Prysmian Group

PANDUIT®

Support Bandwidth-Heavy and Low Latency Dependent Technologies with CORD Deployments

WHITE PAPER

Introduction

As more bandwidth-heavy and low latency dependent technologies become commonplace, CORD deployments need to be equipped to provide the necessary space and services required to handle these technologies in an efficient and effective manner. CORD is an acronym for Central Offices Re-architected as Data Centers. CORD was introduced by the Open Network Foundation (ONF) in 2017 with a mission of providing Telco Operators a foundation of understanding and supporting emerging technologies in the Central Office network. In addition, it sought to bring data center economies of scale and cloud agility to the Central Office. The network architecture being supported by CORD is a spine-leaf design utilizing enterprise data center compute and network equipment, both of which are foreign to most traditional Telco Operators.

Panduit and Prysmian Group have collaborated to discuss CORD and how to effectively deploy physical infrastructure. Both companies bring expertise in the enterprise, data center, and Telco marketplace to contribute to the development of the CORD initiative.

This paper will review the development of CORD through ONF and the drivers that allow new technologies such as 5G, Internet of Things (IoT), Artificial Intelligence (AI), Virtual Reality (VR) and Augmented Reality (AR), etc. to move forward. This is the first paper of a three-paper series on CORD. Later papers will discuss the physical infrastructure products that are required to have a successful CORD solution, as well as how to efficiently install and utilize these products.

What is CORD?

In the last decade, global telecom revenue (average revenue per user), has been stagnating or flattening. In that time period, traffic demands have increased exponentially to support millions of devices that are being connected, such as high definition video streaming and future applications including VR and AR. These demands have experienced a major spike during the recent pandemic period (COVID-19) when most office workers are required to do work activities remotely. This “pandemic bandwidth” has stressed Telco and ISP networks to the limit of their capacity. This trend and global events further widen the revenue and traffic gap (Figure 1).

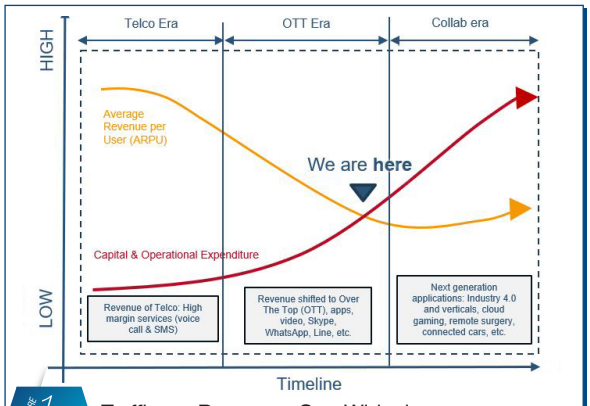

FIGURE 1 Traffic vs. Revenues Gap Widening

Telco companies have been under increasing pressure to create efficiencies in both their capital expenditure (CapEx) and operational expenditure (OpEx). The central office is one of the key elements of a Telco network and consumes a big portion of expenditures. Technological convergence is pushing “open” data center technologies and architectures. These technologies and architectures have been deployed for many years in data centers. They provide major CapEx and OpEx efficiency, as well as improve business velocity and automation. The Telco industry will benefit greatly from both.

A pioneering initiative of disaggregating and virtualizing Telco networks, centered at their central offices, is being led by an organization called Open Network Foundation (ONF). The main goal of this initiative is to bring cloud economies to the Telco central offices, focusing on simplicity and system interoperability. CORD projects deployed in the last few years have relied heavily on data center spine-leaf network architecture. This architecture is drastically different than how legacy Telco networks have traditionally been structured. At the very foundation of legacy Telco networks, 23" wide Telco racks, DC powered Telco equipment, and singlemode fiber connections have been the norm. With the shift to CORD, more traditional data center equipment will be utilized, opening a whole different section of infrastructure products. Some of these products are multimode fiber, AC power, UPS equipment, and Out-of-Band (OoB) management over category copper cabling.

Why Implement CORD?

