

D-Link 10-Gigabit Ethernet

Standardized Solutions for Maximizing Bandwidth and Enabling Storage and Computing Technologies

White Paper
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Abstract

Bandwidth intensive applications, VoIP, OS virtualization, cluster computing, video and audio proliferation, and high-performance back-up solutions are all driving the charge for higher capacity networking. There's also a push to simplify networks and reduce connectivity costs – all while maintaining reliability and decreasing latency. Fortunately, network bandwidth doubles approximately every two years. Gigabit Ethernet, for example, is now maturing and making way for 10Gigabit Ethernet (also referred to as 10GbE or IEEE 802.3ae), which was introduced in 2002.

10GbE, which increases capacity by a factor of 10 over Gigabit Ethernet, easily connects to existing Ethernet equipment, enables network/server consolidation and clustering virtualization, and offers copper technology specifically designed for upgrading short-range links. A 10GbE solution is particularly compelling in SAN/NAS disaster recovery and business continuity environments, where expensive Fiber Channel links can be replaced while unifying the entire network on Ethernet.

10GbE and iSCSI technology can act as high-speed trunk lines where multiple GbE clients access the SAN, for example – supporting disaster recovery and business continuity initiatives. In departmental scenarios, this option is a very compelling alternative to Fibre Channel switches. Existing Ethernet skill sets ensure that training and implementation costs are minimized. There is no additional technology to learn and no new expertise necessary.

This white paper explains 10GbE solutions for fiber optic links as well as copper, summarizes market drivers, examines some of the more common applications, and details D-Link's new low-cost 10GbE local area and wide area solutions.

10-Gigabit Ethernet – Low-Cost, High-Speed Data Transfer

As demand for network bandwidth continues, 10GbE is poised to profoundly impact the networking landscape and add a much-needed performance boost across Local Area Networks, Wide Area Networks and Metropolitan Area Networks – LANs, WANs and MANs. 10GbE offers standardized Ethernet technology that fits neatly into existing architectures and super-charges a variety of IT applications, from supercomputing to networked storage. Essentially, 10GbE enables high-speed data transfer at low cost. As 10GbE spreads, high-bandwidth, low-latency applications as well as converged voice, video, and data networks will flourish and excel far beyond current end-user performance expectations.

10GbE is already displacing slower switches in the LAN and SAN markets. At 10 times the speed of Gigabit Ethernet, the technology is considered a major, “disruptive” advance. Blade servers are now being manufactured with 10GbE I/O backplanes, Fibre Channel links are being replaced by cheaper 10GbE gear, and server-to-server links inside data centers are being augmented with short-run copper CX4 10GbE links (see definitions below). Buyers can choose between optical fiber (XFP) and copper (CX4) modules for connecting to 10GbE switches. CX4 modules provide a cost effective solution for short-run (15 meters or less) 10GbE rack-to-rack or box-to-box applications.

10GbE technology also plays a key role in computer clustering. The standard now contends with InfiniBand for the high-speed links that connect groups of computers into a single, virtual machine. These clusters challenge supercomputer performance at a fraction of the cost.

Perhaps most compelling is the fact that 10GbE offers an elegant, consolidated solution for fragmented, competing networking standards that complicate network management. With 10GbE, you no longer need parallel networks for storage, virtualization and consolidation projects. Everything returns to the single Ethernet networking standard, which allows for excellent scalability, reduced knowledge set and training, and a clear path for performance upgrades across existing enterprise networks.

Applications and Market Drivers

Faster CPU clock rates and storage technology have been driving data center expansion, consolidation projects and performance upgrades. Simply put, more bandwidth is needed to move data in and out of data centers and between the various servers within them. As a result, analysts see no end in sight for 10GbE growth at the corporate backbone and beyond.

