etern laser, ZK Litecore, InSiGa, Mindsemi, Mini Silicon, Phograin, Shijia Photons, Top-IC, X-Y Tech, Yuanjie, Wingcomm, ZettaSemi

PAM4 and Coherent DSPs

FREQUENCY: ANNUAL ⬤ DATE: FEBRUARY

This report analyses the market for semiconductor IC chipsets used in optical transceivers and related products. The chipsets include laser drivers, CDRs, TIAs, and in some cases FEC, PAM4 and coherent DSP ICs. Demand for 400GbE connectivity inside mega data centers and 400G DWDM optics on the outside boost demand for PAM4 and coherent DSP chips, making it a very attractive business opportunity in 2024-2029.
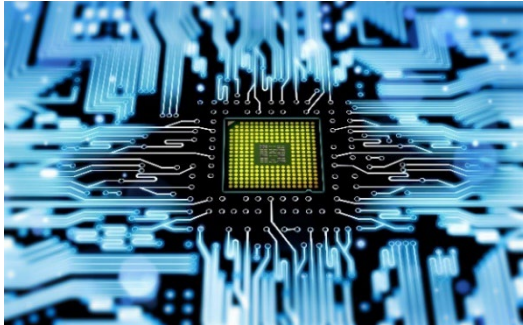
COMPANIES PROFILED

Cisco (Acacia), Credo, Marvell, Macom, Maxim, Maxlinear, Semtech
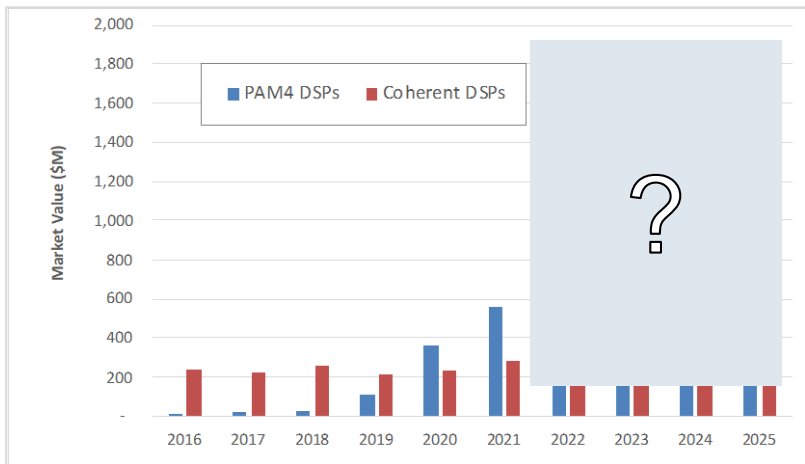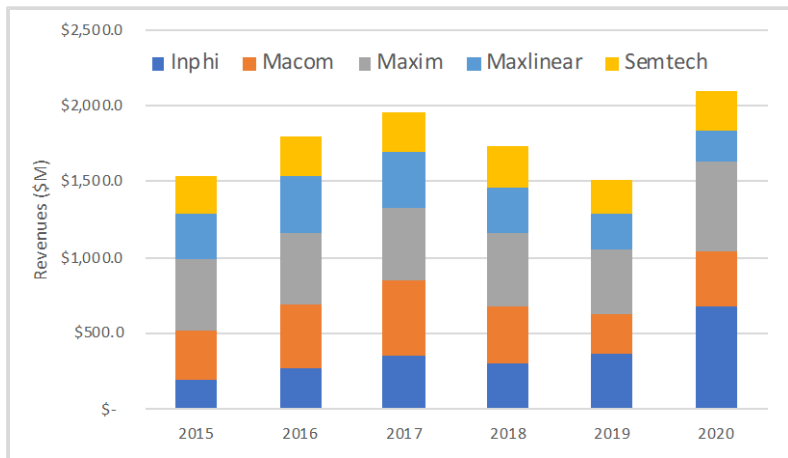
Quarterly Market Updates

FREQUENCY: QUARTERLY ✚ DATE: MARCH, JUNE, SEPTEMBER, DECEMBER

The quarterly market reports summarize the latest quarterly financial results and news of service providers, cloud companies, optical networking equipment vendors, module and component vendors. Each report comes with a database featuring quarterly shipments, pricing and sales for more than 100 categories of optical components and modules based on confidential sales data collected by us from more than 25 leading vendors. The database also includes quarterly historical revenues of the leading ICPs, CSPs, equipment, optical components, and semiconductor vendors, as well as ICP and CSP capital expenditures.