CORD is essential to providing high bandwidth and low latency (Fronthaul and Backhaul) networks in traditional Telco Operator space. These networks are vital to the success of many new and emerging technologies.

Below is a list of drivers/technologies that could benefit from using these CORD networks:

Revenue Opportunities

CORD can present additional revenue opportunities for Telco providers. The evolution of network equipment with a smaller footprint has reduced the white space consumption by a significant amount (Figure 2). Telco providers are now presented with revenue opportunities through repurposing of this space. Some examples for additional revenue include edge colocation, 5G deployment colocation space, and many ancillary services that would be required (i.e.: remote hands, cross-connects, etc.).

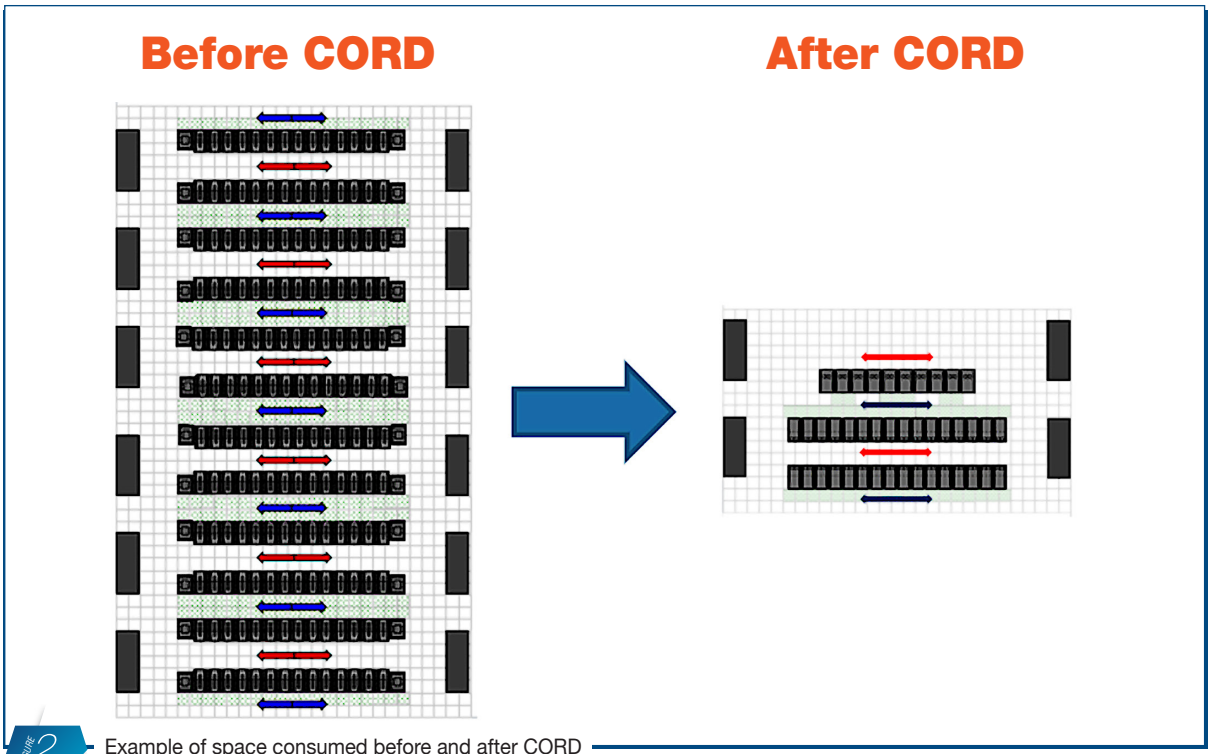

FIGURE 2 Example of space consumed before and after CORD

Speed of Delivery

These networks utilize 25/40/100 Gbps to support the new technologies and information-heavy exchanges to and from the end user. Below are some of the reasons CORD deployments in Telco CO's are well positioned for speed of delivery:

- Brick and mortar data center-like space already built and available
- Modularization for fast deployment
- Networks can easily support a mixed use of applications

A Telco managed edge will be an exchange point for information as current networks are not fast enough to make it to/from the data center to support AI and Industrial IoT applications.

