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high-performance

# power over ethernet

## gigabit connectivity

**Product Brief**

## Nortel Networks BayStack 5520 Switches

*Figure 1. The BayStack 5520-24T-PWR Switch (top) and BayStack 5520-48T-PWR Switch (bottom)*

### BayStack 5520 Switch benefits

- Power to IP phones, wireless access points, network cameras, security and lighting devices, and access control devices
- Provides power on all ports
- IEEE 802.3af compliant to power multiple vendors' equipment
- Enables data and power to be transmitted over a single cable without using power outlets
- Automatically provides power to a detected device
- Up to 384 ports of Gigabit desktop connectivity in an 8-rack unit high design—the highest density in the industry
- Industry-leading Gigabit Ethernet performance with innovative stacking using FAST stack (Flexible Advanced Stacking Technology)—providing up to 640 Gbps
- High-performance switch fabric of 160 Gbps assures wire-speed operation with no packet loss
- Hardware-based Layer 3 routing at wire-speed and across the stack
- Intelligence at the network edge with Quality of Service (QoS)
- Cost-effective plug-and-play stacking with built-in stacking ports
- Up to 32 built-in SFP GBIC uplink ports in a stack
- Flexible stacking across all BayStack 5000 series switches—a stack is managed as a single entity with a single IP address
- Unmatched resilient connectivity and stackability for minimal network downtime
- Secure access and data traffic protection
- All BayStack switches come with a lifetime warranty

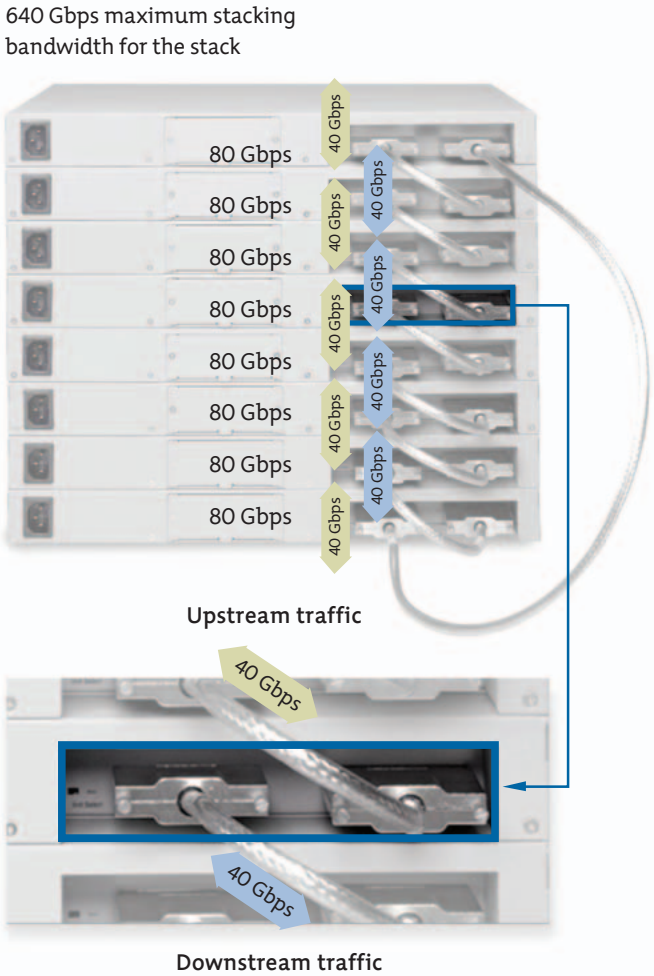
The way in which businesses use LANs is changing and the performance requirement at the edge of the network is becoming more demanding. IP Telephony and other collaborative applications are driving more traffic to the edge of the network. As file sizes continue to grow, users need more bandwidth. Quite simply, the convergence of voice, video, data, and storage enables users to do more from their desktop. Enterprises need to be able to address today's increased demands and still prepare for the unknown demands of tomorrow. By re-assessing how they're using the wiring closet, they can achieve both goals, and be assured that their investments will be protected for a long time to come.

Power over Ethernet (PoE) technology provides power and data connectivity to devices such as Internet telephones, wireless access points, network cameras, security and lighting devices, and access control devices. According to IDC's Worldwide Power over Ethernet 2004-2008 Forecast and Analysis report, the Power over Ethernet market revenue is expected to grow at an 8.9 percent CAGR (compound annual growth rate) over the next five years.

Part of Nortel Networks BayStack 5000 Series, BayStack 5520 Switches are one rack unit high stackable 10/100/1000 Mbps Ethernet Layer 3 routing switches designed to provide high-density Gigabit desktop connectivity and Power over Ethernet capability to mid-size and large enterprise customers' wiring closets.

Available in two models (Figure 1)—BayStack 5520-48T-PWR Switch with 48 10/100/1000BASE-T RJ-45 ports, and BayStack 5520-24T-PWR Switch with 24 10/100/1000 BASE-T RJ-45 ports—they feature four built-in SFP GBIC ports for uplink. Both models may be stacked with each other or themselves, in stacks of eight units, to achieve a maximum of 384 10/100/1000 ports for high-density desktop switching. These models will also be able to stack with the BayStack 5510 Switches and future BayStack 5000 models.

*Figure 2. Innovative FAST stacking*




## Highest-density Gigabit desktop switching

The BayStack 5520-48T-PWR PoE Switch features 48 10/100/1000 BASE-T RJ-45 ports for desktop switching and four built-in SFP (Small Form Factor Pluggable) GBIC ports for uplink. Ports 45, 46, 47, and 48 offer configuration flexibility by allowing the network administrator to configure each port as either 10/100/1000 or make use of the built-in SFP GBIC. However, power will still be provided from ports 45-48 and can be used to troubleshoot or power any 802.3af compliant device that only requires power and not a data connection. As many as eight BayStack 5520-48T-PWR Switches can be stacked to achieve up to 384 10/100/1000 ports for highest-density desktop switching.

The BayStack 5520-24T-PWR PoE Switch offers 24 10/100/1000BASE-T RJ-45 ports for desktop switching and four built-in GBIC ports for uplink. Ports 21, 22, 23, and 24 offer configuration flexibility as either a 10/100/1000 or a built-in SFP GBIC port. However, power will still be provided from ports 21-24 and can be used to troubleshoot or power any 802.3af compliant device that only requires power and not a data connection. Both BayStack 5520-24T-PWR and BayStack 5520-48T-PWR Switches may be combined in a single stack for maximum flexibility.

## IEEE 802.3af compliant

The BayStack 5520 Switches are IEEE 802.3af compliant. They can provide Power over Ethernet to any IEEE 802.3af compliant device such as IP phones, wireless access points, network cameras, security and lighting devices, and access control devices. The benefit of being interoperable with standards-based equipment means that customers are not forced to tie themselves to any one vendor, as the switches have the flexibility to power multiple vendors' devices. The BayStack 5520-48T-PWR Switch can supply power up to 15.4 W per port (with the addition of the BayStack 15 PSU and RPSU module). Without BayStack 15 Power Supply Unit (PSU), the BayStack 5520-48T Switch would supply an average of 6.5 W per port (ports can exceed 6.5 W per port as long as the total of all ports requiring power does not exceed 320 W). The BayStack 5520-24T-PWR Switch can supply up to 15.4 W per port as well (with the addition of the BayStack 15 PSU). Without BayStack 15 PSU, the BayStack 5520-24T-PWR Switch would supply an average of 13 W per port (ports can exceed 13 W per port as long as the total of all ports requiring power does not exceed 320 W).