FINANCIALS OF THE FOLLOWING COMPANIES ARE INCLUDED

ICPs: Alibaba, Alphabet, Amazon, Apple, Baidu, eBay, Equinix, JD.com, Meta, Microsoft, NetEase, Oracle, PayPal, Tencent, VIPShop.com

CSPs: AT&T, BT, China Mobile, China Telecom, China Unicom, Comcast, Deutsche Telekom, KDDI, NTT, Orange, Softbank, Telecom Italia, Telefonica, Verizon, Vodafone

Telecom equipment suppliers: Adtran, Calix, Ciena, Ericsson, FiberHome, Fujitsu, Huawei, Infinera, Nokia, Ribbon, ZTE

Datacom equipment suppliers: Arista, Cisco, Dell, Extreme Networks, H3C, HPE, IBM, Inspur, Juniper, Lenovo, NetApp, Oracle

Optical components vendors: Accelink, Applied Optoelectronics, Broadex, Coherent, CIG, Eoptolink, Fabrinet, HGG, Hisense, Innolight, Landmark, Linktel Technologies, Lumentum, OE Solutions, Sumitomo

Semiconductor companies: AMD, Analog Devices, Broadcom, Credo, Intel, MACOM, Marvell, Maxlinear, Microchip, Nvidia, Semtech

2Q23/2Q22 Segment Growth — Telecom, Datacom

	Telecom	Datacom
Capex	-10%	-8%
Equipment	-0.4%	-0.5%
Components	-33%	-15%

Q2 2023 / Q1 2023 — Adva, Ciena, Cisco, Huawei, Infinera, Nokia, ZTE, Fujitsu, Others
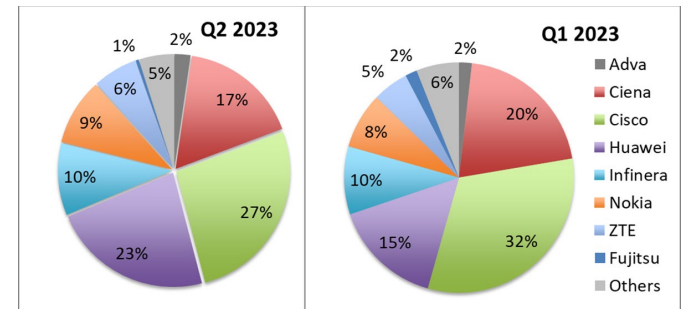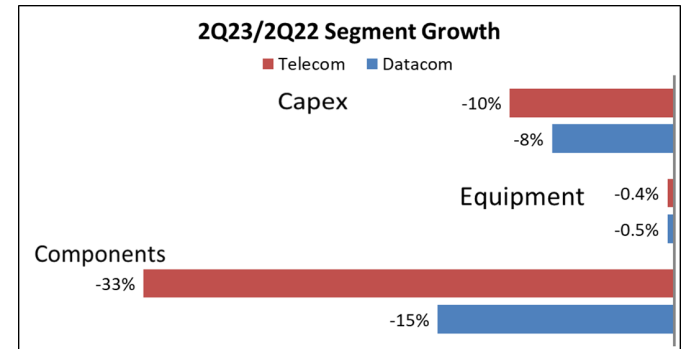
Ethernet Optics

FREQUENCY: SEMI-ANNUAL   DATE: MARCH, SEPTEMBER

This report is focused on the markets and technologies for Ethernet Optical transceivers. It includes the latest shipment data and forecasts for more than 50 types of Ethernet transceivers segmented by speed, reach, and form factor. Confidential sales data from more than 20 leading suppliers provides the basis for this report. LightCounting is uniquely placed to provide an insider perspective on vendors' latest products and technologies.

Despite potential adoption of co-packaged optics, pluggable transceivers will continue to dominate the market over the next decade.

800G Ports by 2026   1.6T Ports by 2026

■ 800G XCVRs ■ 800G CPO   ■ 1.6T XCVRs ■ 1.6T CPO
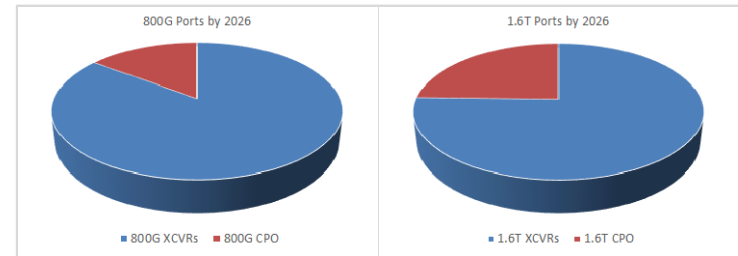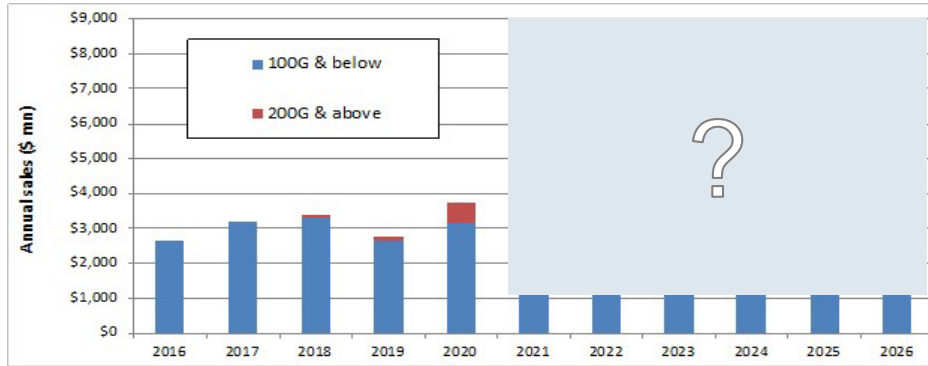
Market Forecast

