

6.5 อุปกรณ์ Layer 3 Switch

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Product Brief Ethernet Routing Switch 5500 Family

Converged Edge

- > Desktop connectivity
- > Power over Ethernet
- > IP Telephony
- > Wireless LAN
- > Data center
- > Centralized applications including:
 - Enterprise Resource Planning
 - Unified Messaging



ERS 5510-24T

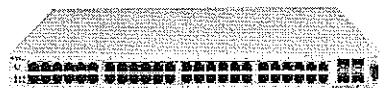
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ERS 5520-24T-PWR



ERS 5510-48T



ERS 5520-48T-PWR



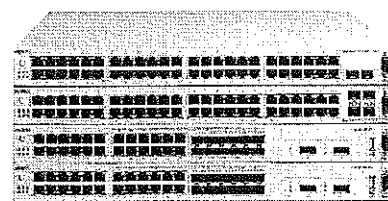
ERS 5530-24TFD

New advanced features in Release 5.0

- > Dynamic IP routing including RIP, OSPF, ECMP and VRRP
- > Switch Clustering (Split Multi-Link Trunking)
- > Nortel Secure Network Access (NSNA) support
- > IP Flow Information eXport (IPFIX)
- > 802.1ab, Link Layer Discovery Protocol
- > Auto Detection/Auto Configuration (ADAC) of IP phones
- > User Based Policies
- > Multi-Host Single-Authentication on EAP ports
- > DHCP Snooping/Dynamic ARP Inspection

Business advantage

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



ERS 5500 stack

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. Time delay-sensitive applications benefit from higher bursting capabilities; therefore, end users' quality of experience (QoE) is improved by deploying Gigabit desktop switches. As more Gigabit desktops are deployed, the need for faster uplink is also impacted, driving the need for multiple Gigabit trunked together or 10-Gigabit technology. Also, it may not be long before Gigabit-hungry applications will start choking throughput and cripple today's networks.

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. Nortel's Ethernet Routing Switch 5500 family is designed to address these critical business needs.

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New key features with Release 5.0

IP routing

Routing Information Protocol (RIP)

Routing Information Protocol (RIP) is a distance vector routing protocol used to discover routes in a network based on information from directly-connected routers. RIP implementation is useful in large networks where static route administration is impractical. RIPv1 and RIPv2 are supported. RIP is easier to administer than OSPF, but not as desirable for larger networks.

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Open Shortest Path First (OSPF)

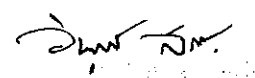
OSPFv2 is a dynamic routing protocol that discovers network topology and calculates the shortest path to each destination based on cumulative cost. OSPF can reduce central processing unit (CPU) and memory resource requirements in a large network by partitioning the network into contiguous areas. OSPF results in faster network convergence in case of a link failure (Advanced Routing License required).

Equal Cost Multi Path (ECMP) (5520 and 5530 only)

ECMP allows routers to determine multiple equal cost paths to the same destination. Multiple paths (up to four) can be used for traffic load sharing and, in case of network failure, allow faster convergence to other active paths (Advanced Routing License required).

Virtual Router Redundancy Protocol (VRRP)

VRRP dynamically assigns responsibility for a virtual router to one of the VRRP routers on a local area network (LAN). VRRP provides higher availability default paths without configuring dynamic routing protocols on end hosts. It can also be used in load balancing configurations without additional costs (Advanced Routing License required).

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Switch Clustering (SMLT standalone mode only)

Switch Clustering is a Nortel technology that provides an active/active configuration from wiring closet to core without Spanning Tree. Switch clustering uses Split Multi-Link Trunking (SMLT) to load balance multiple uplinks to multiple switches in the core, providing system-level redundancy and eliminating any point of failure in the network.

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SMLT allows a standard Multi-Link Trunk connection to be effectively split, connecting one access switch to two interconnected peer aggregator switches (Figure 1. Nortel Ethernet Routing Switch 5500 Network Diagram). As SMLT operates with STP disabled, traffic flows from the access switch to both aggregator switches simultaneously. SMLT provides redundant paths and MAC synchronization across the peer aggregator switches for fast failover and recovery and better traffic load balancing. Switch Clustering is agnostic to the edge devices and therefore totally interoperable with any edge switch, server or other network appliance that supports some form of link aggregation. The Ethernet Routing Switch 5500 Series implementation is based on the Ethernet Routing Switch 8600 Series implementation adapted to the 5500 Series hardware platform. In Software Release 5.0, SMLT is supported on standalone switches or on the base unit of a stack (Advanced Routing License required).