Gigabit Ethernet prices have dropped off precipitously over the past two years, and most 10/100-Ethernet switches now leverage Gigabit

uplinks. In addition, high-performance PCs include integrated Gigabit Ethernet connectivity. The network is scaling for maximum throughput and the fattest pipes at every juncture. While Gigabit Ethernet used to be limited to 5 kilometers between campuses, new 10GbE transponders now cover up to 40 kilometers.

This is a noteworthy development for enterprises like movie production studios, video editing companies, sophisticated engineering and design firms and the like. With wide area Gigabit Ethernet on the desktop and 10GbE connectivity across campuses, transfer rates for huge files become trivially insignificant. Video surveillance applications that require high bandwidth and multi-core CPUs to keep up with data transfers benefit, as well.

Metro

As demand for Gigabit Ethernet grows, service providers have been extending infrastructure, servers and even client devices that can handle GbE to the metro edge. The problem is that a single fiber is restricted to one Gigabit throughput unless expensive Dense Wavelength Division Multiplexing (DWDM) equipment is employed to multiplex the Gigabit feeds. With 10GbE, 10Gb throughput is achieved at a much lower cost, offering additional capacity where needed.

With 10GbE you enable the following benefits:

- Low-cost, high-speed Ethernet access to the metropolitan optical infrastructure
- 10Gb metro campus interconnects over dark fiber (up 40 km)
- Simple, end-to-end connectivity with familiar Ethernet management systems

Server Farms

Some organizations are developing huge server farms that spread across multiple locations and are interconnected using GbE and 10GbE. The result is a massive virtual supercomputer. By using OS virtualization, they consolidate applications and enable stunning performance and computational leverage. The problem is that I/O bottlenecks for LAN traffic and storage inevitably arise. 10GbE solves this dilemma by adding capacity and alleviating congestion across the system.

Blade Servers & 10GbE

Blade servers are now integrating 10GbE with rack management systems. IBM's BladeCenter, for example, works with 10GbE switches. These systems are priced at less than \$500 per port. 10GbE solutions (using twisted pair wires and RJ-45 connectors) are expected in 2008-2009. D-Link plans to participate in this market once the technologies become standardized and have traction. As these advances unfold, growth of 10GbE will continue to accelerate.

Storage: Fibre Channel or iSCSI

10GbE technology enhances storage systems, acting as a high-speed trunk where multiple GbE clients access the SAN. Fibre Channel switches can be replaced by standardized 10Gb Ethernet and iSCSI, making life easier for IT and reducing the amount of time and money spent on training and network maintenance. Since networking staffs are already well-versed in Ethernet and TCP/IP, 10Gb/iSCSI can be rapidly implemented. Fibre Channel experience, however, is not as prevalent, so training and project launches are usually much more challenging.

Disaster recovery and business continuity initiatives can easily be supported by 10GbE. Terrorism, natural disasters and ongoing reliance on mission critical IT systems will continue to drive DR and business continuity growth. 10GbE offers an elegant solution with low costs, the ability to use existing implementation skill-sets, and open flexibility based on the Ethernet standard.

Implementation

Like common Ethernet deployment, 10GbE requires Ethernet switches and Network Interface Cards (NICs) plus modules (or adapters) that interface with existing switches where necessary. D-Link xStack™ 3300 and 3200 series switches support CX4 and XFP modules, for example (without the modules, the switches are high-performance gigabit stackables). The type of connection used depends on cabling distance. CX4 (copper) modules can be used if the interconnect distances are less than 15m. This is the most cost-effective technique for short runs. XFP modules can be used for longer distances. These come in short, long, and extra long reach versions (300m, 10Km and 40Km). Since 10GbE uses the standard Ethernet MAC protocol, equipment can be deployed using star or ring topologies. Newer 10GbE switches deliver network reliability similar to Sonet/SDH rings.