FREQUENCY: SEMI-ANNUAL 🌓 DATE: APRIL, OCTOBER

This report provides a detailed market demand forecast through 2024-2029 for optical components and modules used in Ethernet, Fibre Channel, CWDM/DWDM, wireless infrastructure, FTTx, and high-performance computing (HPC) applications.

Key inputs include an analysis of the business and infrastructure spending of the top 15 service providers and of the leading Internet companies, and sales data from 2016 through 2023 for more than 30 transceiver vendors, including more than 20 vendors that shared their confidential sales information with LightCounting. The forecast is based on our proprietary forecast model, which correlates transceiver sales with network traffic growth and the projected deployments of 5G and FTTx systems for broadband access.

Global sales of optical transceivers 2016-2026 by segment
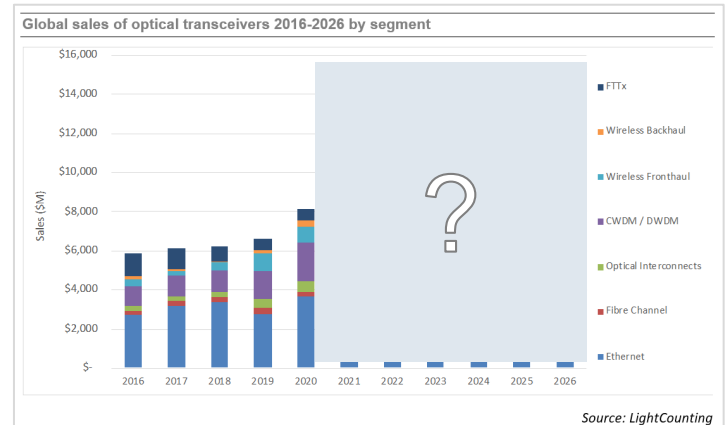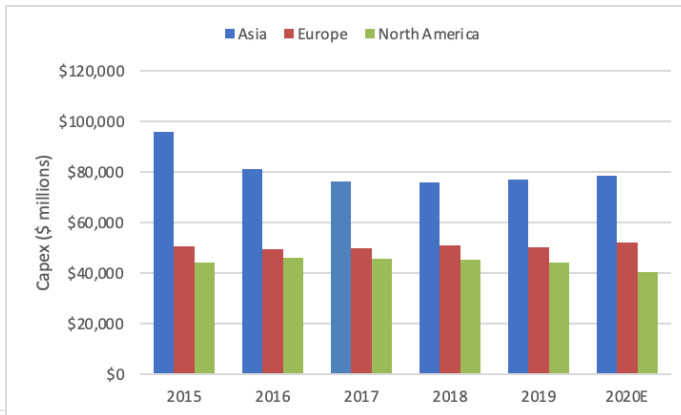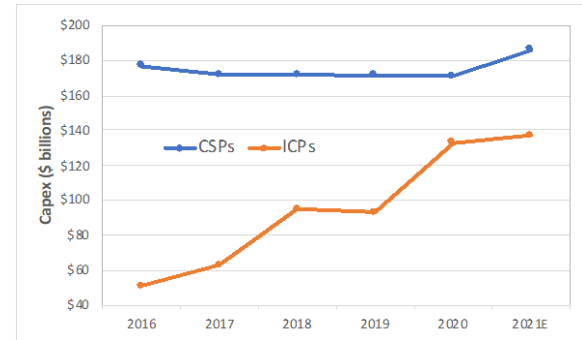
Source: LightCounting

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Ethernet, Infiniband and Optical Switches for Cloud Data Centers

FREQUENCY: SEMI-ANNUAL ◖ DATE: APRIL, OCTOBER

This report offers analysis and a 2024-2029 forecast for the most interesting segment of the switching ASIC market – high bandwidth (3.2T and above), low latency chips deployed in Cloud datacenters. In addition to Ethernet switches, the report now includes InfiniBand and Optical Circuit Switch markets. It excludes products developed for enterprise and telecom networks as well as switch ASICs developed for routers.

