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INFOBrief

PowerConnect 6024 and 6024F Routing Switches

As managed Layer 2 networks continue to grow, the need for interoperable, industry-standard Layer 3 LAN routing switches becomes even more important. Enterprise-class Layer 3 switches must interoperate with existing network equipment and leverage established networking knowledge, such as Command Line Interface (CLI). Standards-based networking equipment should maximize currently deployed tools, such as SNMP-based software applications. The PowerConnect 6024 and 6024F switches provide the network administrator the ability to route data between multiple subnetworks or VLANs, prioritize network traffic, and manage multicast data.

Front view of PowerConnect 6024



Front view of PowerConnect 6024F



Rear view of PowerConnect 6024/6024F



Key Points

- The Dell PowerConnect™ 6000 Series Gigabit Ethernet routing switches are designed to address the connectivity needs of medium and large organizations. These switches provide Layer 3 protocol support, high-availability features and flexible copper and fiber connectivity options with advanced Quality of Service, security and management tools.

- The PowerConnect 6024 and 6024F are rack-dense, fixed-port Gigabit Ethernet Layer 3 switches delivering wire-speed switching performance. Offering 24 Gigabit Ethernet ports in a 1U form factor, the PowerConnect 6024 and 6024F each have a total switching capacity of 48 Gbps and a maximum forwarding rate of 35.6 Mpps. The PowerConnect 6024 has 24 copper Gigabit Ethernet ports and 8 combo fiber SFP slots, while the PowerConnect 6024F has 24 Gigabit fiber SFP slots and 8 combo copper ports. The SFP transceiver slots can be used interchangeably with the copper ports to yield exactly 24 usable ports of Gigabit Ethernet on either switch. Optional 1000 Base-SX transceiver modules support transmission distances up to 550m, while optional 1000 Base-LX transceiver modules support transmission distances up to 10km. Both distances are based on fiber type.
- The PowerConnect 6000 Series switches support a variety of advanced industry standards-based routing and switching features, allowing an administrator to optimize traffic flow in the network. Routing Information Protocol (RIP), Open Shortest Path First (OSPF), and Virtual Redundant Routing Protocol (VRRP) are supported, along with IP Multicast (IGMP) and Distance Vector Multicast Routing Protocol (DVMRP). The PowerConnect 6024 and 6024F can support up to 4063 VLANs, the addition of which enables limitation of broadcast domains in order to increase network security. GVRP (GARP VLAN Registration Protocol) provides for dynamic port-based VLAN configuration as per IEEE 802.1Q and helps reduce administrative tasks associated with static VLANs. Other advanced features include port mirroring, and static and dynamic link aggregation (LACP).
- The PowerConnect 6024 and 6024F switches support a number of management interfaces, including an easy-to-use embedded Web interface as well as an industry-standard CLI, which allows network administrators to utilize existing switch configuration skills. Out-of-Band management access is enabled via a dedicated Fast Ethernet port or a serial RS-232 connection. The switches can be managed via Dell OpenManage IT Assistant and Dell OpenManage Network Manager, as well as third party SNMP-based management console applications. The PowerConnect 6024 and 6024F support a comprehensive Management Information Base (MIB) and four RMON groups (history, statistics, alarms and events). To assist with centralized management of the network infrastructure, the switches also support remote logging via syslog.
- Network traffic prioritization is a key requirement for deploying emerging applications like videoconferencing and voice-over-IP. The PowerConnect 6024 and 6024F provide eight priority queues per port. Packets can be classified based on the Layer 2 IEEE 802.1p standard, the Layer 3 IP Precedence or IP Differentiated Services Code Point (DSCP) standard, or Layer 4 utilizing TCP/IP ports. Advanced flow-based policies enable the network administrator to implement rate limiting, metering and bandwidth guarantees to ports, link aggregation groups and VLANs. These capabilities help increase capability of the network

to scale with growth while protecting networking infrastructure investments.

