D-Link's Distributed Network Architecture (DNA)

Networking Needs of Tomorrow

As today's networks grow and evolve, the burden on infrastructure increases due to larger numbers of users, multiple locations, high bandwidth applications, and distributed data storage. These challenges and others can stretch networks to a breaking point, impacting business operations and, ultimately, the bottom line. To meet the network growth challenge, IT managers must find solutions that address these requirements and have the ability to adapt for future growth. While designing the next-generation network, IT managers should look to build a network infrastructure that supports flexibility, growth, and high-availability.

- Flexibility: Traditional network equipment can limit the network's ability to adapt to future expansion. The ideal network infrastructure must provide for a wide range of possible future network topologies.

- Growth: Even when the basic network architecture fits the organization's needs, IT managers must still be prepared to respond to rapid growth. The ideal network infrastructure must be able to expand and scale without major downtime and without obsoleting current network equipment.

- High-Availability: The pressure is always on to keep the network operational under all circumstances. The ideal mission-critical network infrastructure can respond automatically to failures and continue to handle network traffic while maintaining uptime.

D-Link's Robust Stacking Solution

The Distributed Network Architecture (DNA) Solution

To meet these demands, D-Link has implemented a unique stacking architecture--DNA. Integrated into D-Link's latest generation of xStack switches, DNA enables the design and deployment of high port-density, cost-effective switches that support the stacking requirements of modern fast-moving networks. Switches based on DNA technology allow IT managers to design highly efficient stackable network solutions that meet their company's cost and performance requirements.

Benefits

The DXS-3200 series of xStack switches offer significant benefits to network designers in developing next-generation high-port density, highly resilient stackable switches:

- Versatile architecture: DNA allows different topology configurations to be built from either GbE or 10GbE ports.
- Scalability: DNA enables network and IT managers to expand and optimize the utilization of their networks by easily adding switches to existing stacks without disrupting network operations; up to 32 switches can be connected in a stack.
- Manageability: From the system management point of view, a stack of DNA-based switches appears to be a single switch with a single management interface.
- Redundancy: DNA can be configured with redundant masters and stacking paths, that in the event of a failure will re-route traffic in as little as a few seconds.
- High performance: DNA forwards packets without burdening the switching engine of intermediate devices, and also load balances master CPU bound control traffic in the stack.
- Feature transparency across stack: DNA maintains complete feature transparency across the stack. For example, the following features are kept transparent when multiple systems are connected together using DNA:
  - Port trunking across the stack (allows ports from different switches to be aggregated into a single trunk interface)
  - Mirroring (sniffing) packets to a port (monitor) that may reside on any switch in the stack (Allows the ability to monitor traffic on any port in the stack)
  - VLANs are created across the stack and any port in the stack can be added/removed

What is DNA?

DNA is a combination of hardware and software that is embedded in D-Link's latest 3200 series of xStack switches. These feature-rich switches offer the flexibility in network design and implementation to increase port density and performance. In addition to hardware, D-Link's software provides the ability to control the entire stack as a single unit and provides features such as redundant master, loop-free stacking configuration, and dynamic re-configuration, regardless of the switches physical location.

How DNA Works

Switches built with DNA are easily stackable with little or no system downtime for expansion. For example the DXS-3200 series switches are self-healing by quickly discovering failures in the stack and re-routing traffic to automatically avoid the failed device and discover the new topology. Switches can be connected together using D-Link's optional 10Gbps CX-4 or XFP based modules. With the 10Gbps ports, switches can be connected directly to create scalable and reliable networking solutions. With an aggregate bandwidth of 40Gbps, the 10Gbps ports can be used as dedicated stacking ports offering highly efficient stacking ring or chain configurations. DNA technology is extremely flexible and also allows for front panel stacking through any Ethernet port on the switch. This means DNA can also be used with standard Fast Ethernet (FE) or Gigabit Ethernet (GbE) copper and fiber ports, allowing them to function as stacking ports.