D-Link Solutions

D-Link offers low-cost 10GbE solutions with all the benefits and advantages discussed above. With D-Link 10GbE switches and modules, enterprises and service providers can upgrade existing LANs and SANs without adding expensive Fibre Channel equipment or a third type of network like InfiniBand. Standard Ethernet protocols ensure that existing personnel can manage the new network using traditional Ethernet skill sets. No additional training is required.

D-Link solutions feature:

- Low total cost-of-ownership (equipment, management/maintenance, personnel)
- Linear, standards-based migration path to 100GbE and beyond
- Proven multi-vendor and installed-base interoperability
- Familiar network management feature set

D-Link offers both CX4 and fiber XFP uplink modules, so customers can implement short-run linking solutions at very low cost with copper or longer, high-performance links with fiber. The modules work interchangeably with D-Link xStack 3300 and 3200 switches. Customers can flexibly choose the right technology for their individual needs.

D-Link Products

Currently D-Link offers two 10GbE switches, five modules for XFP applications of varying length, and one module for short-run copper (CX4) applications. The products are described briefly below. Additional information and specifications are available at <http://www.dlink.com/>. We plan on adding new solutions as the market develops.

xStack DXS-3350SR

D-Link's xStack Switches are a series of "Next Generation" high performance stackable switches that deliver high scalability, wire-speed Gigabit performance, high availability, integrated 10-Gigabit stacking, redundant power options, and the option to stack in a ring or star topology.

The xStack DXS-3350SR stacks up to 8 units, providing up to 384 Gigabit ports, and up to 40Gbps of stacking bandwidth. It supports an optional module for an additional 2 ports of either 10 Gigabit fiber XFP ports (DEM-420X) or 10 Gigabit copper CX-4 (DEM-420CX) for uplinking to servers, storage, or backbone switches. The DXS-3350SR stacks with other xStack switches like the DGS-3324SR, DGS-3324SRi, and DXS-3326GSR, providing unprecedented flexibility. It features 48 built-in copper Gigabit ports, including (4) Combo SFP ports supporting either copper links or SFP transceivers for easy, flexible connection to fiber-based Gigabit media and a switching capacity of up to 176Gbps per switch.

xStack DXS-3326GSR

The xStack DXS-3326GSR stacks up to 12 units in a stack, providing up to 288 Gigabit fiber slots, up to 40Gbps of stacking bandwidth in ring mode, and a switching capacity of up to 128Gbps per switch. The switch supports an optional module to provide an additional 2 ports of either 10 Gigabit fiber XFP (DEM-420X) or 10 Gigabit copper CX-4 (DEM-420CX) for uplinking to servers, storage, or backbone switches. It features 24 Gigabit fiber slots, including (4) 10/100/1000 combo copper ports and stacks with the other xStack switches including the DGS-3324SR, DGS-3324SRi, and DXS-3350SR, providing unprecedented flexibility.

xStack DXS-3250

The DXS-3250 is an advanced high-density stackable Layer 2 switch supporting (48) 10/100/1000Base-T interfaces, 4 Combo SFP fiber uplinks, and two optional 10-Gigabit Copper CX-4 or fiber XFP ports. With an optional firmware upgrade the DXS-3250 transforms

into a 'Wireless-Ready' switch capable of providing centralized AP management, seamless roaming between APs, and enhanced wireless security with rogue AP detection and jamming. The DXS-3250 enables up to 16 units to be stacked at up to 48Gbps creating a single IP managed solution. The DXS-3250 also supports advanced security through preconfigured ACLs that detect and filter out known network threats such as DoS attacks, Trojans, Worms and more.

xStack DXS-3227

The DXS-3227 is an advanced stackable Layer 2 switch supporting (24) 10/100/1000Base-T interfaces, 4 Combo SFP fiber uplinks, two optional 10-Gigabit Copper CX-4 or fiber XFP ports, and (1) built-in XFP interface. With an optional firmware upgrade the DXS-3227 transforms into a 'Wireless-Ready' switch capable of providing centralized AP management, seamless roaming between APs, and enhanced wireless security with rogue AP detection and jamming. The DXS-3227 enables up to 32 units to be stacked at up to 48Gbps creating a single IP managed solution. The DXS-3227 also supports advanced security through preconfigured ACLs that detect and filter out known network threats such as DoS attacks, Trojans, Worms and more.