- Advanced security features of the PowerConnect 6000 Series help protect the network from accidental or malicious interference. MAC-based port security is designed to prevent unauthorized MAC addresses from accessing the network. This feature can send an SNMP trap to alert select administrators whenever an unknown MAC address attempts to access the network, and can shut down the port if desired. Access Control Lists (ACLs) deliver even tighter control over the network by limiting what types and volumes of traffic are allowed based upon the flow's source or destination MAC address, source or destination IP address, source or destination TCP/UDP port, DSCP value or IP Precedence. SSL and SSH encryption offer the added security of encrypting switch management traffic. RADIUS support enables centralized, remote authentication of administrative access to the switch. SNMP access filtering provides a mechanism to limit network hosts that have SNMP access to the switches.
- The PowerConnect 6000 Series offers several high availability features to meet demanding enterprise networking needs. Hot-swappable power supplies and cooling fans on the switches help minimize network downtime. The PowerConnect 6024 and 6024F support Virtual Redundant Routing Protocol (VRRP) to dynamically replicate the routing information across the LAN. Dual configuration files and firmware images are also available for rollback purposes if the switch setup has a problem for any reason. In addition, the switches also support an Integrated Cable Tester (ICT) feature that can identify and locate a variety of potential cable problems.

Product Description

The PowerConnect 6024 and 6024F are Layer 3 routing switches offering 24 ports of Gigabit Ethernet in a rack-dense 1U form factor. The PowerConnect 6024 has 24 copper RJ-45 connections and 8 combo fiber SFP slots, while the PowerConnect 6024F has 24 fiber SFP slots and 8 combo copper RJ-45 connections. PowerConnect 6000 series switches support various Layer 3 routing protocols such as RIP, OSPF, and VRRP, while further enhancing availability through dual internal hot-pluggable power supplies and cooling fans. These switches support an industry-standard Command Line Interface (CLI) as well as a web-based Graphical User Interface (GUI) for easy, powerful switch management.

PowerConnect 6024 versus PowerConnect 5224

Table 1 below compares the PowerConnect 6024 to the PowerConnect 5224. The PowerConnect 6024 is designed for customers who need high availability Layer 3 Gigabit Ethernet solutions, while the PowerConnect 5224 is ideal for networks where cost-effective, high-performance Layer 2 Gigabit Ethernet connectivity is required.

Table 1
PowerConnect 6024 comparison to the PowerConnect 5224

Features	PowerConnect 5224	PowerConnect 6024
Total Switching Capacity	48 Gbps	48 Gbps
Maximum Forwarding Rate	35.6 Mpps	35.6 Mpps
Gigabit Ethernet Ports	24 copper GbE ports OR 4 optional fiber GbE via SFP transceivers	24 Copper GbE ports OR 8 optional Fiber GbE via SFP transceivers
High Availability	Optional RPS-600	Integrated redundant hot-swappable power supplies and cooling fans, VRRP protocol, ECMP, Integrated Cable Tester
Layer 3 Protocols	None	RIP v1 / v2, OSPF v1 / v2 w/ ECMP, CIDR, IGMP, VRRP, Static Routes (up to 128)
802.1Q VLAN	Up to 256	Up to 4063
GVRP	Yes	Yes
Quality of Service	L2/L3-aware Trust Mode	L2/L3/L4-aware Trust Mode; L2-L4 Advanced Mode
Priority Queues	4	8
Link Aggregation	Yes, LACP and manual (IEEE 802.3ad)	Yes, LACP and manual (IEEE 802.3ad)
Multicast Support	Yes, IGMP Snooping	Yes, IGMP Snooping, IGMP, DVMRP
Spanning Tree Support	Spanning Tree and Rapid Spanning Tree	Spanning Tree and Rapid Spanning Tree
Remote Management	Yes	Yes
Authentication Support	RADIUS and TACACS+	RADIUS & Local user authentication
MAC-based Port Security	Yes	Yes
Management Traffic Encryption	SSL and SSH	SSL and SSH
Dual Firmware Image Support	Yes	Yes
Configuration File Management	File upload and download	File upload and download; copy file support