Demand for Ethernet switches from Cloud companies created a new market segment for very high bandwidth switches and switch ASICs. It also transformed the industry supply chain as Cloud companies started using internally designed Ethernet switches and opening these "white box" designs to a broader community.

The report offers brief profiles of the leading suppliers of merchant switch ASIC and system integrators, offering products to Cloud companies, and includes a forecast for sales of 25.6T and 51.2T switch ASICs with co-packaged optics (CPO).

Purpose-Built Silicon ➔ Performance Leadership

- 640G — Trident — 64 x 10G
- 1.28T — Trident2 — 32 x 40G
- 3.2T — Tomahawk — 32 x 100G
- 6.4T — Tomahawk2 — 64 x 100G
- 12.8T — Tomahawk3 — 128 x 100G
- 25.6T — Tomahawk4 — 256 x 100G

40X Bandwidth Increase per Switching Element Outpacing Moore's Law

2011 ... 2020
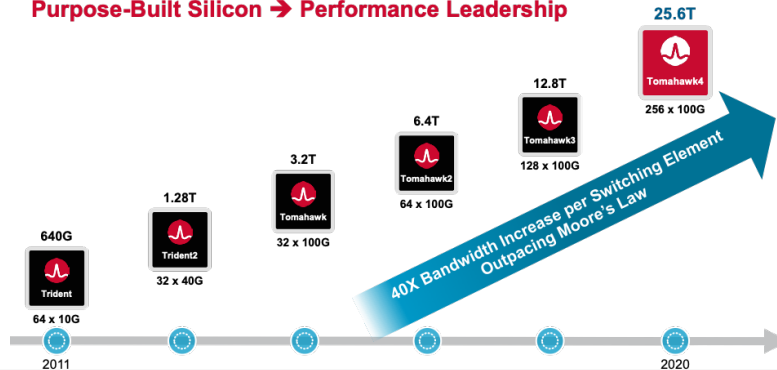
Optical Vendor Landscape

FREQUENCY: ANNUAL ● DATE: MAY

This report provides a holistic analysis of the global communications industry during a period of unprecedented growth in demand for broadband connectivity and the rise of Cloud companies. It examines the business strategies of traditional telecom service providers and Cloud/Web2.0 companies, as well as their suppliers of networking equipment and optical/electronic components.

A detailed analysis of the revenue growth and profitability across different levels of the industry supply chain in 2010-2022 is used to identify challenges and opportunities for the future. The report also includes a review of the latest M&As and their impact.
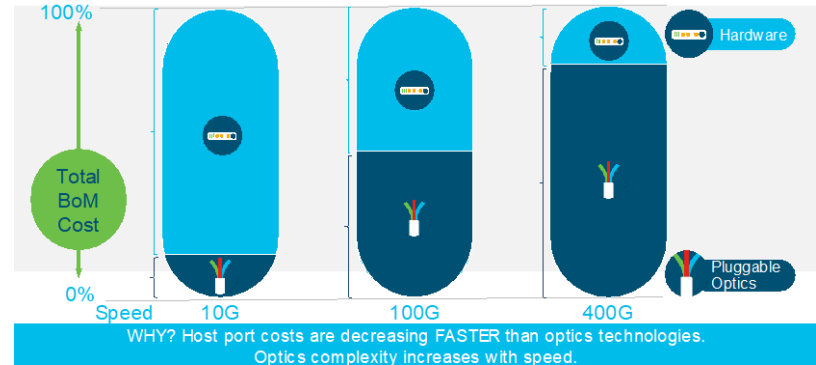
The report takes a deeper look at the suppliers of optical components and modules, providing market shares of the leading vendors in several categories. It includes data for the top 12 leading suppliers of optical transceivers in the Ethernet, Fibre Channel, WDM, FTTx, Wireless, and Optical Interconnect market segments.

Ranking of Top 10 Transceiver Suppliers					
2010	**2016**		**2018**	**2022**	
Finisar	Finisar	1	Finisar	Innolight & Coherent (tie)	
Opnext	Hisense	2	Innolight		
Sumitomo	Accelink	3	Hisense	Cisco (Acacia)	
Avago	Acacia	4	Accelink	Huawei (HiSilicon)	
Source Photonics	FOIT (Avago)	5	FOIT (Avago)	Accelink	
Fujitsu	Oclaro	6	Lumentum/Oclaro	Hisense	
JDSU	Innolight	7	Acacia	Eoptolink	
Emcore	Sumitomo	8	Intel	HGG	
WTD	Lumentum	9	AOi	Intel	
NeoPhotonics	Source Photonics	10	Sumitomo	Source Photonics	

Source: LightCounting

Percentage of Spend on Optics Will Continue to Increase as Speeds Increase

Total BoM Cost

Speed: 10G, 100G, 400G

Hardware / Pluggable Optics

WHY? Host port costs are decreasing FASTER than optics technologies. Optics complexity increases with speed.