xStack DXS-3227P

The DXS-3227P is a 24-port PoE capable stackable Gigabit Layer 2+ switch that supports 4 Combo SFP ports, 2 optional 10 Gigabit fiber or copper uplinks, and 1 built in fiber 10G XFP interface. It supports static routing and resilient failover stacking with a stacking bandwidth of up to 48Gbps. With the purchase of an optional wireless switching key, the DXS-3227P can support centralized AP management, wireless roaming, & rogue AP detection and containment. Enhanced security includes the ability to automatically detect and block known threats such as Trojans, Worms, and DoS attack. The DXS-3227P supports IEEE 802.3af PoE at full power on all ports simultaneously with per port power ratings up to 16.8 Watts.

XFP Modules/Transceivers

DEM-422XT

The D-Link DEM-422XT is a high performance 1310nm Single-Mode XFP transceiver that supports distances up to 10,000 meters (10Km) in Full-duplex, with 10-Gigabit speeds on Single-Mode fiber cables. The unit is 802.3ae 10GBASE-LR compliant and supports Full-duplex 802.3x Flow control. It provides the necessary signal amplification for data to be transmitted to the network cable from the port, and vice versa. The DEM-422XT is hot swappable, so you can remove or replace the transceiver with the system powered on. This permits modules and transceivers to be added or swapped without interrupting network systems.

DEM-421XT

The D-Link DEM-421XT is a high performance 850nm Multi-Mode XFP transceiver that supports distances up to 300 meters. It supports Full-duplex, 10Gigabit speeds on Multi-Mode fiber cables. The DEM-421XT is 802.3ae 10GBASE-SR compliant and supports Full-duplex 802.3x Flow control. The unit provides the necessary signal amplification for data to be transmitted to the network cable from the port, and vice versa. The DEM-421XT is hot swappable, so you can remove or replace the transceiver with the system powered on. This permits modules and transceivers to be added or swapped without interrupting network systems.

DEM-420X

The DEM-420X is a module with 2 XFP slots for 10-Gigabit pluggable transceivers. It is designed for D-Link's two xStack members, the DXS-3550SR and DXS-3326GSR. When the DEM-420X is plugged into the switch, it provides 2 uplink XFP 10-Gigabit ports for connections to the switches, each module providing a whopping bandwidth of 20-Gigabit with two appropriate XFPs. Designed to alleviate any bottlenecks that might occur at the access core, the DEM-420X is targeted for use as an uplink to servers, or backbone switches in medium to large size businesses. The DEM-420X includes an informative LED-Light indicator displaying 10-Gigabit mode link and activity. When using D-Link's XFPs, each transceiver can be removed or added without powering down the switch, enabling network management without any down time.

DEM-411X

The DEM-411X is a 1-port 10-Gigabit XFP Module for the xStack 3200 Series switch. The DEM-411X is fully IEEE 802.3ae compliant and supports data transfer at full duplex for congestion-free data transport. The DEM-411X can be mixed and matched with the DEM-411T (10-Gigabit CX4 module) to provide both 10-Gigabit copper and fiber interfaces on a single switch chassis. The DEM-411X supports industry standards, and it may be compatible with 3rd party XFP transceivers. The DEM-411X can be used to interconnect switches, uplink to servers or provide a clean fiber bandwidth channel for SAN and other network storage devices. For a complete solution, the D-Link DEM-421XT 10Gbase-SR XFP can be added for fiber runs over multi-mode cabling up to 300 meters. If longer hauls are required, D-Link offers the DEM-422XT single-mode 10Gbase-LR XFP capable of distance runs up to 10Km. enabling network management without any down time.