### Auto discovery feature

The BayStack 5520 Switches automatically recognize the connection of a Power over Ethernet device and immediately send power to it. This automatic capability ensures fast connectivity without manual intervention.

### Dynamic power management

Each port can be configured to limit the power delivered to a device. Each port can also be configured for power priority level—low, high, and critical. On the switch, total available power is monitored. In the case where all available power is fully utilized, the switch may turn off lower priority ports and turn on higher priority ports.

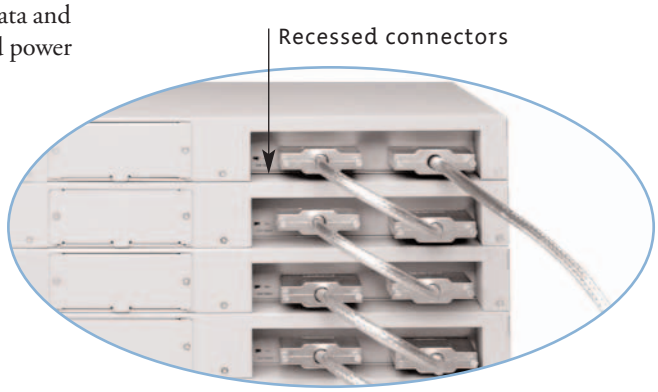
### Active circuit protection

The BayStack 5520 Switches can automatically disable a port if there is a short. All the other ports on the switch will remain active and will not be affected by the disabled port.

### Plug-n-play IP Telephony switching

The BayStack 5520 Switches provide simplified Web-based configurations on data and power properties. The graphical user interfaces make it simple to set up data and power configurations.

*Figure 3. Recessed stack connectors*




### Convenience of a single cable

With the BayStack 5520 Switches, data and power can be transmitted over one cable without using a power outlet. There is no need for a separate cable connecting the device to a power outlet.

### Significant space and cost savings

Traditionally, a mid-span patch panel device connects via a UTP cat 5 cable to a standard Ethernet switch and then the mid-span patch panel device sends power over another standard UTP cat 5 cable to the device such as an IP phone needing power. In essence, two units are needed for Power over Ethernet capability. In contrast, a BayStack 5520 Switch integrates standard LAN switch functionality with the power over UTP cable capability of a mid-span patch panel into one unit. This results in significant cost and space savings.

### Innovative FAST stacking design

Nortel Networks innovative FAST (Flexible Advanced Stacking Technology) stacking design of the BayStack 5520 allows for simultaneous bi-directional traffic flow on each stacking port (Figure 2). In a full stack, this design yields up to 640 Gbps—the highest stacking bandwidth in the industry today.

### Switch fabric architecture offering non-blocking wire-speed performance

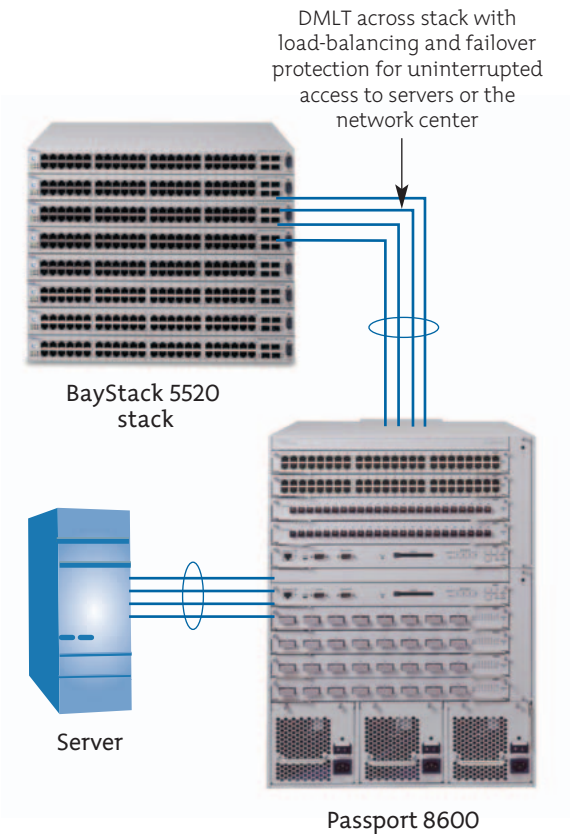
The BayStack 5520 Switches have a high performance Layer 3 switching fabric with a maximum of 160 Gbps forwarding bandwidth and wire-speed performance. The forwarding rate for the BayStack 5520-48T-PWR is 71.4 Mpps (million packets per second) and for the BayStack 5520-24T-PWR is 35.7 Mpps.

### Layer 3 switching

The BayStack 5520 Switch architecture supports wire-speed Layer 3 IP switching across the stack with static and local route support.

The BayStack 5520 switches support high-performance wire-speed IP routing between VLANs. IP routing with static routes at the edge improves the network performance as the packets do not have to go to the core and the routing takes place within the switch or stack. To configure IP routing on the BayStack 5520 Switches or stack, you must use virtual LANs (VLANs) to create IP interfaces. You can create IP interfaces by assigning an IP address to a VLAN. Once VLANs are created, you must also create static routes between the BayStack 5520 Switches and the end device.

*Figure 4. Distributed Multi-Link Trunking (DMLT) across stack*




The BayStack 5520 Switches support the DHCP (Dynamic Host Configuration Protocol) Relay feature that provides the system with the ability to relay DHCP requests to the DHCP server and eliminates the need for a DHCP server on every subnet. It forwards a request for an IP address from a client to a DHCP server across subnets.

Software feature enhancements are planned to include support for routing protocols such as Routing Information Protocol (RIP v1/v2)†.

### Compact form factor

The BayStack 5520 Switches are offered in a compact one-rack unit high design. An eight unit stack provides up to 384 10/100/1000 ports. This allows for significant space and cost savings in the wiring closet.

### Up to 32 built-in GBIC ports in a stack

BayStack 5520 Switches have four built-in SFP GBIC ports for dedicated uplink connectivity to network core switches such as the Passport 8600. This increases the uplink bandwidth as GBIC ports are not required for stacking purposes. Using the proven Distributed Multi-Link Trunking (DMLT) resiliency feature, up to 32 GBIC ports are available for pure uplink connectivity in a full stack—among the highest in the market. BayStack 5000 Switches have also been architected to support future technologies such as 10 Gigabit uplinks.

### Plug-and-play stacking with built-in stacking ports

BayStack 5520 Switches have built-in stacking ports for faster, plug-and-play stacking. This is more cost-effective as cascade modules are not required. This stacking design frees up both of the uplink ports for dedicated connectivity to the backbone. BayStack 5520 Switches include a cascade cable (1.5 feet). In addition, cascade cables are available in different lengths—1.5 feet, 10 feet, and 5 meters (16.4 feet)—to cover a variety of stacking needs.

