Enabling an Efficient Cloud

The communications revolution and the advent of the cloud are placing ever-increasing capacity demands on enterprise and data center networks

The world we live in is in a rapid state of change in terms of the way we communicate and are connected with each other. We are constantly greeted by new advances in communications technology, be it the smartphone, tablet computers, internet gaming, social networks, or e-services like e-money or e-education.

The advent of cloud computing is a natural progression as we advance towards a super-connected world where data centers and local area networks are at the heart of making it all happen. Cloud computing and superconnectivity are placing ever-increasing pressures on these networks.

Networks are now required to increase their capacity and deliver higher data rates and also be energy-efficient. This pressure means that virtualization, next-generation speeds, and the green data center have become key global trends. In striving to cope with these trends, data center managers are destined to encounter certain specific challenges.

Data center dynamics (in collaboration with Corning Inc) recently conducted a survey of 160 data centers in the 6 key markets of the UK, Germany, Netherlands, France, Middle East, and the US, including the top 100 data center owners and operators in those regions.

Results of this survey confirmed that downtime, energy and cooling costs, space utilization, and the ability of installed cabling to meet the needs of next-generation networks are among the top concerns of enterprise managers and therefore need to be considered carefully in the context of cable innovation advances.

Impact on System Uptime and Availability

Data centers are responding to the demand for capacity as driven by cloud computing, by incrementing the level of virtualization of their servers. Virtualization in a simple way is described as smaller servers being virtually consolidated into one large server upon which multiple applications are run in parallel. Virtualization increases server utilization efficiency and therefore reduces the number of servers required. However virtualization results in a reduced level of redundancy in your network, which if not managed carefully can reduce the reliability of system availability and increase the risk of downtime.

Highlights

- Downtime, energy and cooling costs, space utilization, and the ability of installed cabling to meet the needs of next-generation networks are among the top concerns of enterprise managers
- The green agenda requires significant reduction in data center energy consumption

The survey conducted by data center dynamics revealed that there was some degree of virtualization across all data center business sectors. But business sectors where uptime and availability is most critical (financial, IT, and telecoms) had the least degree of virtualization, presumably because their sensitivity to downtime risk makes the reduced redundancy associated with virtualization a far less attractive proposal. Downtime is therefore a key challenge in the new world of advanced data centers and cloud computing.

In the survey, 43% of data center managers reported planning some form of scheduled downtime in the previous 12 months. But they also reported a significant level of unscheduled downtime (overrun or abnormal events). According to the survey such outages have a significant cost impact, costing on average $14,000 per hour. Interestingly, cabling choice and cable management were identified as significant players in the cause of data center downtime.

According to the survey responses, the cost of unplanned downtime due in whole or in part to cabling fault is about $750,000 per year of operation for the 160 data centers in the survey. Downtime is real dollars and thus smart cabling choices that support next-generation speeds matter.

Enabling Higher Data Rates

As consumer usage of bandwidth hungry applications grows, network migration to higher data rates becomes essential. Data rates in enterprise networks and data centers worldwide have increased continuously to the point where 10 Gb/s is now fairly common. Furthermore, 40 Gb/s and 100 Gb/s data rates are increasingly being adopted.

It is essential therefore that data centers have the capability to migrate to higher data rates, and so careful consideration of cabling technology choice is required. The greater bandwidth capability of optical fiber relative to copper cabling naturally translates into greater system reach capability at a given data rate; or conversely far higher data rate capability at a given system reach.

Optical fiber, and particularly multi-mode optical fiber that facilitates the use of low-cost optical transceivers, is therefore the technology of choice when it comes to enabling a pathway to next-generation data center and enterprise network connectivity and speed.

High-bandwidth multi-mode fibers such as OM3 and OM4 are future proof solutions, and as such are recommended in 40 Gb/s and 100 Gb/s standards, as they support longer link lengths and more margin for additional connectors at those high speeds.

But with optical fiber cabling being the technology of choice from the perspective of enabling next-generation networks and the critical need to minimize downtime, is there any recent cabling innovation that can really help to further minimize downtime and maximize uptime and availability? To answer this question we need to explore the concept of data center entropy.

Need for Bend Insensitive Multi-mode Fiber

In an initial installation, people generally follow rules and all cabling is well managed. But the problem is that invariably over the network lifetime there will be moves, adds, and changes that causes the original installation to gradually increase in cable complexity: A process defined as cabling entropy. This is when a bend-insensitive multi-mode fiber really adds value.

Cabling entropy introduces cabling bends that with standard multi-mode fiber will lead to signal power loss which is a particular problem with the tighter loss margins at higher data rates. In addition to addressing this problem, data center managers are also looking for increased density, reduced congestion in pathways and spaces, and improved airflow.

When a standard or legacy multi-mode fiber is bent tightly, light will leak out of the fiber's core at the point of the bend. This is called macrobend loss. Recent innovations in multi-mode fiber design resulted in the development of bend insensitive fibers that effectively have a barrier around the core to minimize macrobend loss.

The result is an optical fiber that exhibits up to a ten-fold reduction in loss at the point of a bend. If a system operates with bend insensitive multi-mode fiber cable, the bend induced loss will be up to 10 times lower than with a standard multi-mode fiber cable, thereby protecting the system margin and ensuring that the system continues to operate in the presence of accidental bends and unscheduled downtime is avoided.

Bend insensitivity also inherently assists with the transition to next-generation networks: By eradicating virtually all cable bend loss, thus freeing up additional system margin to enable the path to higher data rates.

Furthermore, bend insensitive fiber enables small cable designs that in turn can enable increased port density, reduced duct congestion, and improved airflow. The latter can have a significant impact on enabling the 'green' data center.

The Green Agenda

The green agenda requires significant reduction in data center energy consumption. Optical fiber based networks are inherently more energy-efficient than copper networks due to the high insertion loss of copper cables and their heavy reliance on digital signal processing.

That coupled with the lower power consumption of an optical transceiver and the reduction in number of switches required in an optical system compared to a copper equivalent, means that an optical system can yield 55% to 70% energy savings over an equivalent copper system.

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But the challenge of reducing data center network energy consumption is twofold: First, as discussed above, you need to reduce the power consumption of the active components and second, and no less important, you also need to reduce the energy required to cool those active components. This is where bend insensitive multi-mode fiber brings significant advantages. The higher tolerance to bends enables thinner, smaller diameter, and more flexible cables which when installed use up less pathway space, thus easing congestion and improving airflow.

Additionally, smaller, lighter cable designs result in smaller components, resulting in increased port density in racks thereby reducing the footprint and ultimately increasing airflow. Improved airflow and reduced footprint all assist with reducing the power required for cooling.

Hence, if active and cooling energy savings are important, optical fiber cabling should typically be deployed.

Conclusion

The communications revolution and the advent of the cloud are placing ever-increasing capacity demands on enterprise and data center networks. Data centers must continually upgrade to the next-generation of technology, while also ensuring that they become 'green'.

Optical fiber is significantly advantaged in enabling higher data rates for next-generation data centers and enterprise networks. A new innovation, bend insensitive multi-mode fiber, is playing a lead role in reducing data center downtime due to cabling entropy while also reducing power consumption, cooling, and footprint for the 'green' data center. If uptime matters, if green matters and if future of your network matters then bend insensitive optical fiber cabling is not a luxury, but is a true necessity.

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