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Silicon Photonics, Linear Drive Pluggable and Co-Packaged Optics

FREQUENCY: ANNUAL ● DATE: MAY

Increasing data rates required in mega-data centers and DWDM networks have led to the development of more complex optical devices that combine multiple functions on the same chip. New technologies such as Silicon Photonics (SiP) hold promise for integration of optics and electronics.

This report includes analysis of the market data from 2010-2023 and provides forecasts for shipments of integrated optical devices based on InP, GaAs and SiP technologies in 2024-2029. The report also discusses the adoption of optics co-packaged with switching ASICs, FPGAs, CPUs and GPUs for applications in data centers, AI Clusters and High-Performance Computers (HPCs).

Humboldt 25.6T — Bailly 51.2T

Electronic IC · Light Source · Optical IC
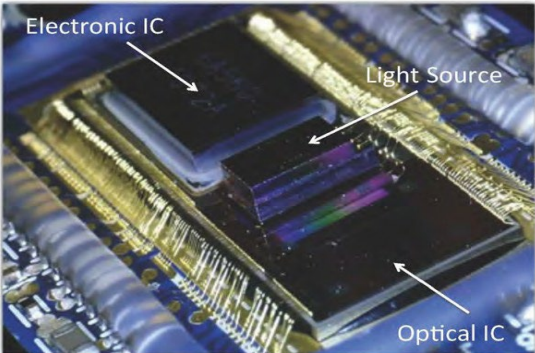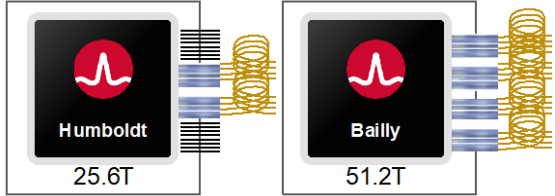
Source: Cisco/Luxtera (with text by LightCounting)

Annual sales ($ millions) — Silicon Photonics, All Other — 2016–2026
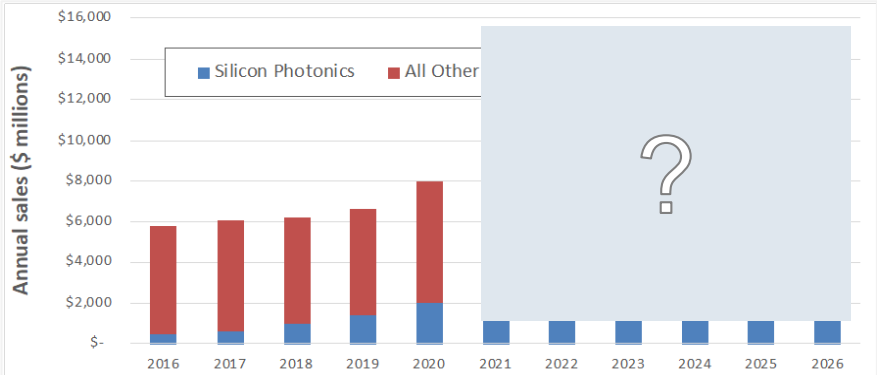
Telecom Network Transformation

FREQUENCY: ANNUAL ● DATE: JUNE

Optical networks run by the communications service providers are changing with the advent of 5G wireless networks, the emergence of mega data centers and global networks run by cloud companies. This report looks at the evolution of optical networking infrastructure in terms of architecture, network automation and the use of open networking hardware and software.
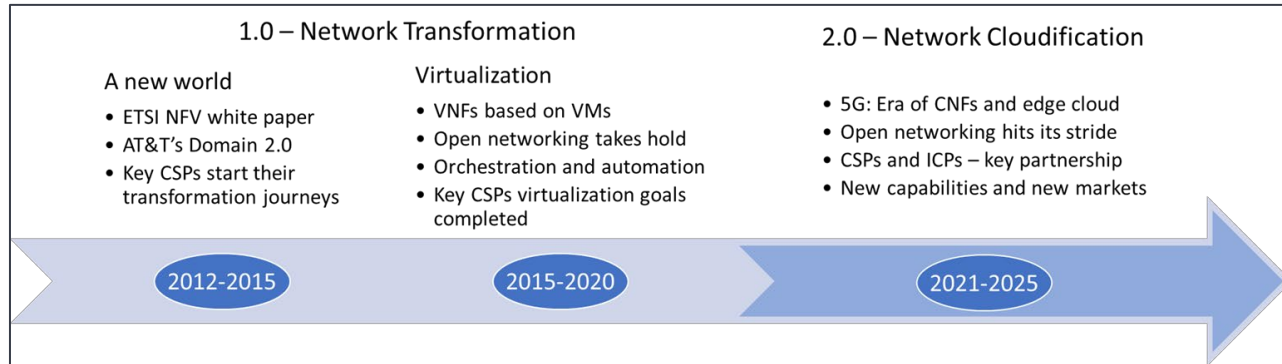
COMPANIES PROFILED

