Creating carrier grade unlimited capacity backbone infrastructure for Data Center connectivity

The role of data centers has been changing over the last decade rapidly moving from offering basic storage services to providing full scale connectivity, storage, and disaster recovery that have become crucial for enterprise customers. In addition, as data centers evolve with the significantly increased data capacity, rack space and power become more and more of a constraint. This calls for integrating new technologies to connect between data centers that will allow higher bandwidth and low latency transmission with minimal patch cords and fibers.

Today, data centers are using the high end carrier grade optical transport solutions of DWDM together with new technologies of 10G/40G and 100G to satisfy the increase in demand of high bandwidth usage. It is no longer enough for data centers to just rent a data service pipe from a service provider which uses the commonly shared infrastructure. Instead, data centers must build private optical networks with dedicated fiber and ultra-low latency. Data centers must create and offer an agile infrastructure that meets the ever growing demands, which is scalable, reliable, and can support both current and future application needs, speeds and cost. In addition, it needs to accommodate a variety of equipment, limited rack space, and limited power source and cooling, which have also become one of the primary considerations. The fiber optical network provides the most agile and cost effective solution for the new challenges data centers are faced with.

This article explores the several aspects and challenges which data centers are faced with in order to achieve their goals and build agile optical networks. Optical backbone infrastructure must comply with the following aspects:

1) Carrier grade, network reliability
2) Low latency
3) Agnostic to SW/router vendors using standard base pluggable optics
4) Flexibility for future growth (Unlimited capacity)
5) Low power consumption
6) Minimal rack space
7) Monitoring and easy maintenance and fault isolation

Cost considerations

Carrier grade reliability
The DWDM (Dense wavelength multiplexing) technology initially originated for the use of the carrier networks and service providers. DWDM optical technology provides high level of scalability able to carry up to 88 wavelengths with each wavelength transporting any protocol of 10G/40G or 100G Ethernet data rates as well as 1/2/4/8/16G Fibre channel. Such architecture reduces the number of fibers needed dramatically and enables full
monitoring on the services running forming layer-1 DWDM transparent solution with high level of reliability.

Due to the increase in demand of data transport between enterprise branches, backup, synchronization, and disaster recovery needs, optical networks became relevant for enterprise and data center backbone infrastructure, as well integrating the mature technology from the carrier back bone to the data center mission critical applications that requires zero down time. The DWDM network and dedicated fiber enables the enterprise to control the capacity, maintain the network and achieve high performance, ultra-low latency and reliable backbone infrastructure with near-to-zero downtime. DWDM technology enables 1+1 layer-1 fast protection scheme with less than 50ms switch over time which enables data centers to provide high uptime for their backbone and service offering.

![Figure 1: Illustration of DWDM ring network](image)

**High Capacity and Future Growth**

DWDM optical network enables unlimited capacity addressing the most bandwidth hungry applications. It is a flexible layer-1 technology which has no limitation regarding the type of data or service and rate of each wavelength it is carrying. Each channel - wavelength is independent and isolated from the others and provides built-in security in case the same fiber is used for multiple applications or shared between different customers. Once the network is up and running, the cost of additional capacity is minimal and the network can scale easily to meet future needs. DWDM enables multiplexing of up to 88 wavelengths within the same fiber, each wavelength can carry up to 100Gbps traffic. So today, a single fiber can carry over 8.8 Tera bit per sec.
PacketLight addresses the emergence of these enterprise and data center needs with ultra-low latency CWDM and DWDM technology for high utilization of dark fiber infrastructure. With PacketLight’s solution set, it has never been easier to design, install and maintain a high capacity carrier grade private optical network that meets the highest data capacity needs of today and the future.

## Size and Power Consumption

Many of the data centers worldwide are reaching their maximum capacity in rack space, power consumption and cooling capability. Therefore, data centers are looking to implement technology with low rack space and low power requirements. PacketLight’s solutions are focused on addressing and solving these issues with the most compact and integrated high capacity solutions on the market. PacketLight’s products are all 1U in size and with low power consumption, high capacity and reliability along with ease of use, are ideal for data center applications.

As an example, with PacketLight’s technology a 100Gbe application is possible in only 1U of rack space multiplexing 10x 10Gbe, 2x40Gbe or 100Gbe link for up to 120Km distance.

## Monitoring, management and troubleshooting

In order to provide proper SLA support, all data center network managers must have proper diagnostics tools readily available for easy troubleshooting. PacketLight’s integrated management software enables fast and easy troubleshooting, fault isolation and monitoring with built-in test capabilities such as:

- Power monitoring of each wavelength through real time data on each wavelength
- Constant monitoring on the fiber attenuation between the sites
- Loopback testing for troubleshooting link existence
- PRBS testers on all links - built in BER testers
- NMS/EMS tools or SNMP interface to any 3rd party SNMP manager enable full monitoring and control of multiple networks with hundreds of network elements

## Low CAPEX and OPEX

Cost is always an important consideration for data center operations. Both initial investment and ongoing maintenance costs must meet the profitability margins and result in high ROI. The maintenance costs include not only equipment maintenance, but also the maintenance of space that equipment occupies, power consumption and other operational issues.

PacketLight’s solutions are competitively priced and provide high ROI from the start. In addition, PacketLight products reduce the optical backbone infrastructure cost from both CAPEX and OPEX perspective. PacketLight’s standards-based DWDM product set allows data centers to utilize their existing network infrastructure by integrating PL equipment into their standards based DWDM infrastructure. PacketLight’s small footprint...
1U solutions combined with rich CWDM/DWDM functionality and low power consumption reduce both operation and maintenance cost.

**Summary**
Having high end active L1 optical network is now within reach for data centers and the enterprise market. With DWDM technology, data centers can implement a carrier grade optical backbone infrastructure with high reliability, scalability, low-latency and unlimited capabilities. PacketLight’s affordable product suite provides the needed DWDM capabilities to data centers with necessary troubleshooting tools and reduced CAPEX and OPEX. PacketLight’s modular architecture allows data centers to grow whenever needed, regardless of the switching and routing technology and storage products utilized on the network. For more information, visit [www.packetlight.com](http://www.packetlight.com) or email us at info@packetlight.com.

**About PacketLight Networks, Ltd.**
PacketLight Networks offers a suite of Leading 1U CWDM/DWDM and OTN based solutions, for transport of data, storage, voice and video applications, over dark fiber and WDM networks, featuring high quality, reliability and performance at affordable prices. Our products are distinguished with low power consumption ideal for CLE (Customer Located Equipment) allowing maximum flexibility as well as ease of maintenance and operation and providing real Pay-as-you-grow architecture. PacketLight customers are carriers, service providers, data centers, IT integrators and enterprises who are active in meeting the demands for metro Ethernet, business continuity, Triple Play solutions and enterprise data sharing applications. For product and reseller information, please contact info@packetlight.com.