Features	PowerConnect 5224	PowerConnect 6024
Management		copy files support
SNMP Support	SNMP v2c	SNMP v1/v2c
Remote Logging	Syslog	Syslog
Industry-standard CLI	Yes	Yes
Form Factor	1U, rack mountable	1U, rack mountable

Target Markets/Applications

The PowerConnect 6000 Series is designed for customers who require high-performance Layer 3 connectivity to resources like high-speed network backbones and servers, or for customers who need LAN routing at the edge of the network. Additionally, these routing switches are ideal for customers with growing networks because of their support of copper and fiber Gigabit Ethernet media to help future proof the network topology.

- Traffic Aggregation to Network Backbone: The PowerConnect 6024F can form a Gigabit Ethernet aggregation layer/backbone via its SFP fiber slots and the appropriate transceivers (1000SX or 1000LX). Also, seven Gigabit Ethernet aggregated links (with up to 7 member ports each) can be created to offer multi-Gigabit link bandwidth as well as automatic fail-over in the case of a failed link within the aggregation group.
- Cost-Effective Gigabit Ethernet Datacenter Switch: Up to 23 Gigabit-enabled servers can be connected to the PowerConnect 6024 in the datacenter to support Gigabit connectivity between datacenter servers and the network core. Alternatively, 20 servers can be connected to a PowerConnect 6024 while a trunk that supports 4 Gbps can be established as the uplink to the core or backbone. Other combinations for each switch are also possible depending upon individual datacenter needs.
- Mini-Core / Branch Office Solution: Customers needing a cost effective solution for a branch office or mini-core Layer 3 application can find the features they are looking for in the PowerConnect 6024/6024F. The PowerConnect 6000 series can easily accommodate the routing needs of over 300 end stations. With dual integrated hot-swappable power supplies and cooling fans in a 1U chassis, these switches provide high availability in a small form factor. The flexible port configuration allows for high speed Gigabit Ethernet backbone and server connectivity. Users can enable static routes or Layer 3 routing protocols like RIP v1/v2, and OSPF v1/v2. Advanced Quality of Service features can also be deployed to shape network traffic and groom bandwidth.

Features and Benefits

The features and benefits of the PowerConnect 6024 and 6024F are shown in the following table.

Table 2

Features, Functions and Benefits of the PowerConnect 6000 Series

Feature	Function	Benefit
Total Switching Capacity	Enables full wire-speed switching across all ports, including Gigabit Ethernet ports/slots.	Can maximize the available bandwidth of your network.
Maximum Forwarding Rate	Enables wire-speed switching and routing across all ports, including Gigabit Ethernet ports and SFP slots.	Helps take full advantage of the speed of the devices connected to the switch.
Built-in Copper Gigabit Ethernet Ports	Provides up to 10-times higher bandwidth than Fast Ethernet ports.	Helps eliminate performance bottleneck at critical traffic aggregation points; can use Gigabit Ethernet with standard Cat5 cabling, but Cat5e cabling is recommended.
Fiber-Capable Gigabit Ethernet Ports	Accommodates various types of fiber interface modules (e.g., 1000SX, 1000LX; modules sold separately).	Flexibility to use fiber media if large distances have to be covered by the network.
High Availability	Delivers high availability with redundant hot-swappable power supplies, cooling fans and VRRP protocol.	Provides additional reliability for mission critical networks while helping to save money when compared to deploying external redundant power supplies.
MAC Address Table	Stores MAC addresses in internal memory.	Provides lower-latency forwarding of data to a maximum of 14,000 MAC addresses stored in memory.
MAC-Based Port Security	Port locking feature.	Network security based on MAC addresses associated on a specific port of the switch.
Access Control List (ACL)	Up to 1024 ACLs supported in the system. ACLs are comprised of Access Control Elements (ACE). Up to 1024 ACEs are supported in the system. ACLs can be either IP-based or MAC-based.	Provides added security to the switch, and also serves as a basis for Quality of Service mechanisms.
RIP	RIP allows routers to exchange routing table information.	Perhaps the easiest routing protocol to install and manage, RIP provides simple LAN

