Optical Networking Opportunities in the 5G Infrastructure Market: 2019-2028

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P.O. Box 432
Crozet, VA 22932
www.cir-inc.com
sales@cir-inc.com

CIR
ENLIGHTENED ANALYSIS

CIR Market Report

P.O. Box 432
Crozet, VA 22932
Tel: 434-872-9008 Fax: 434-872-9014

CIR Market Report

Since CIR published its first report on optical networking in the 5G infrastructure in 2017, a lot has happened in the 5G world. In particular, expectations for subscriber numbers have grown, leading CIR's more bullish expectation for PON, WDM, Carrier Ethernet, space division multiplexing and optical cable in 5G-focused backhaul and fronthaul nets.

The report includes profiles of 17 mobile operators with advanced 5G strategies, showing how these carriers are planning to deploy optical networks and who their suppliers of hardware and cable will be. It also includes analyses of the leading optical equipment and optical cable suppliers for the 5G infrastructure. There are also detailed 10-year forecasts in volume (ports) and value ($ Millions) terms of both optical equipment and cable with breakouts by type of technology, fronthaul vs. backhaul deployment, and geography.

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Chapter One: Introduction

1.1 Background of this Report

5G is the next generation of mobile technology, which will begin to appear in the later part of 2018 and early part of 2019. Supposedly, the 5G "revolution" will bring true mobile broadband to the world and may do to wireline broadband technologies such as DSL, what mobile phones have done to wireline voice—in other words kill them dead! Such dramatic prognostications are countered by the fact no one really knows whether consumers will want 5G or will simply be happy with 4G LTE and the fact that it is unclear whether many of the carriers really have the funds to make 5G fully happen.

That said, it is hard to avoid capacity issues. According to Cisco, by 2020 connected mobile devices will produce 30.6 exabytes per month and annual global mobile data traffic will reach 366.8 exabytes. To meet the requirement for collection, transport, storage, and analyze of all these data, mobile operators must move forward in some way.

1.1.1 How will the 5G Infrastructure be Built?

A primary concern here is how the new mobile infrastructure will be built. For most purposes, this is discussed in terms of "backhaul" and "fronthaul." The backhaul consists of the links from the mobile network back to wired network. It has been a part of every mobile network since the beginning of cellular communications and has used fiber for as long. The deployment of 5G will mean an opportunity for backhaul suppliers, but not as big as some hope, because the service providers will re-use much of the backhaul network from previous generations of mobile service.

Fronthaul uncertainties: The fronthaul represents more of an opportunity for equipment and optical cable suppliers in that the 5G conception of the fronthaul is something new under the sun. Fronthaul consists in the connections between a new network architecture of centralized baseband controllers and remote standalone radio heads at cell sites. In addition, to make matters "worse" the fronthaul concept is a network concept in the making and the network needs to be flexible enough to inexpensively adapt to new data rates and protocols. The accelerating deployment of CRAN adds yet another set of network design questions that did not exist in infrastructure networks that prior to 5G.

We think that PONs will account for much of the fronthaul infrastructure, but that WDM will play an important role, too. This in itself is not a very controversial statement. However, it hides a lot of uncertainties. What type of PON will be used—10G PON, XGS PON, NGPON? There are WDM connection options to be determined as well.

1.1.1 The Need for 5G Infrastructure

Some of the investment money required for 5G will go towards messaging the new service and developing the phones. But a lot of it will have to go to building the new infrastructure

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we have just described. In some cases, this infrastructure will simply use the equipment that was in place from the 4G LTE era, perhaps shifting this to new geographies. But more infrastructure will be needed for two primary reasons:

- **The performance of 5G is so high that it will outpace the mobile infrastructure that is in the ground now.** For example, 5G will require 1 – 10 Gbps connection to end points in the field and latency of 1 millisecond or less. The existing mobile infrastructure isn't often up to this in most countries and what is there now will need refurbishing or replacement. These service performance levels become even harder to achieve when one considers that 5G is also supposed to achieve a 90 percent reduction in energy usage.

- **Current mobile infrastructure has an architecture that has never been designed to cope with 5G as envisioned.** While the structural requirements for mobile backhaul are not that different from 4G LTE, the fronthaul requirements are shaped by an extreme microcell philosophy. As a result the opportunities in the fronthaul space will be more interesting than the backhaul space. Previously, fronthaul was not a part of the mobile infrastructure that people talked about much.

1.1.2 Rebuilding the Mobile Infrastructure for 5G: Who is it Good For?

Rebuilding the mobile infrastructure of 5G is big business. According to Deutsche Telekom, 5G will generate $363 -$606 (€300-500) billion in growth for network equipment manufacturers in Europe alone. A comparable investment can be expected in North America and Asia.

CIR believes that with much of the traditional public network already "fiberized," creating optical backhaul and fronthaul networks for 5G may represent the largest opportunity for optical equipment and cable manufacturers at the present time, with very little chance that some other type of optical networking will produce more revenues. The only candidate for a comparable revenue stream from optical networking would be optical gear in large data centers.