Low Latency

Latency is the delay between a user's action and a web application's response to that action. The question is, how do we minimize it? This is achieved by locating key compute resources closer to end users. This reduces latency by presenting the shortest round trip "time of flight" through the network.

Examples where Low Latency is Important:

Online Gaming/Interactive Experience — Placing CORD facilities in municipalities where clusters of players are located enhances game experience by reducing player lag disadvantage for regional users.

Cost Savings and Revenue Generation — If the handful of most popular shows/movies streaming from a hyperscale facility can be cached in CO-based pods/containers located in remote key markets, all users will stream content more efficiently because streaming sources are disaggregated and closer to all users. This results in far less data back to the cloud which saves and/or generates substantial revenue for transactional businesses.

Latency in 5G Experience — The target latency for 5G digital business transformation is in the realm of 10-20ms (Figure 3). This can be achieved by carriers for their municipal customers by deploying CORD, hence mitigating buffering delays which occur in a large percentage of end devices.

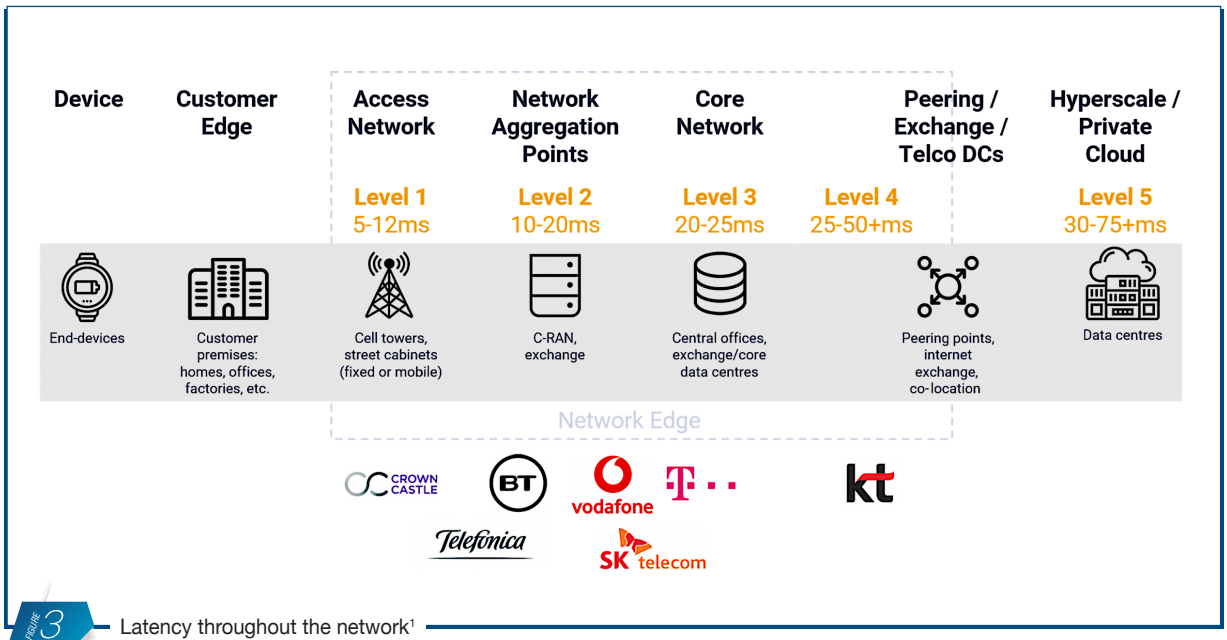

FIGURE 3 Latency throughout the network[1]

The challenge for carriers providing CORD will be to guarantee highly available low latency services, particularly for enterprise customers who will need to depend on the network for mission critical applications. Minimizing latency by hosting applications closer to customers, CORD will enable reliable low latency networks from distributed data sources, across varied infrastructure and devices for FTTx, 5G, and carrier-grade Ethernet network services.