Feature	Function	Benefit
		routing for small and medium sized networks.
OSPF	Open Shortest Path First routing protocol sends information to all nodes in the network to calculate the shortest path to each hop.	Provides a method of determining the networks topology, flexible in a topology that is subject to changes. OSPF provides less "Network Chatter" and can scale into larger environments.
CIDR	Provides a single IP address that can be used to designate many unique IP addresses.	Helps reduce the size of routing tables and makes more IP addresses available.
IRDP	Helps the PowerConnect 6024/6024F to discover the IP addresses of their neighboring routers.	Provides the ability to track dynamic changes in router availability.
ICMP	Used for out-of-band messages related to network operation or malfunction.	Helps routing devices to communicate with each other to determine the network status.
VRRP	Virtual Router Redundancy Protocol is used to replicate routing tables between routers.	Defines a master and backup routers to maintain a copy of the networks routing table. The backup router is elected if the master is no longer available.
ARP	A TCP/IP protocol used to convert an IP address into a physical address.	Allows a routing device to determine the physical addresses of other devices connected to it.
IGMP	The standard protocol for Multicast traffic.	The protocol allows a host to inform its local router, using Host Membership Reports, that it wants to receive messages addressed to a specific multicast group.
DVMRP	Distance Vector Multicast Routing protocol.	Allows the network to advertise the shortest-path (as counted in hops).
Static Routes	Allows the user to manually enter static addresses of other network routes.	Provides an easy method to recording known hops in small or static networks.
802.1Q VLAN	Virtual LANs combine a number of ports into distinct, separated sub-networks. GVRP allows for	Allows for limitation of broadcast domains as well as improved security. GVRP

Feature	Function	Benefit
	dynamic port-based VLAN configuration as per IEEE 802.1Q.	provides dynamic VLAN configurations and reduces administrative tasks associated with static VLANs.
802.1p Priority	Utilizes separate transmission queues for low and high priority traffic.	Helps ensure low-latency delivery of time critical network traffic, e.g., traffic associated with voice or video communication.
Quality of Service (QoS)	Prioritizes traffic based upon user-defined criteria, including L2, L3 and L4 information.	Helps ensure time-critical network traffic is delivered as per network administrator's prioritization needs. Helps expedite traffic based upon L2, L3 or L4 information, such as IP ToS, and provides greater control over traffic flow within the network.
Link Aggregation (802.3ad)	Groups up to seven ports together into a single, high-bandwidth trunk. LACP provides automatic detection of link aggregation groups.	Helps increase bandwidth for critical network links (e.g., uplinks to a network backbone) and creates link redundancy. LACP provides easy to deploy and resilient link aggregation groups.
Multicast Support	Detects ports that are participating in IP Multicast communication, e.g., multimedia streams.	Limits broadcast traffic to those ports that are actually participating in the communication.
Spanning Tree Support	Automatically configures ports for speed, duplex mode, flow control and cabling used. Rapid spanning tree improves the time to reconfigure the topology as compared to standard spanning tree.	Helps reduce network set-up time and improves network availability by automatically activating standby links when current link goes down.
Management	Enables remote configuration and monitoring of the switch via a Web-browser or a SNMP-based management console application. Industry standard CLI provides command line interface for switch configuration.	Allows a network administrator to detect and remedy problems at local and remote locations. Industry standard CLI leverages network administrator's knowledge of industry-standard CLI and provide a common platform for switch configurations.
Authentication Support	SSL provides encryption of management traffic when accessing the switch via the embedded web server. SSH	Helps enhance the security of the network by encrypting network management traffic.

