



650 GROUP
MARKET INTELLIGENCE RESEARCH

Routed Optical Networking Leadership Report

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Routed Optical Networking (RON) Definition:

The Routed Optical Networking solution is comprised of a set of existing and new products where ZR/ZR+ optics are integrated into access and core routers to collapse layers and provision IP as well as TDM services over a packet network. The routed optical network has the same level of SLAs and reliability with full transparency for dedicated bandwidth by leveraging circuit emulation and private line emulation. Wavelengths can be provisioned from router to router or from ROADM to ROADM in existing or new networks.

The purpose of Routed Optical Networking is to de-layer and simplify networks to enable automation and network optimization. Rather than providing and managing services across different network layers, Routed Optical Networking enables the customer to provision all existing and future services across a single IP layer. Leveraging Telemetry and Automation will improve efficiency and reduce Time-To-Market for a better customer experience.

Today's Routed Optical Networking market deploys Layer 3 Routers or Switches that use coherent pluggable modules such as CFP2, ZR and ZR+ that leverage modern management tools, telemetry, and automation. As the industry moves from discrete Optical Transport Systems, Routers, and Ethernet Switches to converge the layers, ZR/ZR+ modules, photonics, and new and existing ASICs will enable this journey to provide a better solution. The routed optical network is built on standards to enable third party interoperability at all layers.

In this report, vendors with technological innovation and a market presence in routing and optical technologies such as coherent pluggable optics, optical transmission systems, and massively scalable routers for vertical integration will be leaders in this space.

This study looks at vendors' current and publicly announced products that address Routed Optical Networking.

Methodology: 650 Group used the following information sources for this report: 650 Group's 4Q22 Router Report, 650 Group's 4Q22 Optical Transport Report, 650 Group's 4Q22 L3+ table, companies 10Ks, 10Q, and other public disclosures such as press releases and public presentations, company websites, and product specification. While quantitative and qualitative research was used as input, the final product of this report is based on the analyst's opinion. Analyst opinion is subject to change based on future company disclosures, product launches, and customer adoption. 650 Group is under no obligation to update this report.

Criteria: We looked at the following criteria:

- **Company Vision:** This criterion includes the company's recent announcements, quarterly shipments, activity in standards bodies, and duration of time in each market segment.
- **Ability to Execute:** This criterion includes the company's product launches, product shipment dates, company R&D budget in this segment, and overall financial performance.
- **ASIC strength:** The company's own ASIC announcements and use of L3 Merchant Silicon. We exclude all L2 ASIC-based systems.
- **Metro Router Performance and Cloud Routing:** The company's performance in Telco and Cloud Routing.
- **Long-Haul Capabilities:** The company's performance in Telco and Cloud Optical Transport.
- **Data Center Interconnect (DCI):** The company's performance in Cloud Data Center Interconnect.
- **Automation:** The company's execution in automation of new products compared to previous generation products.
- **ZR/ZR+ Offerings:** The company's current offering in ZR/ZR+ and partnerships in the industry.
- **DSP Offerings:** The company's current offering in ZR/ZR+ and partnerships in the industry.

We expect the transition to Routed Optical Networking will be significantly faster in Cloud hyperscalers than traditional Telco Service Providers, with Cloud becoming the larger market for these products. Therefore our criteria have a higher weighting on Cloud architectures and Routing platforms. Furthermore, for 2023, given the nascent volumes of ZR/ZR+, a company must have both Optical Transport Platforms and L3 Router Platforms to be included as a leader. When ZR/ZR+ products become ubiquitous, we will remove the requirement to have an Optical Transport Platform in the leaders' segment. We have provided a list of offerings focused on the Cloud, Telco SP, and disaggregated sales of ASICs, DSPs, and Optics in tables 1 through 3 in the next section. This specific version of the report has an additional section to link to Cisco's website. No other differences exist except for the URL links.

Companies (listed in alphabetical order)

Arista: The company was one of the first to utilize merchant silicon (Broadcom’s Jericho) to create products to support Layer 3 networks and used the 100 Gbps and new network tiers in the Cloud to gain significant market traction. For purposes of Routed Optical Networking, we consider Jericho-based products to be in the same category as routing. The company currently has no stand-alone Router or Optical transport products. Instead, Arista uses various partnerships to provide module support via a mix of product validation and support for the direct purchase of optics from a vendor to the customer. Direct-purchase remains the most popular with most larger customers.

Arista’s portfolio limits them to address any service other than Ethernet and IP. While Arista continues to add features and functionality to handle Routing use cases, the company still lacks important Routing features like Segment Routing. Arista’s strength is more straightforward routing roles. Therefore Arista can support most Cloud uses cases, but not the majority of today’s Telco SP use cases. Vertically integrated companies will also have an interoperability advantage and the testing to support coherent pluggable modules is extensive.