[1]Disruptive Analysis, Dave Burstein, STL Partners

Ease of Future Scalability

Enterprise networks have a few things going for them that makes them easier to install/deploy, manage, and upgrade. Adopting these attributes will improve the ease of future scalability for Telco providers transitioning to CORD.

- Equipment is more readily available and from a wider selection of manufacturers
- Equipment is mostly AC powered with standardized plugs
- Network connections use LAN style cabling that is easily sourced and allows using pre-manufactured cables
- Enterprise network racks and cabinets allow 19" wide equipment rather than 23" wide, making for more efficient use of data center/CO space

CORD Ecosystem

Open Networking Foundation (ONF)

The Open Networking Foundation (ONF) is a user-driven nonprofit organization focused on promoting the adoption of software defined networking (SDN) through open standards development. ONF has defined a reference design, encapsulating a group of operators interested in an assembly of components to build a platform.

Despite major development on the reference design of the projects, especially on the software side, Telco operators worldwide report they don't have a grasp of the physical infrastructure requirements for CORD projects. Upgrading legacy CO infrastructure to data center-like infrastructure is not straightforward and comes with unique challenges.

Major questions from Telco operators regarding physical infrastructure:

- What kind of future-proof infrastructure is required?
- Are there any integrated platforms based on CORD reference architecture that can be easily and readily deployed?
- How do we reuse or monetize the saved space of central office?

Currently, the ONF community consists of vendors that are focused on layer 2/3 infrastructure manufacturers (as in the OSI model) that are specifying the white box switches and routers, and system integrators that customize the reference design based on the customer's needs. System integrators and local installation teams, share that there is missing information on the physical infrastructure (layer 0), including on what kind of cabling system should be used, as well as cabinet/rack solutions, AC-powered equipment, etc.

Carriers/Operators

Carriers/Operators are the major decision makers/drivers behind the CORD initiative. Companies like AT&T, Comcast, T-Mobile, Verizon, NTT, Telefonica, and others are members of the ONF and are actively transitioning to CORD. Below are some of the physical infrastructure challenges that these carriers/operators are having to consider when moving to CORD:

- Differences in the infrastructure racks/cabinets and network cabling
- AC power and HVAC requirements
- Environmental and operational issues such as: building access, selling space and services, allowing customers to do their own installs

System Integrators (SI)

Carrier CORD deployments can be accelerated by System Integrators and custom professional services, which are provided by companies like WWT (World Wide Technology) and Radisys. Typical services offered by these entities are as follows:

- 'Reference' Pod designs
- System-level experimentation, testing and design verification
- Switch, server/storage integration, and validation
- Custom software design/certification, development, and integration/support including system automation and monitoring
- Assessment of support network, remediation design and development
- Installation, on-site testing/certification, and decommissioning

CORD based Infrastructure and Projects

CORD brings data center economics and cloud agility to the Telco central office by combining Network Function Virtualization (NFV) and Software Defined Networking (SDN). The open model for CORD uses commodity servers, white box switches, and open source software to deliver an extensible platform that supports a variety of application domains (e.g., enterprise, residential, and mobile), based on a common infrastructure. The following projects build the network infrastructure and services with CORD principles, allowing capex and open saving for service provider, while at the same time offering more services and future proofing their network deployments.

Trellis — A leading open-source multi-purpose leaf-spine fabric supporting distributed access networks, NFV and edge cloud applications. Trellis™ acts as the foundation of the CO deployment and is built using bare-metal switches with merchant-silicon ASICs, Trellis is currently deployed in production networks by a Tier-1 US network operator. Trellis provides classic-SDN Control with ONOS to achieve L2 forwarding (Bridging) within server-racks and L3 forwarding (Routing) across racks, MPLS Segment routing for better scale and reduced programming and control plane functionality with Trellis vRouter for external connectivity. High Availability and N-way redundancy is also provided.