### Recessed stacking connectors for higher reliability

BayStack 5520 Switches are designed with recessed stacking connectors that save premium closet space and protect the integrity of the stack from accidental contact (Figure 3).

### BoSS (BayStack operating system Switching Software)

BoSS for BayStack 5000 Switches is a single software image that allows BayStack 5520-48T-PWR, 5520-24T-PWR, 5510-48T, 5510-24T, and future BayStack 5000 models to stack together. BoSS for BayStack 5000 Switches is specific to this next generation of stacking switches, with a software image that supports this new architecture. Earlier BayStack switches support a different version of BoSS—although all share the same core software.

### Simplified network operations

BoSS simplifies network operations by reducing the number of steps required for switch software updates. With BoSS, only a single image needs to be downloaded from Nortel Networks support site for all BayStack 5000 Switch types. Loading the image to different switches is also considerably simplified. The image is loaded only to the base unit of the stack which automatically loads it to other switches in the stack.

### BoSS v4.1 features

Newly released BoSS version 4.1 is included with the BayStack 5520 Switches and is downloadable from the Web for free for BayStack 5510 Switch users. It includes support for the following new features:

- IEEE 802.3ad Link Aggregation
- Default IP address
- Auto unit replacement (config only)
- Simple Network Time Protocol (SNTP)
- System Classifier (Offset Filtering)
- Syslog
- Web Quick Start
- Port Shaping
- 802.1x Enhancements (Multiple Hosts/Multiple Authentication and Guest VLAN)

### IEEE 802.3ad Link Aggregation

IEEE 802.3ad provides an industry-standard method for bundling multiple links together to form a single trunk between two networking devices. BoSS 4.1 supports both Dynamic Link Aggregation Group (LAG) trunks and MLT trunks. Once configured, the Link Aggregation Group or trunk group is managed by the Link Aggregation Control Protocol (LACP). BayStack supports both Link Aggregation and MLT groups. Up to six LAG or MLT groups are supported. The maximum number of active links per group is four. The Link Aggregation allows more than four links to be configured in one Link Aggregation group (LAG). The first four high priority links will be active links and the lower priority link will be a standby link. When one of the active links goes down, the standby link will become active. This feature can be implemented by using Command Line Interface, Device Manager, or SNMP.

### Default IP address

Customers can discover, manage, and configure the switches remotely without having to assign a new IP address to the unit. The default IP address and subnet mask set for the switch/stack will be 192.168.192.168/255.255.255.0 and can be set via the front panel User Interface button.

### Auto unit replacement (config only)

Users can replace a failed unit in the stack without having to re-configure the new unit after placing it in the stack. For this feature to work, the unit that is being replaced must have BoSS v4.1. The next software release will not require the unit being replaced have the same version as the new unit being added.

### Simple Network Time Protocol (SNTP)

With this feature, synchronization of the switch or stack's clock to the real-time clock on the SNTP server is allowed. If the system (switch or stack) uses SNTP, then SNTP time is used to time-stamp system log (Syslog) messages. If SNTP is not in use, then the system uses a time-stamp relative to boot time.

### System Classifier (Offset Filtering)

Users can now define their own filters using any 32 bytes in the first 80 bytes of the packet for more QoS granularity. This gives greater classification capabilities on the switch; the user is no longer limited to just using certain protocol header fields such as VLAN ID, IP source address, or IP protocol field for classification.

***Nortel Networks unique FAST stacking design supports an optimal data flow across the stack using a shortest path algorithm.***

***Most vendors today employ a traditional ring architecture, meaning that a packet travels on the ring in only one direction.***

***For example, in a stack of eight switches, if a packet needs to go from unit 2 to unit 3, it can get there in a single hop. But if a packet needs to go from unit 3 to unit 2, then it has to traverse from 3 to 4, 4 to 5, 5 to 6, and so on until it reaches unit 2. This requires seven hops. Nortel Networks FAST stack design uses the shortest path algorithm, which means that the packet would traverse directly from unit 3 to unit 2 in a single hop.***

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### Syslog

Timestamp can be added to log messages where the SNTP feature is enabled and the SNTP server is available. Also, internal system log messages can be copied to a remote Syslog server. Log messages can be viewed in a reverse chronological order whereby the latest message is shown first.

### Web Quick Start

Provides a quick and simple method of putting a BayStack 5500 Switch into an initial setup mode via a single screen. This makes it easier for network administrators to set up the switch.

### Port shaping

Port shaping offers the ability to limit traffic on each port. While traffic policing is needed to provide different levels of service to data streams on the ingress ports, traffic shaping is needed to smooth the traffic from the egress ports. BayStack 5520 supports port-based traffic shaping. Enterprises working with service providers or carriers utilize this feature when they are deploying Ethernet in place of the traditional Frame Relay, ISDN, or ATM WAN access solutions.

### 802.1x Enhancements (Multiple Hosts/Multiple Authentication and Guest VLAN)

With the multiple hosts/multiple authentication feature, more than one user with unique MAC addresses is allowed access to a port upon successful authentication. For example, in a conference room, if multiple users connect to a hub which is connected to a BayStack 5520 switch port, all of the users can be authenticated and allowed access to the network. Another example would be with an IP phone with an integrated three-port switch. Since there is a MAC address for the IP phone and a MAC address for the PC, without the multiple hosts/multiple authentication feature, neither would be able to access the network using today's single host/single authentication mechanism.

With the Guest VLAN feature, if a user connects to a BayStack 5520 switch port and is not recognized to be authenticated on that port, that user will be placed into a Guest VLAN with the settings as defined by the administrator. An example would be allowing a user to have extranet access, but not intranet access. If a contractor or vendor connects to a port in your network, that person will be placed into a Guest VLAN and have extranet access.