AT&T, BT, China Mobile, China Telecom, China Unicom, Comcast, Deutsche Telekom, KDDI, NTT, Orange, Softbank, Telecom Italia, Telefonica, Verizon, Vodafone

1.0 – Network Transformation		2.0 – Network Cloudification
A new world	**Virtualization**	
• ETSI NFV white paper	• VNFs based on VMs	• 5G: Era of CNFs and edge cloud
• AT&T's Domain 2.0	• Open networking takes hold	• Open networking hits its stride
• Key CSPs start their transformation journeys	• Orchestration and automation	• CSPs and ICPs – key partnership
	• Key CSPs virtualization goals completed	• New capabilities and new markets
2012-2015	2015-2020	2021-2025

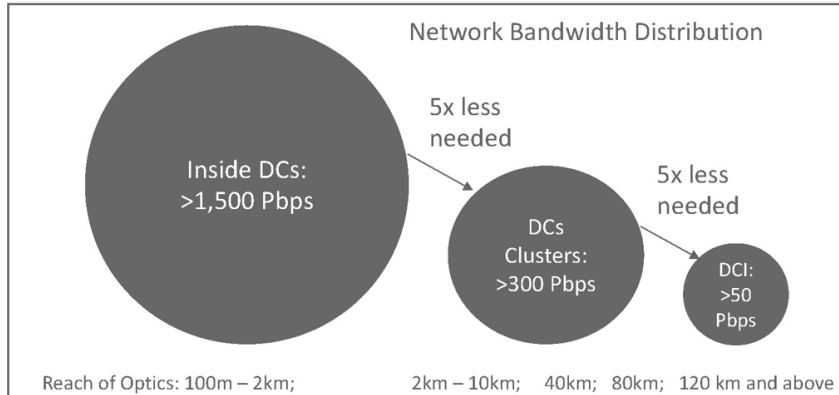# Mega Datacenter Optics

This report analyzes the impact of Mega Datacenters on the market for Ethernet and DWDM optical transceivers. It leverages extensive historical data on shipments of these products, combined with market analyst research, to make projections for the market in 2024-2029.
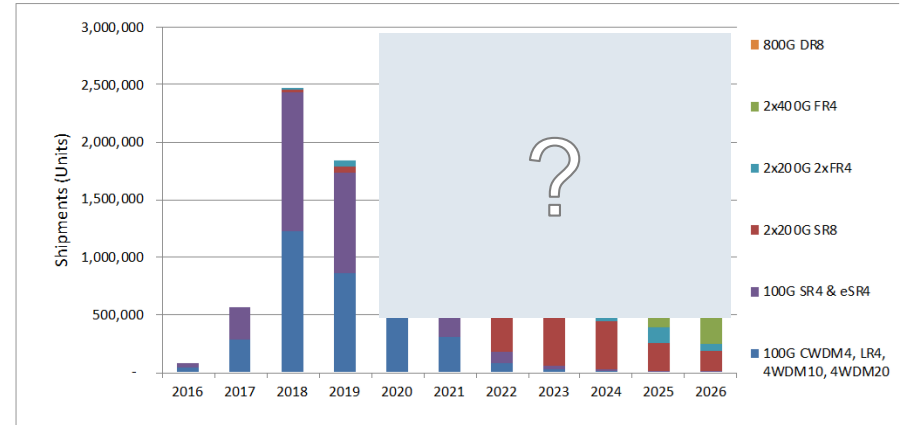
The report offers a comprehensive forecast for more than 60 product categories, starting with 10G and up to 1.6T DWDM and Ethernet transceivers, sorted by reach, form factors. This data is segmented into three main applications: telecom, enterprise and cloud. It includes detailed models for sales of optical transceivers to the top 5 US-based and top 5 Chinese Cloud companies, including: Alphabet (Google), Amazon, Apple, Meta (Facebook) and Microsoft; Alibaba, Baidu, Bytedance, Huawei and Tencent.

Bandwidth distribution in networks of Cloud companies

Network Bandwidth Distribution

Inside DCs: >1,500 Pbps

5x less needed

DCs Clusters: >300 Pbps

5x less needed

DCI: >50 Pbps

Reach of Optics: 100m – 2km;   2km – 10km;   40km;   80km;   120 km and above

Source: LightCounting

Figure 6-3: LightCounting forecast for Google's transceiver purchases

Legend:
- 800G DR8
- 2x400G FR4
- 2x200G 2xFR4
- 2x200G SR8
- 100G SR4 & eSR4
- 100G CWDM4, LR4, 4WDM10, 4WDM20

Source: LightCounting estimates

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Access Optics: FTTx and Wireless

High-speed internet has become an essential part of life for billions of people around the globe, thanks to the widespread deployment of 4G LTE mobile and gigabit Passive Optical Networks (EPON and GPON). Deployment of 5G mobile, and 10G PON networks is well under way, and 6G PON and 25G and 50G PON are in development stages.