Nortel Secure Network Access

Secure Network Access is Nortel's endpoint security and policy compliance solution designed to inspect, assess, ensure compliance to policy, and remediate at the network endpoint source, prior to network access. Nortel's Secure Network Access (NSNA) solution dramatically simplifies the complexity of enterprise network access architectures with a ubiquitous, open solution guaranteeing endpoint security with seamless device quarantine and containment, remediation and repair for LAN users and remote users (IPsec/SSL), with both fixed and

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mobile connectivity devices. The Nortel Secure Network Access solution delivers endpoint security by enabling only trusted, role-based access privileges premised on the security level of the device, user identity and session context.

Running Nortel SNA with Nortel VPN Gateways and Routers and Nortel Ethernet Routing Switch 5500 enables a highly integrated endpoint security solution from a management and ease-of-use perspective. With Nortel SNA, the enterprise can define, deploy and enforce a robust and consistent security policy across its varied network segments with trusted, role-based access enablement premised on user identity and session context. Nortel SNA can ensure devices meet the corporate security policy before they are granted network access and reduce the risk of virus infections, or misconfigured systems being added to the network. Verifying compliance and blocking connections from non-compliant systems can guarantee 100 percent compliance with corporate policy 100 percent of the time.

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IP Flow Information eXport (IPFIX)

Using IP Flow Information eXport (IPFIX), IP flows are defined by an IP Source Address (SA), an IP Destination Address (DA), the IP Protocol Type, the Type of Service (ToS) and the ingress port. For TCP or UDP protocols, an IP flow is defined by two additional parameters: source port and destination port.

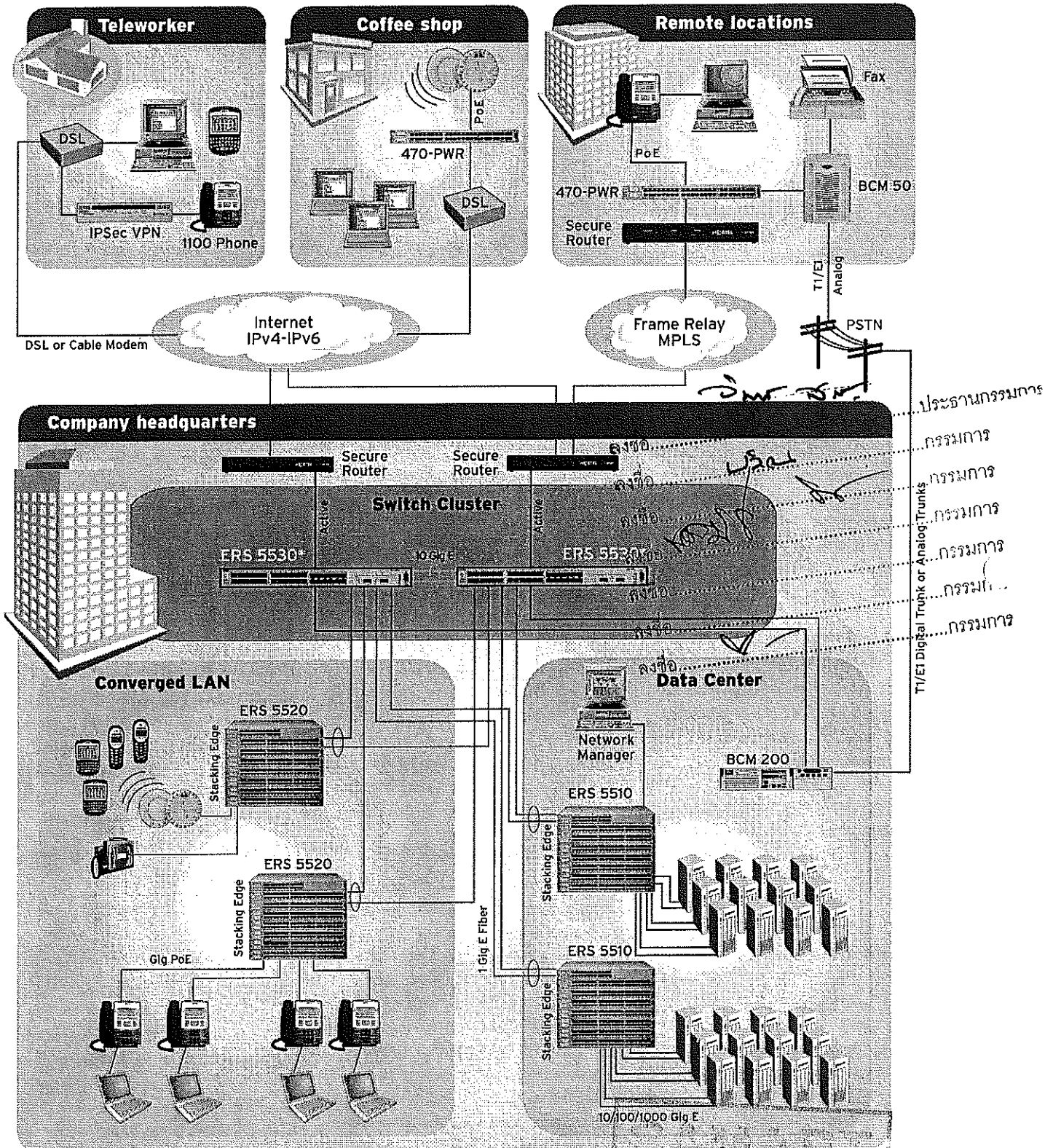
For each IP flow sampled, the following statistics are maintained:

- Packet count
- Byte count
- First packet time
- Last packet time

IPFIX information can be exported to a third-party collector for detailed analysis. The IPFIX information can help optimize bandwidth use and improve IT service delivery, along with identifying security risks on the network. (Advanced Routing License required).

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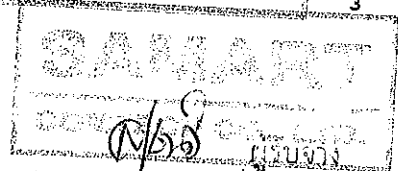
Figure 1. Nortel Ethernet Routing Switch 5500 Network Diagram



* Switch cluster can be used with ERS 5530 or ERS 8600.

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802.1ab, Link Layer Discovery Protocol

Link Layer Discovery Protocol (LLDP) allows stations connected to a LAN to advertise their capabilities to each other, enabling the discovery of physical topology information for network management. LLDP-compatible stations can consist of any interconnection devices including PCs, IP Phones, switches and routers. Each LLDP station stores LLDP information in a standard Management Information Base (MIB), making it possible for the information to be accessed by a network management system (NMS) or application. This standard-based feature allows devices to be discovered by the network management software and simplifies the inventory management. 802.1ab also provides configuration capabilities of end devices supporting the standard. IP phone VLANs can be automatically provisioned on the ERS 5500 switch through exchange of 802.1ab information.

Auto Detection/Auto Configuration (ADAC) of Nortel IP Phones

The Auto Detection/Auto Configuration feature automatically configures the switch to support and prioritize IP Phone traffic. When ADAC is enabled and an IP Phone is connected to the switch, the switch automatically configures the VLAN, port and QoS settings necessary for the transmission of signal and voice between the IP Phone and the switch. Multiple IP Phones can be supported on a single port. This feature simplifies IP Phone configuration, saves time and helps improve Total Cost of Ownership.

User-based policies

Once a user is authenticated on a port, policies can be applied automatically according to the user profile, resulting in time-savings. These user profiles can provide specific QoS settings, security settings or admission control to certain areas of the network.

Multi-Host Single-Authentication on EAP ports

Multi-Host Single-Authentication (MHSA) permits non-EAP MACs without authentication on EAP-enabled ports to accommodate printers and other such devices sharing a hub or switch with a PC. MHSA support is allowed on an EAP multi-host enabled port.