Flexible Architecture

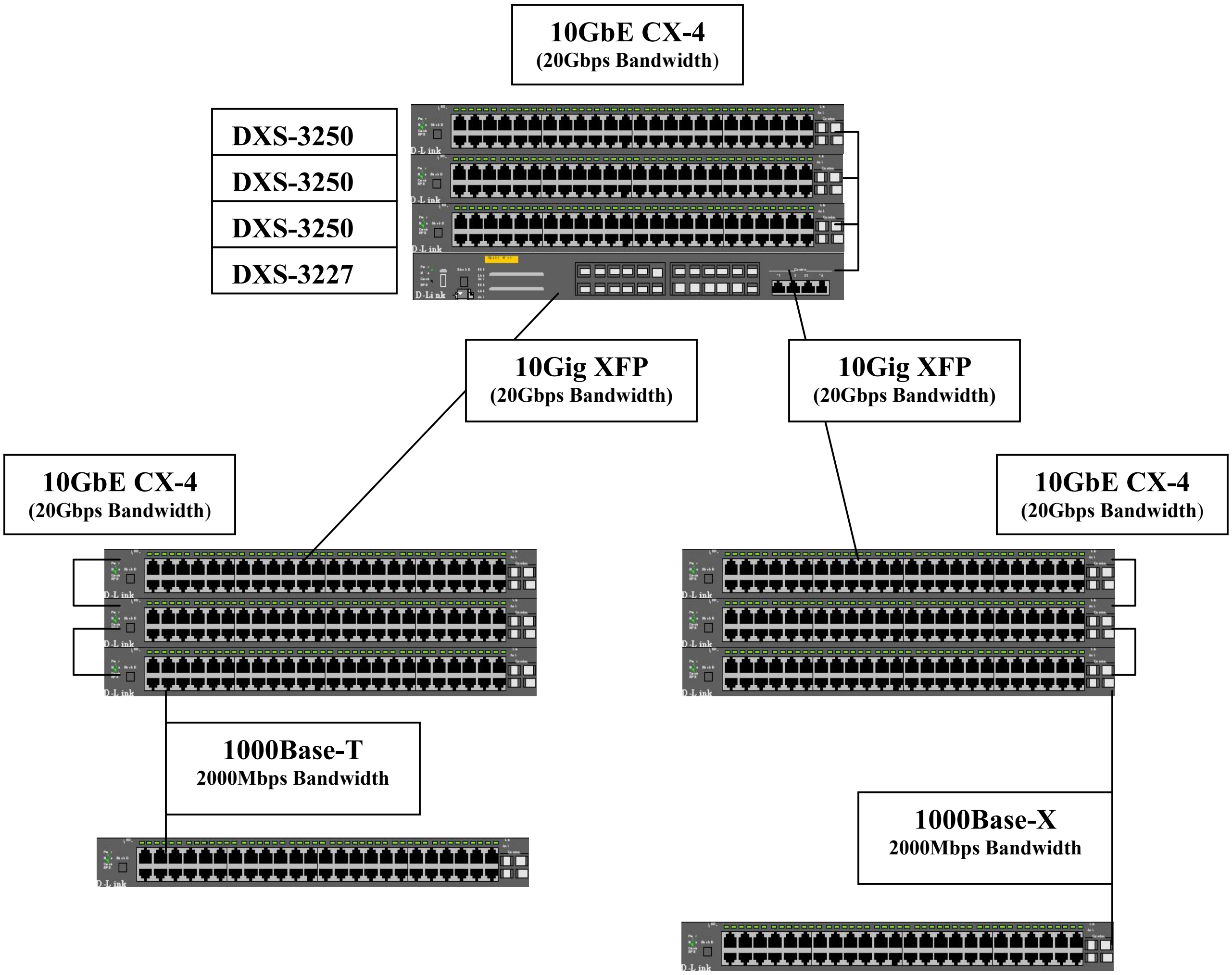
The flexibility of DNA lets network designers choose the right topology for connecting their devices whether it be through a 10 GbE interface or using a 1000Base-X port to connect between wiring closets. The DXS-3200 series switches can be used in a number of topologies such as, ring, star or chain stacking. With the ability to stack up to 32 switches in a single configuration, a maximum of 768 GbE ports and 96 10 GbE ports may be achieved. In addition, the DXS-3200 series allows the network administrator to maintain transparency of system features such as Port Mirroring, VLANs, and link aggregation across the stack. Unlike other stacking solutions, this feature will allow an administrator to add and remove ports from VLANs without having to configure the VLAN on each switch and without the added hassle of creating VLAN trunks between devices. This also allows, through the use of port mirroring, the ability to monitor any port throughout the stack without having to be physically connected to the same device. This flexibility allows for better troubleshooting, faster configuration, and a lower risk of configuration errors.