Feature	Function	Benefit
	provides encryption of management traffic when accessing the switch via CLI.	
IP Address Management	Allows the network administrator to assign an IP address statically or dynamically.	Provides the network administrator options for assigning IP addresses to a switch, including the flexibility to use a BootP or DHCP server for IP assignment.
Configuration File Management	Enables the uploading and downloading of configuration files, as well as copying configuration files (running, startup, backup).	Provides the network administrator an easy and expedient mechanism to configure a switch or multiple switches; administrator can leverage one switch configuration for multiple switches.
Redundant Power Supply	Provides continuous power in the event the primary power supply fails.	Helps increase system availability and reduce system down-time.
Form Factor	Height of switch is limited to 1U.	Saves rack space.
Standard Service	Provides end-user unit replacement in the event of a failure.	Provides next-business day Advance Exchange Service ² replacement to help improve network up-time.

Key Customer Benefits

- **Scalability**

The PowerConnect 6024 and 6024 F provide a variety of Layer 3 features that allow them to be deployed in applications such as routing at the network edge, aggregation of network traffic to the backbone, and core routing in small to medium networks or branch office applications.

- **Support for standards-based advanced switching features as well as standards-based remote management**

The PowerConnect 6024 and 6024F support a variety of open standards to deliver advanced features that help optimize overall network performance (e.g., Layer 2/3/4 Class of Service or IGMP snooping), availability (port trunking) and security (VLAN). Remote management is supported via a web browser-based switch management interface as well as Telnet access to the CLI (Command Line Interface). SNMP-based remote management is also

accomplished with a broad variety of management tools like the Dell OpenManage Network Manager.

- ***Advanced security capabilities***

With MAC-based port security, multi-layer Access Control Lists (ACL), SSL/SSH management traffic encryption, management authentication (including RADIUS) and SNMP access filtering, the PowerConnect 6024/6024F switches deliver advanced user-customizable network security capabilities.

- ***Enhanced availability***

Integrated dual hot-swappable power supplies and cooling fans improve system uptime and minimize the potential for an inoperable switch. The dual hot-swappable power supplies can also help save on infrastructure costs during deployment by providing the integrated function of an external redundant power supply. The PowerConnect 6024 and 6024F switches also support Virtual Redundant Routing Protocol (VRRP) to enhance availability at the router level.

- ***Ideal solution for customers with growing and consolidated datacenters***

The PowerConnect 6024 and 6024F switches provide a high-performance, wire-speed Gigabit Ethernet routing solution. The 1U form-factor allows customers to grow their datacenters while minimizing the amount of rack space required (additionally, no external redundant power supply is necessary.) When the customer network has to cover extended distances, the PowerConnect 6024F can aggregate fiber-based Gigabit Ethernet connections (via SFP modules) into the datacenter.