Other new features

Extensible Authentication Protocol (802.1x) accounting

Extensible Authentication Protocol (EAP) accounting provides RADIUS accounting for EAP-authenticated clients in the network. This feature collects session time, termination reason and packet counter information. EAP accounting starts as soon as user authentication is successful and stops when the user logs off or is no longer authenticated.

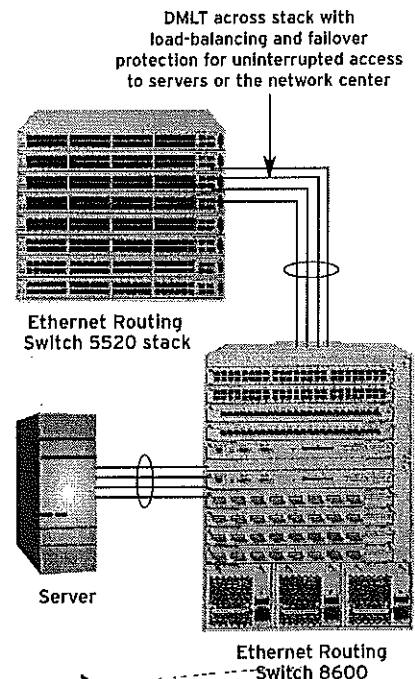
802.1s, Multiple Spanning Tree Protocol

Multiple Spanning Tree Protocol (MSTP) allows multiple RSTP instances to run on the same switch. MSTP supports one CIST (Common Internal Spanning Tree) and seven MSTI (Multiple Spanning Tree Instance) instances for each bridge. Each instance contains one or more VLANs. Each MSTP instance functions as a virtual bridge, and each is independent of the other. Traffic load balancing is supported by configuring multiple MSTI instances on the switch. MSTP is supported on standalone and stack configurations.

802.1w, Rapid Spanning Tree Protocol

Rapid Spanning Tree Protocol (RSTP) is an enhancement to 802.1d STP that converges faster than 802.1d and is backward compatible. RSTP assigns roles to all ports on the switch, and allows a port connected to an end station to be configured as an Edge port. The Edge port transitions directly to the Forwarding state for fast convergence. This standards-based feature

Figure 2. Distributed Multi-Link Trunking (DMLT) across stack



allows 5500 switches to interoperate with other vendors switches and allows faster convergence.
Each Multi-Link Trunk can have up to eight (8) members. Up to 32 trunks can be supported in a switch/stack. You can now also choose between either MAC-based (basic) or IP-based (advanced) MLT load balancing using the CLI. Nortel's 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.

Dynamic Host Control Protocol snooping

DHCP snooping provides network security to a device by eliminating an attacker's ability to respond to DHCP requests with false IP information (DHCP spoofing). It is based on trusted versus untrusted ports. DHCP snooping drops untrusted DHCP replies and verifies the source of the DHCP packets by creating a binding table of DHCP clients.

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Time Domain Reflectometer

The Time Domain Reflectometer (TDR) provides a diagnostic capability to test connected cables for defects (such as shorts, pin open, crossed pairs, etc.). You can perform cable diagnostics on any cable or port in the switch or stack, initiate multiple port tests simultaneously, or you can initiate TDR tests and obtain test results from the CLI or the JDM. The TDR feature eliminates the need for expensive test equipment and minimizes the network downtime.

The Advanced Routing License

With Release 5.0 software, customers are required to have an Advanced Software License if they want support for any or all of the following five features:

- IP Flow Information Export (IPFIX)
- Switch Clustering (SMLT) (supported on base unit or standalone only)
- Open Shortest Path First (OSPF)
- Virtual Router Redundancy Protocol (VRRP)
- Equal Cost Multi Path (ECMP)

The software license file is based on authorized MAC addresses. A single software license file can support up to 1,000 MAC addresses. A software license file is generated based on the MAC address of the switch/stack. The MAC address of the base unit in a stack is required and Nortel recommends that you provide the MAC address of the temporary base unit (when in a stack configuration) to be entered in the license file. This ensures that the licensed features continue to operate if the base unit becomes inoperable. The license files are generated on the Nortel Licensing portal (www.nortellicensing.com).