DES-6512

The DES-6512 is a 2-port 10Gig XFP card for the DES-6500 chassis. It uses standards-based IEEE 802.3ae 10-Gigabit XFP modules to meet the demands of today's Enterprise and Service Provider networking infrastructure. The DES-6512 is the perfect solution for uplinking to servers, storage, or department level switches such as D-Link's xStack DXS-3200 series. Fiber media allows for increased

distances over copper cabling. When used with D-Link's DEM-422XT XFP fiber module a total distance of up to 10Km can be reached. This is often necessary when running across larger distances such as campus or multi-building environments. If shorter distances are required, the DEM-421XT module from D-Link provides 10-Gigabit Multimode at distances of up to 300 meters.

CX-4

DEM-420CX

The D-Link DEM-420CX is a 2-port 10-Gigabit copper CX-4 uplink module for the xStack 3300 series DXS-3326GSR and DXS-3350SR switches. The DEM-420CX offers an affordable, 10-Gigabit uplink option using copper CX-4 cable for distances up to 20 meters. This module is designed for connecting nearby servers, Network Attached Storage devices, and switches. The DEM-420CX is equipped with embedded transceivers, eliminating the need for users to purchase additional costly fiber XFP transceivers. The module slides into the back of the DXS-3350SR or DXS-3326GSR and provides two 10-Gigabit CX-4 ports. Each of these ports is capable of up to 20Gbps in full duplex for a total combined uplink capacity of 40Gbps.

DEM-411T

The DEM-411T is a 1-port full-duplex 10 Gigabit CX-4 Module for the xStack 3200 Series switch. CX-4 is a cost effective means of transporting data over short distances at speeds up to 10Gbps. The DEM-411T is designed to provide up to 12Gbps of bi-directional bandwidth when used as a stacking interface while connected to an xStack 3200 Series switch. The DEM-411T is also IEEE 803.2ak compliant and will operate at a standard 10Gbps when used to uplink to another 802.3ak CX-4 compliant device such as a SAN or Server NIC. The DEM-411T can be mixed and matched with the DEM-411X (10Gigabit XFP module) to provide both 10Gigabit copper and fiber interfaces on a single switching chassis. It is self-contained and does not require the purchase of an additional transceiver to function.

Storage

DSN-3400

The D-Link® xStack Storage Area Network (SAN) Array DSN-3400 offers entry-level and SMB customers a reliable network data storage solution. The DSN-3400 provides the industry's first built-in, fully integrated 10GbE interface in the XStack™ cost effective solution.

The DSN-3400 features a 10Gbit iSCSI System-on-a-Chip (SoC) solution that can handle over 65,000 I/Os per second. It is capable of supporting over 11TB raw capacity using 750GB hard drives (and even higher capacity hard drives as they are introduced). The array can easily be implemented as nearline storage to supplement your primary IP network storage solution. It can also be used as a basic backup and recovery device. By utilizing existing Ethernet and iSCSI technology, the DSN-3400 reduces costs associated with separate host bus adapters. Per-Gigabyte cost for storage is significantly reduced. IP SANs based on iSCSI technology can leverage existing and familiar Ethernet standards to provide speeds of up to 1160MBytes bandwidth with the DSN-3400.

10GbE – The New Standard for Raising Service Levels, Boosting Network Performance and Reducing the Cost of Connectivity

As growth of 10GbE networks continues, everyone benefits – from the end-user to the data center to the service provider. Increasing worldwide Web usage, sophisticated Rich Internet Applications (RIAs) and new forms of clustered computing are all driving capabilities and performance demands to higher levels. The 10GbE market is entering an expansion phase, so equipment prices and rapid adoption will continue the ongoing trend of breakthroughs. Be prepared for more network productivity and efficiency, communication expansion, and creative integration.

For more information about D-Link 10GbE solutions and related equipment, please call 1-888-XSTACK1 or visit www.dlink.com/xStack.