The key optical networking beneficiaries from the "boomlet" that we expect from the surge in investment in 5G infrastructure are of several kinds and none of them should be a surprise. First among many are the giant multinationals that have a long established tie to the mobile industry – both infrastructure and subscriber equipment. The principal firms here are Ericsson, Nokia and ZTE. A year ago we would have included Huawei in this list, but it's current political problems are sure to have an impact on its ability to win contracts. CIR originally thought that Huawei would be impacted in this regard only in the U.S., but its problems seem to be spreading. Once Huawei is excluded from a major cellular operators' list of approved suppliers, it is unlikely to win the business back again in the short term.

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Ericsson, Nokia and ZTE (there are some smaller firms with similar business models) will generate revenues from both the sale of conventional telecom equipment and in their role as general contractor, putting together a team that can supply the carrier with a complete infrastructure package. In terms of this team, arguably the most important constituent is made of PON suppliers, since this is arguably the core technology for 5G infrastructure, especially in the fronthaul. We note that also adding to the competitive strength of the main players are all the usual advantages of being a first mover—Ericsson, Huawei, Nokia, and ZTE are all already shipping pre-standard 5G technologies for evaluation, testing and field trials.

Apart from PONs, other parts of the 5G infrastructure network that will see growth are the WDM backbone networks, which in the new 5G environment may include some of the front haul as well as (more obviously) the backhaul. The main contractors for 5G deployments in this space are well equipped to supply their own WDM gear into the 5G infrastructure space. But other firms such as Infinera and Ciena are also chasing after the WDM business in 5G infrastructure.

Finally, 5G will mean more money for the IT industry and related equipment suppliers. There are several reason for this. One is that the 5G network is a digital data/video network to a greater extent than any previous generation of mobile phone, so the overlap between the 5G infrastructure and the data center network is probably inevitable.
Firms like Cisco and Juniper can therefore expect sales of their high-end routers and IT experts can expect to be hired to optimize traffic in the 5G infrastructure—the choice of architecture will govern the type and scope of new equipment required. Irrespective of the approach, new protocol, and traffic loading testing approaches will be needed. We also note that the involvement of IT equipment firms ensures that Carrier Ethernet will play an important role.

1.2 Objectives and Scope of this Report

The objectives of this report are to identify the business opportunities in the optical networking market in fronthaul and backhaul for 5G. The goal is also to quantify these opportunities in both volume and value terms in ten-year forecasts.

The scope of this report covers both fronthaul and backhaul equipment and the optical cable itself. In both the forecasts and the analysis, the market is broken down further by various protocols, notably WDM, PON, Carrier Ethernet, and SDM. These port types are then broken out by data rate and, in the case of PON, the type of technology that is being used. There is also a geographical breakout. In addition, we also examine the prospects for alternatives to fiber optics in 5G infrastructure. These comprise millimeter and microwave radio and free-space optics.

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At the core of this report are ten-year forecasts of all the technologies listed above and these are presented in both volume and value terms. We have also analyzed the product/market strategies of leading actors in this space. We also examine appropriate strategies for optical networking and other firms to better penetrate the 5G fronthaul and backhaul market.

1.3 Methodology of Report

The methodology used to compile this report is similar to that used in other reports published by CIR. Both secondary and primary sources were used to compile this report.

The primary research consisted largely of interviews conducted across the value chain, including leading service providers, equipment manufactures as well as fiber suppliers. The interviews were conducted at the level of director, marketing manager, business development executives and others of appropriate seniority. The goals of these interviews were to obtain and verify critical qualitative and quantitative information as well as to evaluate the future prospects.

With regards to the secondary sources, we have performed extensive literature searches for this report covering both technical articles and relevant business articles. This research covered the use of extensive secondary sources, directories, and databases, such as company annual reports, business articles, press releases, and investor presentations of companies.

1.4 Forecast Methodology

The forecasting methodology is explained in more detail in the chapters that include the forecasts themselves. Here we note that the framework for the methodology is similar to that used in other CIR reports. An addressable market is calculated and then we forecast based on the penetration of that market.

In this report, we start with a projection of the number of subscribers to 5G and after that relate the number of port points required back to that number, which produces a forecast of the network equipment used. This forecast can then be extended to a forecast for optical cable, by making assumptions about the length of fiber links, and also the cost of the fiber itself.

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1.5 Plan of this Report

The Executive Summary of this report summarizes the opportunities that are identified in the other chapters. In Chapter Two, we include the plan for 5G, usage of fiber in 5G backhaul and fronthaul, and their fiber and equipment suppliers of a major carrier in the backhaul and fronthaul.

In Chapter Three, we focus on market opportunities of various protocols, such as WDM, PON, SDM, and Carrier Ethernet. In this chapter, we also discuss the major optical network equipment manufacturers and their partners in this space. In Chapter Four, opportunities for the supply of 5G-related cable and components is discussed, including manufacturers of optical cable.

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