Table 2: Vendor Product Offerings

(Service Provider Focus)

Vendor	L3+ Merchant ASIC Systems	L3+ Custom ASIC Systems	1 st Party Pluggable Coherent Optics	Optical Transport Systems
Arista	X			
Ciena	P		P	X
Cisco**	X	X	X	X
Huawei	P	X		X
Infinera			P	X
Juniper	X	X		
Nokia	X	X	P	X

*X - >\$100 M in Vendor revenue in 2022;
>\$50 M in vendor revenue in 2H22*
P – Product offering shipping for revenue in 2022
*** Cisco includes Acacia revenues in historical number*
Revenue figures are for the worldwide market, excluding China.

Table 1: Vendor Product Offerings

(Cloud Focus)

Vendor	L3+ Merchant ASIC Systems	L3+ Custom ASIC Systems	1 st Party Pluggable Coherent Optics	Optical Transport Systems
Arista	X			
Ciena			P	X
Cisco**	X	X	X	X
Huawei		P		P
Infinera			P	X
Juniper	P	X		
Nokia	P	X	P	X

*X - >\$100 M in Vendor revenue in 2022;
>\$50 M in vendor revenue in 2H22*
P – Product offering shipping for revenue in 2H22
*** Cisco includes Acacia revenues in historical number*
Revenue figures are for the worldwide market, excluding China.

While Arista continues to expand these capabilities, some integration expertise is limited to hyperscalers.

Ciena: The company continues to expand its portfolio via acquisitions, such as the acquisition of the router company Vyatta from AT&T. Ciena generated product interest with new and smaller form factor optical transport devices that became popular in the Cloud space. While the company has a robust Optical presence, they have not demonstrated the ability to deliver on pluggable coherent interfaces at scale. The company is making ZR available for use in its optical transport products and through its microelectronics segment. In addition, it is making these same modules available for third parties to use in their routers, but to date, volumes remain limited and focused on Ciena’s systems. The company’s long-term history and DSP experience focus more on line card-based deployment, where power consumption is less critical.

The company recently began to focus more on its

Companies (listed in alphabetical order)

Router portfolio, but the company preference remains to steer customers to OTN, which will not allow them to remove network layers. At the same time, the company does not have purpose-built cloud-oriented routers and is therefore limited in the number of L3 use cases it can support.

Cisco: The company has invested significantly in this space organically (NCS families, 8000 Series), through direct acquisitions (Leaba, Acacia), and indirect acquisitions (Luxtera, many automation acquisitions). The company has taken a stance of going to market at the component, system, and software level. For example, Cisco will sell Acacia optics to competitors, sell silicon directly to customers, and the myriad of options in-between. Revenue in each go to market grew Y/Y in calendar 2022. Those different engagement options are currently the widest in the industry.

Cisco’s current portfolio addresses both traditional Optical Transport and Routing use cases and Routed Optical Networking deployments via next-generation platforms and software. In some platforms, Cisco leverages 20+ years of Internet backbone experience in protocols and interoperability, and in other platforms, purpose-built the product for hyperscaler requirements.

Huawei: We included Huawei in this study based on existing shipments and product offerings, which have historically shown leadership in the industry.

We recognize that ongoing trade war and semiconductor shortages could impact Huawei’s future product plans and R&D in this space and the company’s ability to conduct business outside of China. Concurrently, architectures in the Cloud and Service Provider segment continue to diverge between China and the rest of the world. The companies history and focus remain on Optical Networking with limited investment in coherent pluggable modules and DSP technology without compromising density or sacrificing routing and switching capacity.

We see requirements in China and the rest of the world continuing to diverge instead of becoming similar. Therefore Huawei is not as well-positioned to address western hyperscaler and new western Telco SP requirements as it was able to do in previous generations of solutions.

Infinera: The company remains a strong player in the Optical transport segment for Cloud and Telco Service Providers but has limited exposure to the growing Routed Optical Networking portions of the market and lacks a complete portfolio. The company got stronger when it acquired Coriant a couple of years ago and has recently delivered on its 800 Gbps technology upgrade cycle. However, the company lacks a Routing portfolio and used third-party solutions during the 400/600 Gbps upgrade cycle.

Juniper: Juniper is one of the leaders in Cloud and Service Provider Routing markets. However, Juniper’s Optical exposure remains limited to its BTI acquisition, and its own pluggable module initiatives remain nascent. In addition, the company has no vertical integration or experience with any services other than Ethernet or IP, which limits the use cases they can address in Optical transport. The company’s exposure to Cloud exposes it to the long-term growth in the Routed Optical Networking market. Still, it requires partnerships in the near term to address customer needs in areas outside their core Ethernet expertise. Contrail and Apstra help bridge the multi-vendor solutions but is at a disadvantage for customers that want a single-

Table 3: Disaggregated 3rd Party use of Components

Vendor	ASICS	DSP	Pluggable Coherent Optics
Arista			
Ciena			P
Cisco**	X	X	X
Huawei			
Infinera			P
Juniper			
Nokia			P