SEBA — SEBA™ is a lightweight platform for broadband access that supports a multitude of virtualized access technologies at the edge of the carrier network, including PON, G.Fast, and eventually DOCSIS and more. SEBA supports both residential access and wireless backhaul and is optimized such that traffic can run 'fastpath' straight through to the backbone without requiring VNF processing on a server. SEBA is comprised of VOLTHA, ONOS with Trellis and NEM (Network edge Mediator). VOLTHA, Virtual OLT Hardware Abstraction, currently provides a common, vendor agnostic, PON control and management system, for a set of white-box and vendor-specific PON hardware devices. On its northbound interface, VOLTHA abstracts the PON network to appear as a programmable Ethernet switch to an SDN controller. Major operators such as DT and Turk Telekom have SEBA and VOLTHA in production, others such as NTT, TIM, Telefonica and AT&T are at different stages of trials.

AETHER — Aether is the first open source Enterprise 5G/LTE Connected Edge Cloud platform. Aether provides cloud managed mobile connectivity and edge cloud services for distributed enterprise networks. Aether is optimized for multi-cloud deployments, and simultaneously supports wireless devices over licensed and unlicensed (CBRS) spectrum. Aether is delivered on top of commodity hardware and enables enhanced performance 5G mobile edge computing experience with networks and services supporting a disaggregated/ virtualized evolved packet core (EPC) and a programmable radio access network. A micr-service based SD-RAN deployment is included. Aether opens up the 5g edge to cost savings with better programmability, new services and deployment agility, while introducing visibility and verification.

Conclusion

Panduit and Prysmian Group have joined forces to discuss CORD. This paper is the first in a series to support CORD deployments. The intention of this paper is to introduce the topic and provide some base knowledge of the value of CORD. We reviewed the development of CORD through ONF, explored the market drivers that require CORD, and a few of the applications that require the decreased latency in the network that CORD can provide. We also discussed some of the physical infrastructure considerations involved in CORD. The next papers will discuss the products that are required to have a successful CORD physical infrastructure solution, as well as how to efficiently install and utilize these products.

Authors

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Brian manages a team of engineers that develop new physical infrastructure products/solutions used in data center, enterprise, and industrial segments. He has worked in the Telecom/Data Center industry for over twenty years at companies like Cable & Wireless, XO Communications (now Verizon), SBC (now AT&T), and Server Central, prior to starting at Panduit in 2012.

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Ilham is a strategy manager with global experience and proven track record in new business development and strategy projects.

Robert Reid — Sr. Technology Manager for Panduit's Data Center Connectivity Group

Robert currently defines product development direction for Panduit's fiber optic structured cabling product line. He has been active in the fiber optics industry for over 35 years, in the development of passive optical components, optoelectronic, and specialty optics systems.

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John has over 25 years experience in data center design and construction, Telecom networks, and passive optical distribution component design.

About Prysmian Group

Prysmian Group is world leader in the energy and telecom cable systems industry. With almost 140 years of experience, sales of over €11.5 billion, about 29,000 employees in over 50 countries and 112 plants, the Group is strongly positioned in high-tech markets and offers the widest possible range of products, services, technologies and know how. It operates in the businesses of underground and submarine cables and systems for power transmission and distribution, of special cables for applications in many different industries and of medium and low voltage cables for the construction and infrastructure sectors. For the telecommunications industry, the Group manufactures cables and accessories for voice, video and data transmission, offering a comprehensive range of optical fibers, optical and copper cables and connectivity systems. Prysmian is a public company, listed on the Italian Stock Exchange in the FTSE MIB index. Additional information is available at prysmiangroup.com.

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About Panduit

Since 1955, Panduit's culture of curiosity and passion for problem solving have enabled more meaningful connections between companies' business goals and their marketplace success. Panduit creates leading-edge physical, electrical, and network infrastructure solutions for enterprise-wide environments, from the data center to the telecom room, from the desktop to the plant floor. Headquartered in Tinley Park, IL, USA and operating in 112 global locations, Panduit's proven reputation for quality and technology leadership, coupled with a robust partner ecosystem, help support, sustain, and empower business growth in a connected world.

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