This report examines how the latest 5G fronthaul and PON networks are reducing the opportunity for some types and speeds of optical modules, and dramatically increasing it for others. The report comes with a detailed 5-year forecast of transceiver shipments, prices, and revenues, broken down by speeds, reaches, and colors for both PON and fronthaul applications.
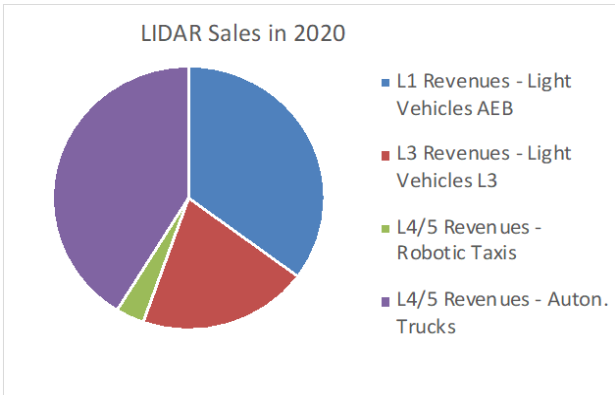

2016

2022

- Mobile traffic (CAGR 48%)
- Fixed traffic (CAGR 24%)

Access Optics Market

units

revenue

- FTTx - PON
- FTTx - Pt-to-Pt
- Fronthaul - grey
- Fronthaul - WDM
- Backhaul & Midhaul

Source: LightCounting
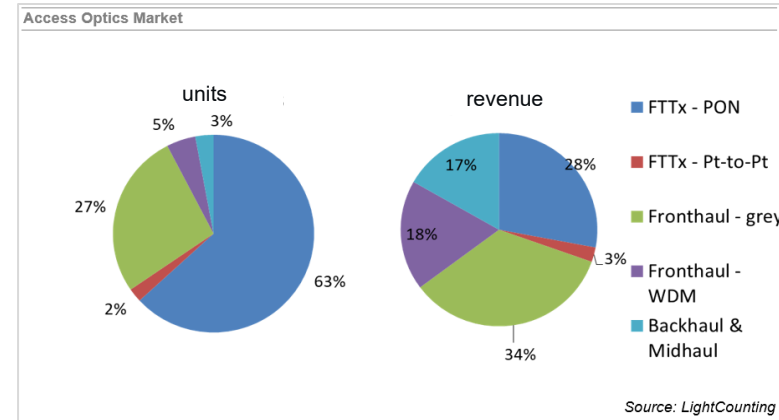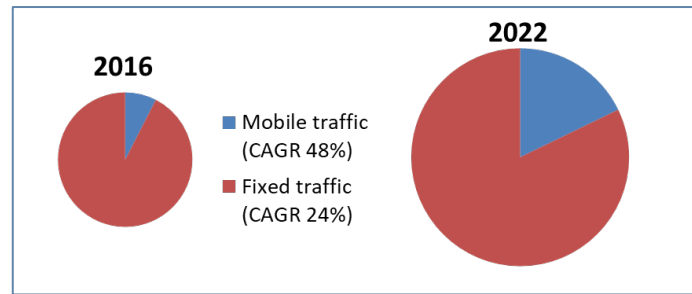
Optical Sensors