Typical Implementations

Diagram 1. Cost-Effective Gigabit Datacenter Solution

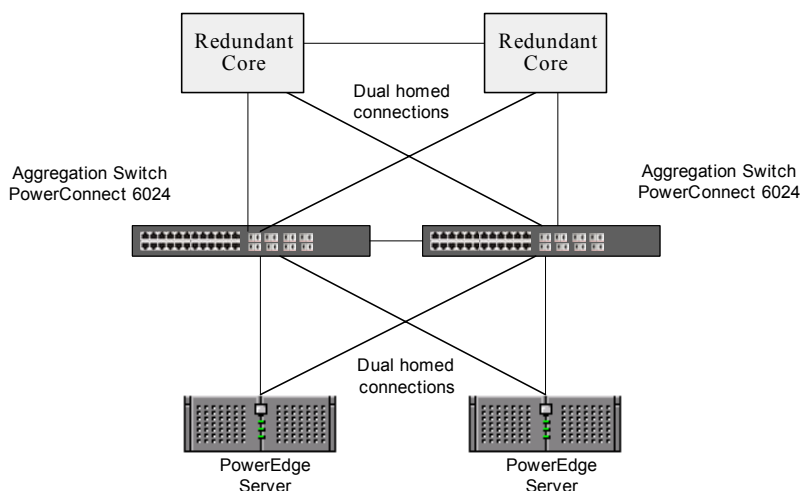


Diagram 1 is an example of a resilient datacenter center designed using PowerConnect 6024 switches. This solution provides high availability wire-speed Gigabit routing capabilities to access a large number of servers. Servers can be connected to the switches using either copper or fiber cabling. Each switch is capable of supporting up to 21 servers while providing resilient Gigabit Ethernet uplinks to the network core. Additionally, the two PowerConnect 6024 switches are connected to each other to provide higher availability. In the event of an uplink from either switch losing communication with the core, traffic can still be routed via the failover links. With the Virtual Redundant Routing Protocol (VRRP), the routing tables are replicated between the two switches. To ensure high availability, the PowerConnect 6024's integrated redundant hot-swappable power supplies and cooling fans maximize the uptime of the network. Standards based networking protocols help keep deployment challenges to a minimum.

Application benefits include:

- Highly-available network connectivity
- High-performance server connectivity
- Cost-effective server connectivity

Diagram 2. Aggregation Solution

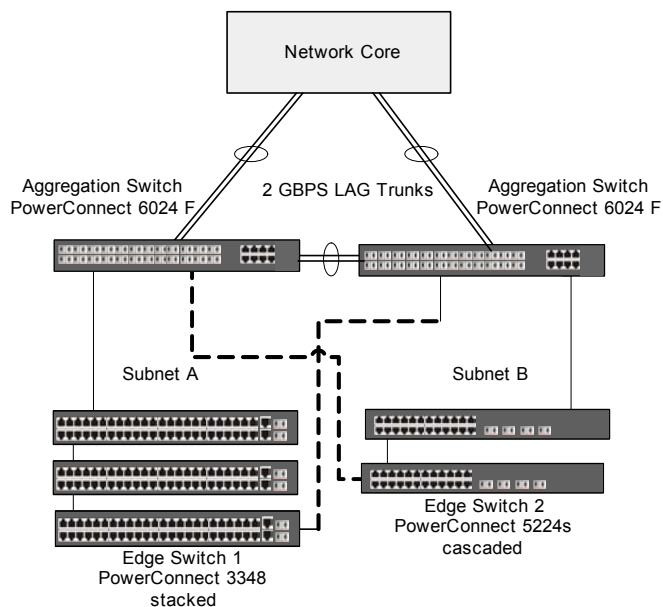


Diagram 2 is an example of a traffic aggregation solution designed using PowerConnect 3348, 5224 and 6024F switches. This solution can provide high availability and fail-over protection for a large number of desktop clients.

In this example, the PowerConnect 6024F switches connect different subnets or VLANs to the network core using multiple fiber SFP ports as a single IEEE 802.3ad aggregated link. The aggregation switch provides Layer 3 capabilities which enable it to route traffic without having to

switch all packets to the core. Data leaving the stack of Edge Switch 1 with a destination address at Edge Switch 2 would not have to take the additional hops of going to the core of the network and then back out to Edge Switch 2.

In this scenario, the aggregation switch can actually run multiple links to the network core and to the edge switches to provide faster connectivity. Edge Switch 1 consists of three stacked PowerConnect 3348s that are linked together via their stacking modules. One uplink is connected to the first PowerConnect 6024F at the top of the stack, while a second uplink is connected to the redundant PowerConnect 6024 F. This creates multiple data paths to the core, providing high availability of the network data. Edge Switch 2 is similar except the switches are cascaded to each other via their Gigabit ports. Multiple Spanning Tree protocol on the PowerConnect 6024 switches is enabled to help prevent a broadcast storm. RIP or OSPF routing can be enabled to route data between these subnets.