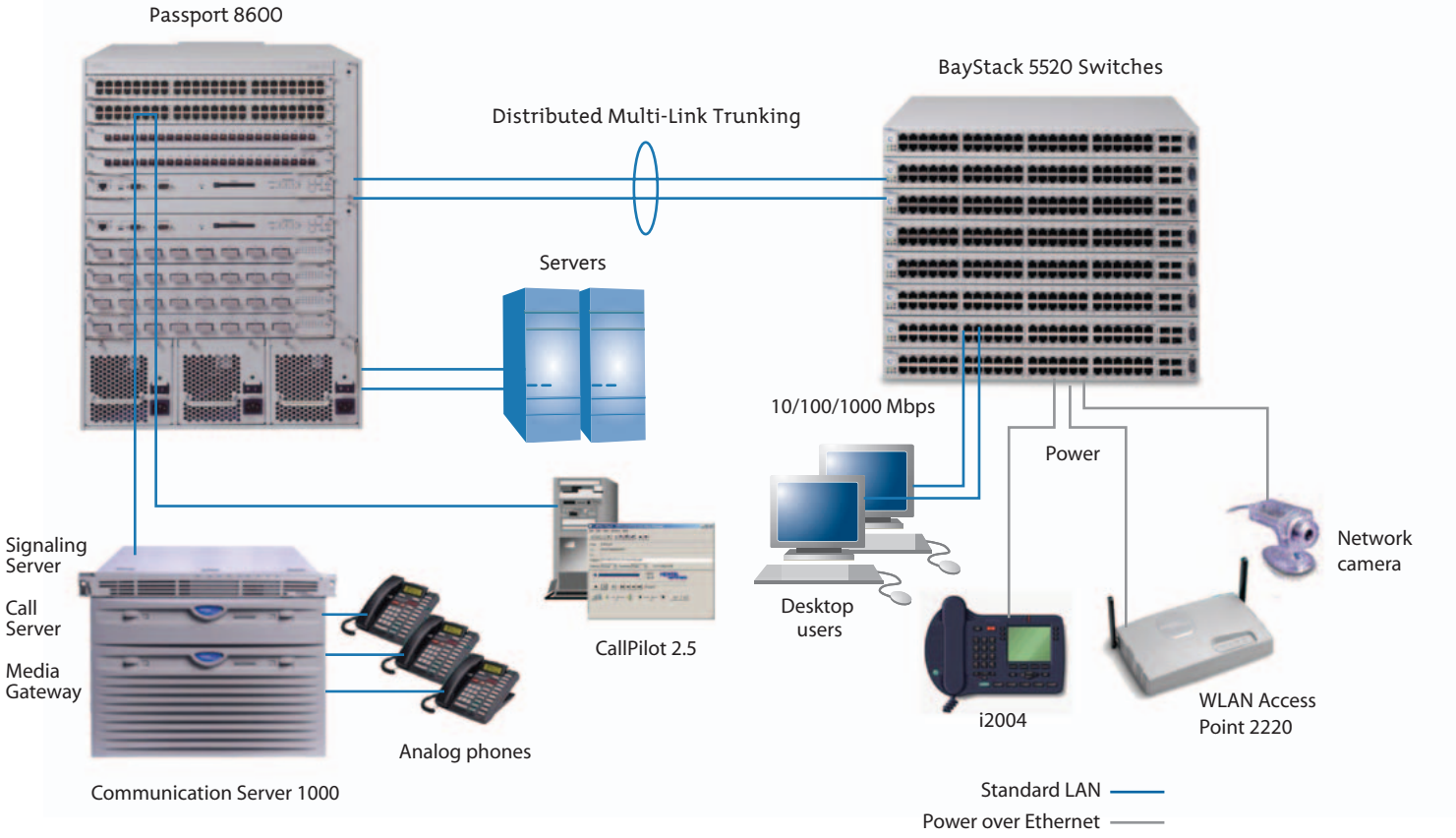
### Multi-Link Trunking

Multi-Link Trunking (MLT) enables grouping of links between the BayStack 5520 and another switch or server to provide greater bandwidth with active redundant links. Nortel Networks unique Distributed Multi-Link Trunking (DMLT) feature allows trunked ports to span multiple units of the stack for fail-safe connectivity to mission-critical servers and the network center (Figure 4). BayStack 5000 Switches have been architected to support up to 32 trunks per switch or stack, with each trunk consisting of up to eight members per trunk. Each trunk will be able to provide bandwidth of up to 16 Gbps. Currently, the BayStack 5000 Switches support up to six trunks per switch or stack, with each trunk consisting of up to four members per trunk.

The Split Multi-Link Trunking (SMLT) feature of Passport 8600 eliminates single points of failure in the network and allows wiring closet switches, such as the BayStack 5520, to have multiple active connections to the network core. All links from a distributed multi-link trunk can be active simultaneously. This allows customers to load-balance their network, double the bandwidth, and use all the ports they have paid for.

By combining the reliability of the Passport 8600 with the BayStack 5520's resilient trunking features—including DMLT, MLT, and bi-directional FAST stacking, Nortel Networks has created the next generation of flexible networking solutions. BayStack 5520 Switches are architected to support SMLT and Inter Switch Trunk (IST) in the future.

*Figure 5. Enterprise solution*




## End-to-end IP Telephony

BayStack 5520 Switches provide enterprises with another option for end-to-end deployment of IP Telephony. Communications Server 1000, Business Communications Manager*, Meridian*, and BayStack all provide the choices that allow enterprises—from small and medium businesses to large campus infrastructures—to deploy the solution that is right for them and offers the flexibility to implement infrastructure changes at their own pace. Figure 5 shows an example of a large enterprise solution.

## Integrated Time Domain Reflectometer (TDR)†

For advanced resiliency, the BayStack 5520 is architected to include an integrated TDR. This feature will simplify troubleshooting of the physical cable plant, enabling IT managers to quickly identify the failing mechanism and isolate to the source of the problem, helping ensure maximum uptime of the network.

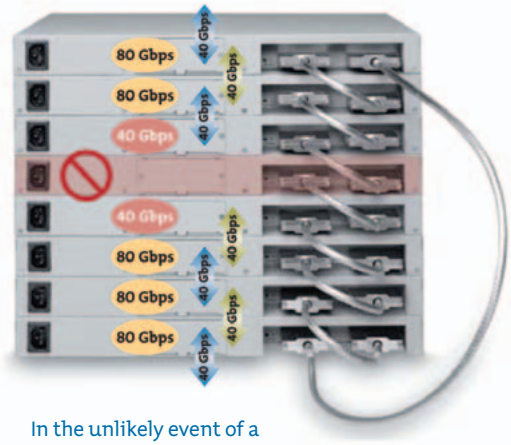
Through remote and non-invasive diagnosis of cabling issues such as cable opens, cable shorts or impedance mismatch in the cable and report, within one meter, the distance of the fault. The switch can detect and report these issues without unplugging cables and plugging in expensive cable testers. (Feature supported with future software release.)

## Power sharing options

BayStack 5520 Switches can be used in conjunction with the BayStack 15 PSU (Power Supply Unit) to create a load sharing or RPSU (redundant power supply unit) solution.

*Figure 6. Fail-safe stacking*

480 Gbps maximum stacking bandwidth for the stack




In the unlikely event of a switch failure, the stack integrity is maintained: remaining switches continue to work as a stack.

***Load sharing***

A BayStack 5520-24T-PWR or 5520-48T-PWR Switch provides up to 320 watts available for Power over Ethernet devices. With the addition of a BayStack 15 PSU chassis and the 600-watt RPSU module to the BayStack 5520-48T-PWR Switch, up to 740 watts of power can be supplied to power devices. This solution will provide 15.4 W per port from the BayStack 5520-48T-PWR Switch. Without the BayStack 15 Power Supply Unit (PSU), the BayStack 5520-48T-PWR Switch would supply an average of 6.5 W per port (ports can exceed 6.5 W per port as long as the total of all ports requiring power does not exceed 320 W). With the addition of a BayStack 15 PSU chassis and the 600-watt RPSU module to the BayStack 5520-24T-PWR Switch, up to 370 watts of power can be supplied to power devices. This solution will provide 15.4 W per port from the BayStack 5520-24T-PWR Switch. Without BayStack 15 PSU, the BayStack 5520-24T-PWR Switch would supply an average of 13 W per port (ports can exceed 13 W per port as long as the total of all ports requiring power does not exceed 320 W). A DC cable connector cable is required to connect from a BayStack 5520 Switch to the BayStack 15 RPSU module (see ordering information section for order numbers).