FREQUENCY: ANNUAL ● DATE: NOVEMBER

This report analyzes the new business opportunity for suppliers of optical components in the market for automotive LIDARS and 3D depth sensors used in smartphones and other applications. It offers a summary of recent progress in development of autonomous driving solutions enabled by Level 4 and 5 LIDARS as well as ADAS based on Level 2/3 technology. It reviews different LIDAR and 3D sensing technologies and the optics required, with a focus on vertical-cavity surface-emitting laser (VCSEL) arrays.
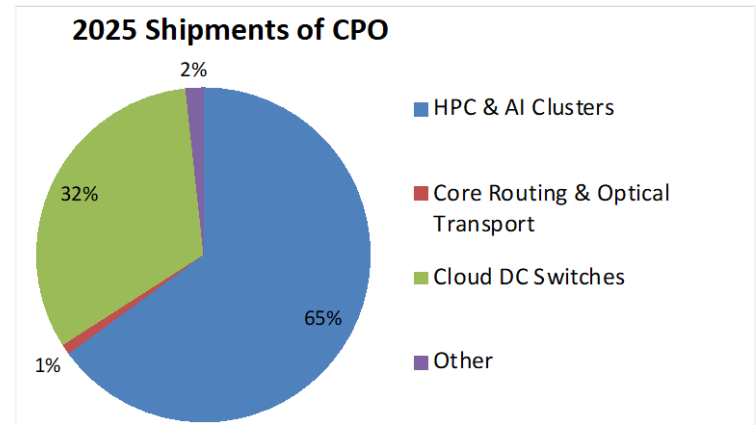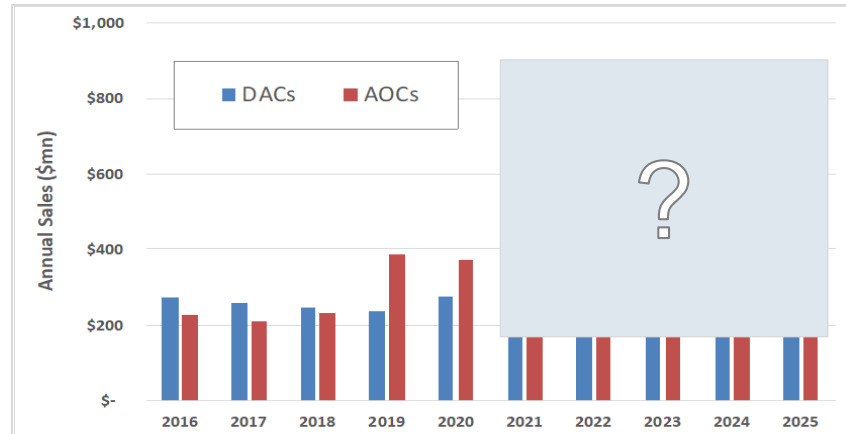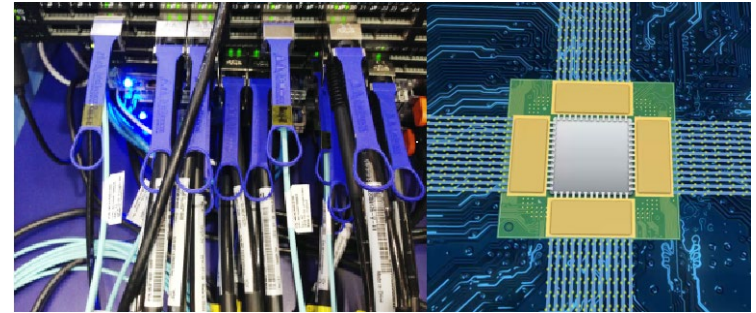
The report includes historical data of shipments of these products for 2018-2023 and forecasts for 2024-2029. It offers an analysis of the leading vendors and discusses future developments in the supply chain.

LIDAR Sales in 2020

- L1 Revenues - Light Vehicles AEB
- L3 Revenues - Light Vehicles L3
- L4/5 Revenues - Robotic Taxis
- L4/5 Revenues - Auton. Trucks

AOCs, DACs, Linear Drive Pluggable and Co-packaged Optics

This report analyzes the adoption of high-speed copper and active optical cables as well as board mounted optics in data centers, AI clusters and high-performance computers. It also examines the business case and technical barriers for optical engines co-packaged with switching ASICs. The report includes a database with historical data of shipments, pricing, and sales of these products for 2018-2023 and forecasts for 2024-2029.

2025 Shipments of CPO

- HPC & AI Clusters — 65%
- Core Routing & Optical Transport — 1%
- Cloud DC Switches — 32%
- Other — 2%

SUBSCRIPTION PACKAGES

LightCounting offers six subscription packages:
Platinum Plus, Platinum, Gold Plus, Gold, Silver, and Bronze

Make headway — subscribe to LightTrends Newsletter

The 2024 publication calendar includes 10 annual reports, 6 semi-annual reports, and 4 quarterly market reports.

The publication of each report is followed by a live webinar at which the major findings are discussed.

In addition to the reports, subscribers also receive bonus material, including previews of the quarterly and semi-annual forecasts, at least 12 research notes throughout the year, and unlimited analyst inquiries (access to analysts for further information and discussion).

Find out all details about the subscription options:

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LIGHTCOUNTING

THE NAME ALONE IS WHAT SETS US APART AND WHAT DEFINES US AS A COMPANY.

20 years ago, LightCounting began with an analyst team focused on research of high-speed interconnects for the datacom, telecom, and consumer communications markets. From that time, our research has evolved to cover the entire supply chain that supports Optical Networks, Data Centers and AI Clusters. We continue to define and refine the market intelligence mix ever since, to offer our clients unique perspective on the industry landscape and the current and future business opportunities.

THAT'S OUR MARKET INTELLIGENCE. THAT'S HOW IT HELPS OUR CLIENTS GROW.