Application benefits include:

- High bandwidth network from the desktop to the core
- Resilient and cost-effective wiring closet solutions
- Cost-effective aggregation solution

Diagram 3. Mini-Core or Remote Office Solution

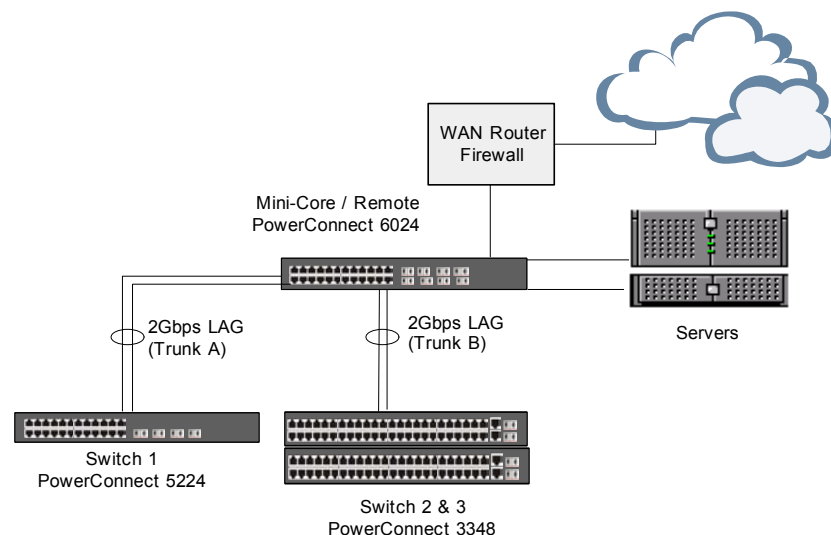


Diagram 3 is an example of a Gigabit Ethernet mini-core or remote office solution designed using the PowerConnect 6024. This solution provides Gigabit Ethernet connectivity to the local servers and WAN/firewall devices. Uplink trunks from switches 1, 2 and 3 are aggregated to the PowerConnect 6024, thus providing a high speed connection from the edge switches. This solution provides both high-performance and high reliability while offering Layer 3 routing functionality in a mini-core application. The solution can easily scale by adding additional PowerConnect 6024 switches to create a redundant mini-core network.

With the Virtual Redundant Routing Protocol (VRRP), the PowerConnect 6024 switches will synchronize their routing tables with one another to ensure fail-over support in the event of a switch or link failure. Additionally, the PowerConnect 6024 can be configured with up to seven trunk groups (with a maximum) of seven ports in a trunk group to provide high performance link aggregation.

Both a Web-based GUI and a Command Line Interface are available to manage the device. The PowerConnect 6024 can also be managed remotely via common SNMP management tools and supports switch access password protection. SNMP access filtering is used to provide secure access to the device along with SSH/SSL encryption of the management traffic. Dell OpenManage IT Assistant provides a single console to manage your servers, workstations and network switches. If a more advanced network management tool is required, Dell's OpenManage Network Manager allows you to easily administer your managed PowerConnect switches in a one-to-many fashion.

Application benefits include:

- High availability
- High-performance connectivity to server workgroups
- Scalability
- Security
- Remote management capabilities

Service and Support

Standard Warranty and Service Plan

- Three-year limited warranty¹ supplemented with three years of Next Business Day Advanced Exchange Service²
- 7-day/24-hour Telephone Technical Support for troubleshooting and diagnosis of Dell hardware
- 7-day/24-hour Online Support Services
- Lifetime firmware upgrades (available for download via support.dell.com)

Warranty and Service Upgrades

You can upgrade to three years of Advanced Exchange Service with Same Day response, or five years of Advanced Exchange Service, with either Same Day or Next Business Day response. You may also choose three or five years of On-Site Hardware Support Service², with either Same Day or Next Business Day response.

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- Remote Software and Storage Support

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- Customer-defined Call Priority so that you maintain control of your case
- On-Demand Engineer Dispatch for select Severity 1 incidents to quickly receive on-site service
- Software Support Resolution Pack
- Web-Based Remote Troubleshooting to quickly mobilize experts

Dell PowerConnect 6000 Series switches feature the Prestera™ chipset from Marvell®.

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