***Redundant power support***

With connectivity to the BayStack 15 PSU and RPSU module, a BayStack 5520 Switch delivers redundant power supply support crucial in mission-critical environments. Nortel Networks BayStack 15 Power Supply Unit is capable of having up to three 600-watt power supply modules to provide redundant power supply support to up to three BayStack 5520 Switches. A DC cable connector cable is required to connect from a BayStack 5520 Switch to a BayStack 15 RPSU module (see ordering information section for order numbers).

***Uninterruptible power supply support***

For uninterruptible power supply support, a third-party vendor such as APC (www.apc.com) is recommended to provide UPS support to the BayStack 5520 Switches.

## IPv6 filtering and classification support for future applications

BayStack 5520 Switches are able to identify, prioritize, classify, and redirect IPv6 traffic to a router. These switches can address the need for larger addressing and tighter security as the networks grow.

## Jumbo frame support for larger file applications

Jumbo frame support of up to 9,216 bytes is provided on each port for applications requiring large frames such as graphics and video applications.

## Quality of Service (QoS)

The QoS features of the BayStack 5520 Switch allow users to not only utilize bandwidth more efficiently, optimizing existing network resources and capabilities, but also provide packet classification and marking at the edge of the network, simplifying the QoS deployment at the aggregation and core of the network. By classifying, prioritizing, policing, and marking LAN traffic (based on DiffServ, Code Point, and 802.1p), networks can offer reliable connectivity and required bandwidth for mission-critical applications, such as IP Telephony, to specific groups, users, and individual devices.

For each of these applications, advanced QoS features support Internet Engineering Task Force (IETF), the standard DiffServ QoS architecture—a packet classification based on the content of IP packet header fields (voice, video, data)—as well as traffic policing.

## QoS and policy management

DiffServ QoS enables networks to read, alter, prioritize, tag, or mark IP packets based upon information embedded in the Type of Service (ToS) field. The level of service can be marked in the embedded information inside the ToS field of each IP packet. DiffServ is based on the ToS field. BayStack 5520 Switches have application-specific integrated circuits (ASICs) to enable the DiffServ Code Point (DSCP) to be mapped to the IEEE 802.1p user priority bits to provide consistent QoS at Layer 3 (IP) and Layer 2 (Ethernet). The QoS policies can be configured via the BayStack 5520 Switch's built-in Web-based management tools to facilitate QoS. Alternatively, Optivity* Policy Services can be utilized for dynamic end-to-end enterprise-wide policy and QoS management.

### Simplified QoS

BayStack 5520 Switches support Nortel Networks Service Classes (NNSC) which provide simplified QoS provisioning. NNSC provides factory-default QoS configurations, eliminating the complexities often associated with QoS-enabled network deployments.

NNSC provides default settings such as:

- DSCP marking per class
- DiffServ forwarding behavior (PHB) per class
- DSCP to queue mapping
- DSCP to 802.1p mapping
- Default scheduler per class

By classifying the traffic and placing it into an NNSC, complex QoS configurations are eliminated. NNSC simplifies the deployment of a QoS-enabled network with Nortel Networks switching solutions, using a Web-based interface. This not only saves on provisioning time but most importantly, ensures that the QoS functions are provisioned consistently across the network.

### Queuing function

BayStack 5520 Switches provide network availability for mission-critical applications, devices, and users by classifying, prioritizing, and marking LAN IP traffic using up to eight hardware-based queues on every port including the stacking ports. This is based on the following parameters:

- MAC address-based filtering
- IP ToS/DSCP marking
- IP source address/destination address or subnets
- TCP/UDP source/destination port/port range
- IEEE 802.1p user priority bits
- Ingress source port
- IP Protocol ID (e.g., TCP, UDP, IGMP)
- EtherType (e.g., IP, IPX)
- IEEE 802.1Q VLAN ID

BayStack 5520 Switches also have the ability to read packets that have been marked from other devices such as the Passport 8600. Additionally, weighted round robin prevents normal priority traffic from being starved by expedited traffic (on a per-packet basis). BayStack 5520 also supports strict priority queuing.

### Quality of Service provisioning

With Optivity Policy Services software, policies can be created through a simple and intuitive drag-and-drop workflow. Optivity Policy Services is the Policy Decision Point in a DiffServ QoS implementation.

Further benefits include:

- Simple intuitive policy creation
- Ability to re-use common filter sets
- Provision of a network-wide view of policies currently in use
- Ability to avoid QoS provisioning errors
- Centrally managed DSCP and 802.1p queue mapping tables
- Saved time in provisioning the network—as thousands of CLI or Web transactions are reduced to a few simple actions

### Traffic policing

Traffic policing enables provisioning of different levels of service by limiting traffic throughput at the ingress (incoming) port of the BayStack 5520 Switch. For example, if a port is set to a certain speed, such as 10 Mbps, all traffic under 10 Mbps on that port will pass, and traffic that exceeds 10 Mbps on that same port is dropped. Service providers will find this especially useful to control bandwidth to their customers. Up to 64 traffic meters per port are provided and yield higher resolution for control.

### Port shaping

Port shaping offers the ability to limit traffic on each port. While traffic policing is needed to provide different levels of service to data streams on the ingress ports, traffic shaping is needed to smooth the traffic from the egress ports. BayStack 5520 supports port-based traffic shaping. Enterprises working with service providers or carriers utilize this feature when they are deploying Ethernet in place of the traditional Frame Relay, ISDN, or ATM WAN access solutions.

### Enhanced security

The BayStack 5520 Switches offer the highest level of security with features including Secure Shell (SSH), Secure Sockets Layer (SSL), IEEE 802.1x based security (also known as Extensible Authentication Protocol (EAP), assignment of proper VLAN and priority, user-based policies†, Simple Network Management Protocol (SNMPv3), IP Manager List, MAC-address-based security, and Remote Authentication Dial-In User Service (RADIUS) authentication.

SSHv2 supports strong authentication and encrypted communications. It allows network administrators to log into the switch from an SSH client and perform a secure Telnet session using CLI commands. This feature is ideal for security conscious customers, such as federal governments. SSL provides a secure Web management interface and makes it easy for the network administrator to configure and manage a switch using a common Web browser.

For added security, BayStack 5520 Switches support the 802.1x-based security feature. The IEEE 802.1x-based security feature limits access to the network based on user credentials. A user is required to "login" to the network using a username/password; the user database is maintained on the authentication server (not the switch). Network connectivity without password authorization is prevented. This feature is useful where the network is not 100 percent physically secure or where physical security needs enhancement; for example, banks, trading rooms, or classroom training facilities. This feature supports client access to the network and interoperates with Microsoft Windows XP and other compliant 802.1x clients. 802.1x is also known as Extensible Authentication Protocol (EAP).

Now part of BoSS version 4.1 or higher, with the multiple hosts/multiple authentication feature, more than one user with unique MAC addresses is allowed access to a port upon successful authentication. For example, in a conference room, if multiple users connect to a hub which is connected to a BayStack 5520 switch port, all of the users can be authenticated and allowed access to the network. Another example would be with an IP phone with an integrated three-port switch. Since there is a MAC address for the IP phone and a MAC address for the PC, without the multiple hosts/multiple authentication feature, neither would be able to access the network using today's single host/single authentication mechanism.