Resilient and Available

When changes are made to the stack, DNA automatically discovers the new topology and reconfigures the system to accommodate the changes. In the unlikely event of equipment failure, the switches rapidly reconfigure the stack to avoid the failed switch, resulting in extremely fast failover times and little to no downtime. Once a replacement unit is received, simply give it the same stack ID as the failed unit and connect it back to the stack. DNA will then automatically configure the switch to match that of the previous unit. The DXS-3200 series switches, feature a high level of resiliency and availability, vital assets for the enterprise network.

DNA at Work

The diagram below shows one example of how the DXS-3200 series switches can be stacked in an enterprise environment. This configuration could support a department or group of up to 548 users, each connected to a GbE port on the stack. This system can be deployed as a single switch and scaled over time simply by adding additional switches to the stack and changing the interconnections. To the external network, the entire stack appears as a single high-density entity. Internally, the individual switch chassis are connected through a variety of media types including 10Gig CX-4, 10Gig XFP, 1000Base-T, and 1000Base-X creating a flexible topology that can extend over long distances.



The interconnections support bi-directional traffic flow supporting 20 Gbps capacity with a total of 40 Gbps on the DX-3250 and 60 Gbps on the DXS-3227 on the 10 gig interfaces. The stack has complete feature transparency, and supports backup master and load balances master CPU bound control traffic across multiple CPUs in the stack for optimal efficiency.

Traffic-Flow Features

The DXS-3200 series switches include special features that help control the flow of packets within a stack. Ports that connect systems directly to each other are called stacking or cascade ports.

Single-Target Packets (Unicast traffic)

A single-target destination packet (unicast) is associated with a destination device number and port number. If the destination device is a remote device, the unicast packet is sent out according to the remote device's destination ID. DNA discards any packet that has the same source and destination address, eliminating the possibility of packet looping.

Multi-Target Packets

A multi-destination packet (unknown unicast, multicast, or broadcast) is forwarded according to the VLAN ID (VID) and its multicast group assignment (VIDX). The stacking ports on the device are fixed members of all VLANs, for easy configuration, and multicast groups and propagate the packet to all relevant devices in the system. However, if the topology of the cascaded system is not a spanning tree, for example, a ring topology, a loop may exist which could cause a frame to be received several times by a single device. DNA stops this by allowing multicast destination packets to be flooded in a given topology and assigned a unique source device identifier (Source-ID) by the device that receives the packet. This Source-ID value is propagated along with the packet flow, and other devices in the topology perform filtering of packets based on their Source-ID. Once the topology is learned, the system management software calculates a spanning tree that is rooted at the local device and reaches all the other devices in the system. It then configures the Source-ID based filtering on all the devices to prevent unwanted looping. This configuration may be changed as necessary to provide fault-tolerant system architectures.

Quality of Service (QoS)

DNA includes built-in intelligence to support applications requiring Quality of Service (QoS). System designers have control over how each QoS type is handled in the stack environment. When oversubscribed, a stacking interface may suffer from congestion and packet loss. By using the DNA mechanisms, traffic on stacking ports can be classified as “data”, “control”, or “mirror-to-analyzer”. Control traffic is defined as either traffic ‘to the CPU’, or traffic ‘from the CPU’. To segregate control traffic from data and mirror-to-analyzer traffic, control traffic can be assigned a traffic class on the stacking port. A special case of control traffic is CPU-to-CPU, typically used for internal system control. To segregate this type from other less critical traffic (to and from the CPU), each type of control traffic can be assigned drop precedence. Data traffic, which is defined as network-to-network traffic, is sent across a stacking port according to a global parameter that maps the packet traffic class and drop precedence to the stacking port traffic class and drop precedence. Mirror-to-analyzer traffic can be assigned a dedicated traffic class and drop precedence for ingress mirrored traffic as well as dedicated traffic class and drop precedence for egress mirrored traffic.

DNA: The Right Architecture

Existing stacking solutions fall short in addressing the exploding needs of enterprise networks. Lacking the ability to scale longer distances, requiring deep packet processing at each intermediate switch and the inability to future-proof switching systems, all of these increase overall costs and impact performance/functionality. D-Link’s DXS-3200 series of xStack switches combine the best to create efficient and economical stacking solutions for the enterprise market. Switches built with DNA offer network managers extreme flexibility, scalable growth, and high availability. D-Link’s new xStack family of switches offers DNA technology to meet the needs of today with the ability to scale for tomorrow.