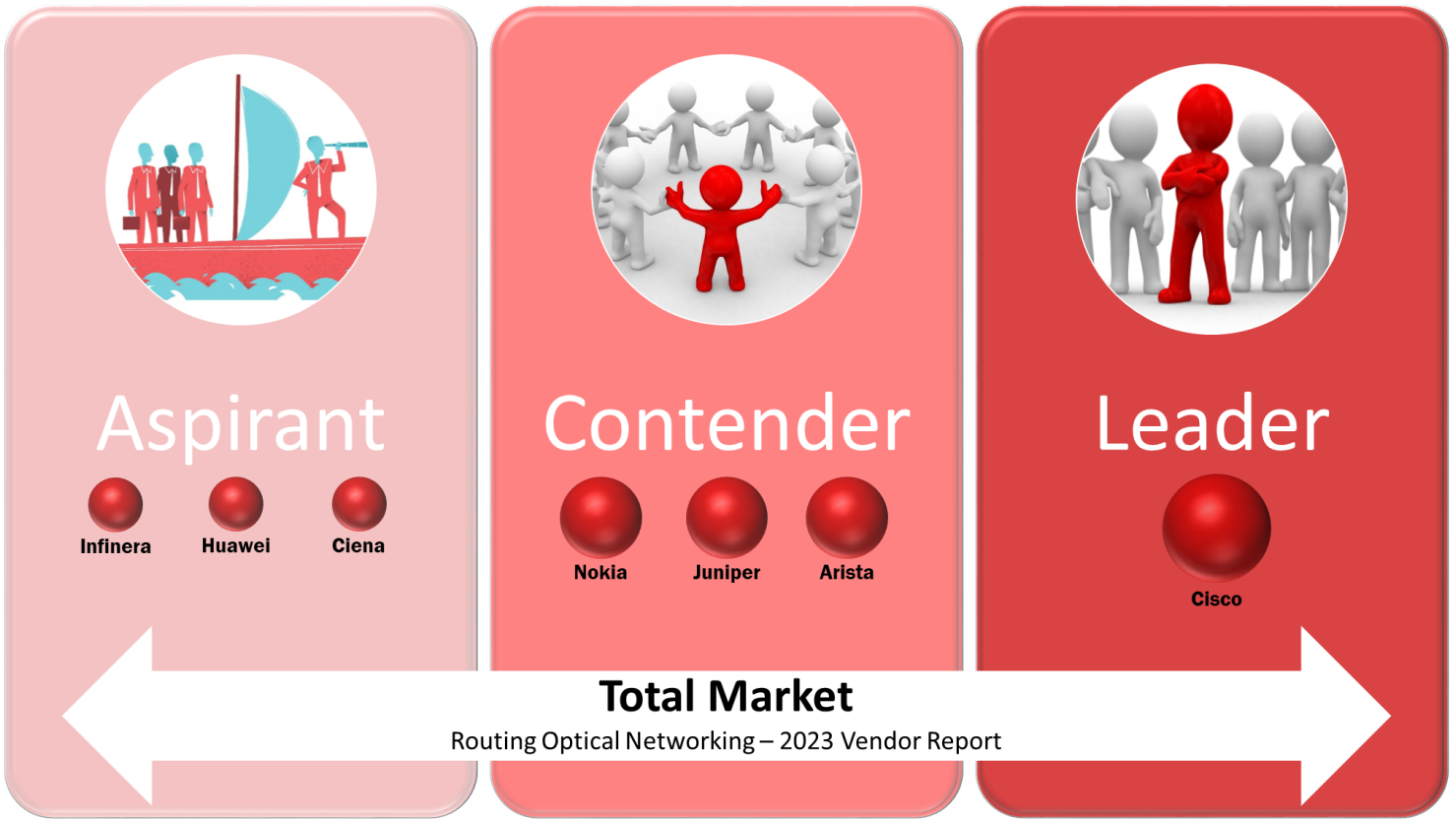
X - >\$25 M in vendor revenue in 2H22
P – Product offering shipping for revenue in 2H22
** Cisco includes Acacia revenues in historical number
Revenue figures are for the worldwide market, excluding China.

Companies (listed in alphabetical order)

vendor solution.

Nokia: The company's portfolio and acquisitions continue to support traditional Optical Transport, Routing, and Routed Optical Networking and the transformation occurring across Cloud and Telco Service Providers. The company purchased Elenion to support its photonics efforts, produced a new cloud-scale Routing Silicon (FP4 and FP5), and began offering its DSP technology to customers directly and through ZR modules. Concurrently, the company also began supporting merchant silicon to broaden its product portfolio.

The company maintains a substantial share and is engaged with customers in making the transition to next-generation architectures. However, Nokia's DSP technologies remain focused on line systems with limited pluggable exposure. While Telco Service provider engagement remains robust for previous and new technologies, the company has only made modest gains in Cloud beyond optical transport space.





Learn More

This section was included into the Cisco version of the whitepaper to help direct readers to more information about the companies offerings. Please visit the following urls to learn more about the companies current offerings mentioned in this report:

www.cisco.com/go/ron



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