With the Guest VLAN feature (also part of BoSS version 4.1 or higher), if a user connects to a BayStack 5520 switch port and is not recognized to be authenticated on that port, that user will be placed into a Guest VLAN with the settings as defined by the administrator. An example would be allowing a user to have extranet access, but not intranet access. If a contractor or vendor connects to a port in your network, that person will be placed into a Guest VLAN and have extranet access.

SNMPv3 provides user authentication and data encryption for higher security. It also offers secure configuration and monitoring.

IP Manager List limits access to the management features of the BayStack 5520 Switches by a defined list of IP addresses or IP address ranges/subnets, providing greater network security and manageability.

BaySecure* MAC address-based security allows authentication of all access, not only to the switches for management and configurations, but also access to the infrastructure through these switches. This software feature limits access to only network authorized and trusted personnel, including full tracking of network connections. With BaySecure, network access is granted or denied via proper MAC-address identification (up to a maximum of 448). In addition, with the Distributed Access List Security feature, network access is granted or denied on a per-port basis. BayStack 5520 Switches also provide RADIUS authentication for switch security management.

### Fail-safe stacking

A key differentiator for BayStack 5520 Switches is their resilient stacking feature. BayStack 5520 Switches can stack up to eight units with a cascade stacking design, assuring continuous uptime even if a single switch in the stack should fail. A loop-back or cascade cable is used to seamlessly connect the entire stack to provide no single point of failure.

In the unlikely event of a switch failure, traffic performance is maintained at 40 Gbps on the immediate units on either direction of the failed unit via a 'wrapping' method; the remaining units in the stack continue to send traffic bi-directionally at full bandwidth capability of 80 Gbps per switch (Figure 6).

### MAC addresses

BayStack 5520 Switches support up to 16,000 MAC addresses per switch or stack. For deployment of large-scale, enterprise networks with many attached devices and workgroups, this permits scalability to be achieved in a cost-effective manner.

### VLAN support

VLANs can be established for each switch to extend the broadcast domain and segment network traffic. These VLANs can be spread among port-based or protocol-based VLANs. The VLANs can be on a standalone switch or across a stack. Protocol-based VLANs allow switch ports to be assigned to a broadcast domain based on the protocol information within the packet. These VLANs localize broadcast traffic and assure that the specified protocol type packets are sent only to the protocol-based VLAN ports. The BayStack 5520 Switches support up to 4,096 VLAN IDs. A VLAN ID is the number you assign to a VLAN, which can range from 0 to 4,095. For example, you can have 255 VLANs with VLAN IDs 3,000 to 3,254. The switches are architected to support 4,000 VLANs in the future. Currently, the switches support 256 port or protocol-based VLANs. BayStack 5520 Switches also support per VLAN Tagging option on each port.

### IGMP snooping

BayStack 5520 Switches feature IP Multicast support by examining ('snooping') all Internet Group Multicast Protocol (IGMP) traffic in hardware at line rate, and pruning unwanted data streams from affecting network or end-station performance. Up to 256 IGMP groups are supported.

### Multiple Spanning Tree protocol groups

BayStack 5520 Switches support multiple Spanning Tree Groups (STGs), either in a single standalone switch or distributed across a stack. STGs provide multiple data paths which can be used for load-balancing and redundancy. The BayStack 5520 Switches have been architected to support up to 256 STGs. The switches will support IEEE 802.1s and 802.1w in a future software release.

### Nortel Networks Command Line Interface (NNCLI)

The NNCLI is used to automate general management and configuration of BayStack 5520 Switches. The NNCLI is used through a Telnet session or through the serial port on the console.

### ASCII configuration file

BayStack 5520 Switches can download a user-editable ASCII configuration file from a TFTP (Trivial File Transfer Protocol) server. The ASCII configuration file can be loaded automatically at boot time or on demand using the management systems (console menus or CLI). Once downloaded, the configuration file automatically configures the switch or stack according to the NNCLI commands in the file. This feature provides administrators with the flexibility of creating command configuration files that can be used on several switches or stacks with minor modifications.

### ASCII configuration generator

The configuration settings of the switch can be displayed or saved to an external ASCII configuration file made up of a series of CLI commands. This editable ASCII configuration file can then be uploaded to a switch from an external file server. The ASCII configuration file contains configuration settings for the following network management applications:

- Core applications (system information, topology, etc.)
- Internet Protocol
- Multi-Link Trunking (MLT)
- Port configuration
- Partial Spanning Tree configuration, including configuration of port priority and path cost
- VLAN configuration
- Quality of Service (QoS)
- RMON

### Custom Auto-negotiation Advertisements

This feature enables the network manager to tune the capabilities that a particular Ethernet port can advertise via auto-negotiation. The capabilities include half-duplex and full-duplex modes with speeds of 10, 100, and 1000 Mbps. Auto-negotiated Ethernet ports establish a connection based upon the highest common capabilities. This feature saves the network manager from having to go to each workstation and switch to configure a "fixed" speed.

### Customizable Queue/Buffer Allocation

Using this feature, the network administrator is able to specify the number of CoS queues supported and the buffering resources that may be consumed by a given port. It allows the network administrator to tune the use of system resources based upon their business needs.

### Auto MDI/MDIX

BayStack 5520 Switches can be connected to a hub or another switch quickly and cost effectively with either a crossover or straight through cable. When a cable is connected to one of the 10/100/1000 ports on the switch, the switch port automatically detects the energy on the cable and configures itself. This feature eliminates the need for an MDI/MDIX port; any port may be used for connection to a hub or switch.

### Common look and feel

All BayStack switches, including the BayStack 5520, have a common “look and feel” which reduces training costs. This allows the switches to be managed in a similar fashion via a broad set of management tools. These tools include Web, Java™-based Device Manager (JDM), Command Line Interface (CLI), menus, Optivity Network Management System (ONMS), Optivity Switch Manager (OSM), and Optivity Policy Services (OPS).

### Web-based management

Web-based network management makes managing the BayStack 5520 Switch stack easy with a Web browser. Summary, configuration, fault, statistics, application, administration, and support pages can be provided for the entire stack. Traffic classification and prioritization can be set via the Web-based QoS Wizard and advanced configuration tool. Real-time sampling provides up-to-date LED statistical information for stacked units. The Web interface also allows for static configuration of numerous parameters of the device.

## Network management

***On-Box management***

Network management begins with the device. BayStack 5520 Switches support four groups of Remote Monitoring (RMON) on all ports and are SNMPv3 compliant. RMON2 support is achievable via port mirroring and the use of an external probe. The SNMP agent software resides in the switch and uses the information it collects to provide management for all ports in the stack providing comprehensive network monitoring capabilities.

## Configuration management

The process of configuration begins with a single device but finishes across multiple devices. Java Device Manager is the device configuration tool for those functions that require communicating with a single device. It uses a common user interface and workflow that supports many Nortel Networks Ethernet switches. This commonality allows the network manager to become familiar with one tool instead of multiple tools. Optivity Switch Manager (OSM)† is another tool that performs the configuration function such as VLAN assignments, MLT, and Multicast across multiple Nortel Networks Ethernet switches.

## Policy-management

Optivity Policy Services†—a suite of policy-management software that enforces business-level policies automatically across the network—now supports BayStack 5520 Switches. OPS supports network managers by providing centralized control of advanced packet classification and the ability to priority mark, police, meter, or block traffic.

## Fault management and resolution

With Optivity Network Management System (ONMS)†, the network manager has quick access to the information required to manage and isolate all network events on BayStack 5520 switches. Tools, such as Physical Topology View, inform the network manager how a particular event is affecting the physical connectivity within the network. The 'End Node Locate' tool provides the ability to locate a failing end node and, with one mouse click, provide access to the RMON statistics for the failing Ethernet port supporting that end node. These solutions provide visual and statistical tools necessary to quickly resolve any network event or to manage performance in real-time. The BayStack 5520 Switches support "syslog" capability that helps in troubleshooting network issues.

## Port mirroring

The port mirroring feature (sometimes referred to as 'conversation steering') allows the network administrator to designate a single switch port as a traffic monitor for a specified port. Port-based monitoring can be specified for ingress and egress at a specific port. MAC address-based mirroring can also be specified. Additionally, an external probe device can be attached to the designated monitor port.

## User Interface push-button

The User Interface push-button on the front panel is provided for ease of use in configuring the unit. It can be used for the purpose of base unit selection and for resetting the unit or the stack.

## LED indicators

The LED indicators on the front panel make it easy to monitor the switch status and help in isolating and diagnosing switch problems. These indicators include "Power," "Base unit," "Up" and "Down," "RPSU," "Speed/Duplex/PoE," and "LNK/ACT" functions.

# Summary

With more than 100 years in telecommunications, Nortel Networks is uniquely positioned to help your business reduce costs by combining voice and data into an integrated system. Why take a chance on a vendor that only understands part of the equation? Let us show you how the BayStack 5520 Switches, along with other Nortel Networks products, can increase your profitability, streamline your business operations, increase productivity, and help you gain the competitive edge.

† *Supported in a future software release.*

# Technical specifications

## Table 1. BayStack 5520 Switches technical specifications

### Physical specifications

| | |
|---|---|
| Weight: | 8.4 kg (18.5 lb) for -24T-PWR, 8.8 kg (19.5 lb) for -48T-PWR |
| Height | 4.45 cm (1.75 in) |
| Width | 43.82 cm (17.25 in) |
| Depth | 38.74 cm (15.25 in) |

### Performance specifications

| | |
|---|---|
| Switch fabric bandwidth: | 160 Gbps for the switch; Up to 1,280 Gbps for the full stack |
| Stacking bandwidth: | 80 Gbps for the switch; Up to 640 Gbps for the full stack |
| Maximum data throughput: | 768 Gbps for a full stack of BayStack 5520-48T-PWR |
| Frame forwarding rate: | 71.4 Mpps (million packets per second) for the BayStack 5520-48T-PWR and 35.7 Mpps for the BayStack 5520-24T-PWR; 571.4 Mpps for a full stack of 8 BayStack 5520-48T-PWR units |

### Port forwarding/filtering performance

| | |
|---|---|
| For 10 Mbps: | 14,880 pps maximum (64-byte packets) |
| For 100 Mbps: | 148,810 pps maximum |
| For 1000 Mbps: | 1,488,100 pps maximum |
| Address database size: | 16,000 entries at line rate (16,000 entries without flooding) |
| Addressing: | 48-bit MAC address |
| Frame length: | 64 to 1518 bytes (IEEE 802.1Q Untagged)<br>64 to 1,522 bytes (IEEE 802.1Q Tagged) |
| Jumbo frame support: | Up to 9,216 bytes |
| Multi-Link Trunks: | Up to six trunks, four members per trunk |
| VLANs: | Up to 256 port- or protocol-based per VLAN Tagging option |
| Multiple Spanning Tree Groups: | Up to eight STGs |

### Interface options

| | |
|---|---|
| 10BASE-T/100BASE-TX/ 1000BASE-T | RJ-45 (8-pin modular) connectors for Auto MDI/MDI-X interface 1000BASE-T with auto-polarity |

*The BayStack 5510 Switches support the following SFP GBICs:*

| | |
|---|---|
| 1000BASE-SX | Uses short wavelength 850 nm MTRJ or LC type fiber optic connectors to connect devices over multimode (275m, 62.5um core or 550m, 50.0um core) fiber optic cable |
| 1000BASE-LX | Uses long wavelength 1300nm duplex LC type fiber optic connector to connect devices over single mode (10km, 9um core) fiber optic cable |
| 1000BASE-CWDM | Uses long wavelength 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610nm LC type fiber optic connector to connect devices over single mode (40km, 9um core or 70km, 9um core) fiber optic cable |

### Network protocol and standards compatibility

IEEE 802.3af compliant (Power over Ethernet)
IEEE 802.3 10BASE-T (ISO/IEC 8802 3, Clause 14)
IEEE 802.3u 100BASE-TX (ISO/IEC 8802-3, Clause 25)
IEEE 802.3u Autonegotiation on Twisted Pair (ISO/IEC 8802-3, Clause 28)
IEEE 802.3x (Flow Control on the Gigabit Uplink port)
IEEE 802.3z 1000BASE-SX and 1000BASE-LX
IEEE 802.1d MAC Bridges (ISO/IEC 10038)
IEEE 802.1p (Prioritizing)
IEEE 802.1Q (VLAN Tagging)
IEEE 802.1D Spanning Tree Protocol
IEEE 802.3ad (manual/static)
IEEE 802.3ad (LACP)
IEEE 802.1s *
IEEE 802.1w *
IETF DiffServ

# Technical specifications

## Table 1. BayStack 5520 Switches technical specifications *(continued)*

### RFC support

RFC 1213 (MIB-II); RFC 1493 (Bridge MIB); RFC 1573 (IF-MIB); RFC 2863 (Interfaces Group MIB); RFC 2665 (Ethernet MIB); RFC 2737 (Entity MIBv2); RFC 2819 (RMON MIB); RFC 1757 (RMON); RFC 1271 (RMON); RFC 1157 (SNMP); RFC 2570 (SNMPv3); RFC 2571 (SNMP Frameworks); RFC 2573 (SNMPv3 Applications); RFC 2574 (SNMPv3 USM); RFC 2575 (SNMPv3 VACM); RFC 2576 (SNMPv3); RFC 2572 (SNMP Message Processing) RFC 791 (IP); RFC 792 (ICMP); RFC 793 (TCP); RFC 783 (TFTP); RFC 826 (ARP); RFC 768 (UDP); RFC 854 (TELNET); RFC951 (Bootp); RFC 2236 (IGMPv2); RFC 1112 (IGMPv1); RFC 1945 (HTTP v1.0); RFC 2138 (RADIUS); RFC 894 (IP over Ethernet); RFC 2674 (Q MIB); RFC 1058/RFC 1723 (RIPv1/v2)†; RFC 2030 (SNTP [Simple NTP])

### Electrical specifications

| | |
|---|---|
| Max input current: | 6.5A at 115VAC or 3.25A at 230VAC |
| Input voltage (rms): | 100 to 240 VAC 50/60 Hz |
| Power consumption: | 600W max. |
| Thermal rating: | 850 BTU/Hr |
| | Inrush current 20A 120VAC at max. load, 40A 240VAC at max. load |
| | Turn on condition 1 second max after application of AC power. |
| | ***Note:*** 12V output rise time, from 10% to 90%, shall be a maximum of 50 ms and monotonic under all defined input and output conditions. |
| Efficiency: | 70% min. |

### Environmental specifications

| | |
|---|---|
| Operating temperature: | 0° to 40°C (32° to 104°F) for continuous operation and 0° to 55°C (32° to 131°F) for short time operation |
| Storage temperature: | –40° to +85°C (-40° to 185°F) |
| Operating humidity: | 10% to 90% relative humidity, non-condensing |
| Storage humidity: | 10% to 95% relative humidity, non-condensing |
| Operating altitude: | Up to 3,048 m (10,000 ft.) above sea level |
| Storage altitude: | -304.8 to 3,048 m (-1,000 to 10,000 ft.) above sea level |

### Safety agency approvals

UL EN60950 (UL Listed or CSA 22.2 No. 60950 (CUL))
IEC 60950/EN 60950, CB report and certificate with all national deviations
C22.2 No. 950 (CUL) with all national deviations
UL-94-V1 flammability requirements for PC board
NOM-019 (NOM)

### Electromagnetic emissions summary

***Meets the following standards:***

| | |
|---|---|
| US: | CFR47, Part 15, Subpart B, Class A |
| Canada: | ICES-003, Issue 3, Class A |
| Australia/New Zealand: | AS/NZS 3548:1995, A1:1997/A2:1997 class A |
| Japan: | VCCI-V-3/02.04 class A |
| Taiwan: | CNS 13438, Class A |
| | EN55022:1998/A1:2000 |
| | EN61000-3-2:2000 |
| | EN61000-3-3:1995/A1:2001 |

### Electromagnetic immunity

The module meets the EN55024:1998/A1:2001 standard.

### Declaration of Conformity

As stated in the Declaration of Conformity, the BayStack 5520 Switch complies with the provisions of Council Directives 89/336/EEC and 73/23/EEC.

† Future software release

## Ordering information

### Table 2. BayStack 5520 Switches ordering information

| Order No. | Description |
|---|---|
| AL1001?05** | BayStack 5520-48T-PWR Stackable Power over Ethernet Switch (48 10/100/1000BASE-T ports plus 4 built-in SFP GBIC slots and built-in stacking ports including a 1.5 feet cascade cable) |
| AL1001?06** | BayStack 5520-24T-PWR Stackable Power over Ethernet Switch (24 10/100/1000BASE-T ports plus 4 built-in SFP GBIC slots and built-in stacking ports including a 1.5 feet cascade cable) |
| AL2018009 | BayStack 5000-SRC Cascade Return Cable (3 feet) |
| AL2018010 | BayStack 5000-SSC Cascade Cable (1 foot) |
| AL2018011 | BayStack 5510-SSC Cascade Cable (1.5 feet) |
| AL2018013 | BayStack 5510-SSC Cascade Cable (10 feet) |
| AL2018014 | BayStack 5510-SSC Cascade Cable (5 meter/16.4 feet) |
| AL2011013 | Console cable for use with BayStack and Passport 8300 switches |
| AA1419013 | 1-port 1000BASE-SX SFP GBIC (LC connector) |
| AA1419014 | 1-port 1000BASE-SX SFP GBIC (MT-RJ connector) |
| AA1419015 | 1-port 1000BASE-LX SFP GBIC (LC connector) |
| AA1419025 | 1-port 1000BASE-CWDM SFP GBIC – 1470nm Wavelength (40km), LC connector |
| AA1419026 | 1-port 1000BASE-CWDM SFP GBIC – 1490nm Wavelength (40km), LC connector |
| AA1419027 | 1-port 1000BASE-CWDM SFP GBIC – 1510nm Wavelength (40km), LC connector |
| AA1419028 | 1-port 1000BASE-CWDM SFP GBIC – 1530nm Wavelength (40km), LC connector |
| AA1419029 | 1-port 1000BASE-CWDM SFP GBIC – 1550nm Wavelength (40km), LC connector |
| AA1419030 | 1-port 1000BASE-CWDM SFP GBIC – 1570nm Wavelength (40km), LC connector |
| AA1419031 | 1-port 1000BASE-CWDM SFP GBIC – 1590nm Wavelength (40km), LC connector |
| AA1419032 | 1-port 1000BASE-CWDM SFP GBIC – 1610nm Wavelength (40km), LC connector |
| AA1419033 | 1-port 1000BASE-CWDM SFP GBIC – 1470nm Wavelength (70km), LC connector |
| AA1419034 | 1-port 1000BASE-CWDM SFP GBIC – 1490nm Wavelength (70km), LC connector |
| AA1419035 | 1-port 1000BASE-CWDM SFP GBIC – 1510nm Wavelength (70km), LC connector |
| AA1419036 | 1-port 1000BASE-CWDM SFP GBIC – 1530nm Wavelength (70km), LC connector |
| AA1419037 | 1-port 1000BASE-CWDM SFP GBIC – 1550nm Wavelength (70km), LC connector |
| AA1419038 | 1-port 1000BASE-CWDM SFP GBIC – 1570nm Wavelength (70km), LC connector |
| AA1419039 | 1-port 1000BASE-CWDM SFP GBIC – 1590nm Wavelength (70km), LC connector |
| AA1419040 | 1-port 1000BASE-CWDM SFP GBIC – 1610nm Wavelength (70km), LC connector |
| AA0005017 | BayStack 15 PSU Chassis |
| AA0005?19** | BayStack 15 600-Watt RPSU Module (up to three modules can be installed in the chassis; each module requires a DC connector cable to connect to a single BayStack 5520 Switch) |
| AA0005018 | BayStack 15 DC connector cable for BayStack 5520 Switch (required for connection to BayStack 15 RPSU module) |

### Table 3. Maintenance Services

| Order No. | Description |
|---|---|
| GW5300000 | Software Release Subscription Services—Basic |
| GU5300000 | Software Release Subscription Services—Plus |
| GE5300000 | Technical Support Service |
| GL5300000 | Return & Replace Service |
| GF5300000 | Managed Spares Services Pack—Next Business Day |
| GH5300000 | Managed Spares Services Pack—4 Hour 7x24 |
| GJ5300000 | Managed On-Site with Spares Services Pack—Next Business Day |
| GN5300000 | Managed On-Site with Spares Services Pack—4 Hour 7x24 |

** The seventh character (?) of the order number must be replaced with the proper code to indicate desired product nationalization:

"A" No power cord included

"B" Includes European "Schuko" power cord common in Austria, Belgium, Finland, France, Germany, The Netherlands, Norway, and Sweden

"C" Includes power cord commonly used in the United Kingdom and Ireland

"D" Includes power cord commonly used in Japan

"E" Includes North American power cord

"F" Includes Australian power cord, also commonly used in New Zealand and the People's Republic of China

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