Nortel Ethernet Routing Switch 5500 family

Nortel's Ethernet Routing Switch 5500 family is comprised of stackable 10/100/1000 Mbps Ethernet Layer 3 routing switches available in three

models — Ethernet Routing Switch 5510, 5520 and 5530. These switches are designed to provide high-density Gigabit desktop connectivity and Power over Ethernet capability to mid-size and large enterprise customers' wiring closets, data centers or small core installations. Table 1 shows the feature comparison for the ERS 5500 family.

Ethernet Routing Switch 5510

The Ethernet Routing Switch 5510s are 1 rack unit high stackable 10/100/1000 Mbps Ethernet Layer 3 routing switches designed to provide high-density Gigabit desktop connectivity for mid-size and large enterprise customers. The Ethernet Routing Switch 5510 models offer a scalable and resilient solution, providing exceptional security features and support for enhanced convergence while minimizing capital and operational expenses. The Ethernet Routing Switch 5510 is available in two models — the Ethernet Routing Switch 5510-48T and the 5510-24T.

The Ethernet Routing Switch 5510-48T features 48 10/100/1000Base-T RJ-45 ports for desktop switching and two built-in SFP (Small Form factor Pluggable) ports for uplink. Port 47 and Port 48 offer configuration flexibility by allowing the network administrator to configure each port as either 10/100/1000 or SFP port. The Ethernet Routing Switch 5510-24T provides 24 10/100/1000Base-T RJ-45 ports and two built-in SFP ports. Port 23 and Port 24 offer configuration flexibility as either a 10/100/1000 or a built-in SFP port. Up to eight switches can be stacked to achieve up to 384 10/100/1000 ports for high-density Gigabit desktop switching.

All models can be stacked together in any combination and managed as a single entity. Regardless of which switch you choose, the Ethernet Routing Switch 5500 family is a scalable and

resilient solution that provides exceptional security features and support for enhanced convergence while minimizing capital and operational expenses.

Ethernet Routing Switch 5520-PWR

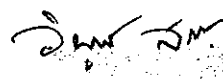
The Ethernet Routing Switch 5520 is a one rack unit high stackable 10/100/1000 Mbps Ethernet Layer 3 routing switch that combines high-density Gigabit desktop connectivity and Power over Ethernet capability. Available in two models — Ethernet Routing Switch 5520-48T-PWR with 48 10/100/1000Base-T RJ-45 ports, and 5520-24T-PWR with 24

10/100/1000Base-T RJ-45 ports. They feature four built-in SFP ports for uplink. Port 45 through Port 48 on the Ethernet Routing Switch 5520-48T-PWR offer configuration flexibility by allowing the network administrator to configure each port as either 10/100/1000 or SFP port. Similarly, Port 21 through Port 24 on the Ethernet Routing Switch 5520-24T-PWR offer configuration flexibility as either a 10/100/1000 or a built-in SFP port. Up to eight switches can be stacked to achieve up to 384 10/100/1000 ports for high-density Gigabit desktop switching.

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Power over Ethernet details IEEE 802.3af-compliant

The Ethernet Routing Switch 5520 models 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.

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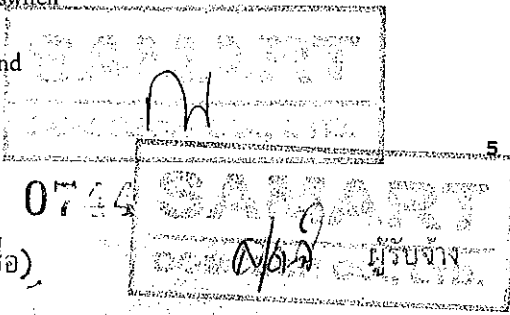
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Auto discovery feature

The Ethernet Routing Switch 5520 automatically recognizes the connection of a Power over Ethernet device and immediately sends 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 Ethernet Routing Switch 5520 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 Ethernet Routing Switch 5520 provides simplified Web-based configurations on data and power properties. The graphical user interfaces make it simple to set up data and power configurations.

Convenience of a single cable

With the Ethernet Routing Switch 5520, 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.

Load sharing for 5520-PWR

An Ethernet Routing Switch 5520-24T-PWR or 5520-48T-PWR provides up to 320 watts available for Power over Ethernet devices. With the addition of an RPS 15 PSU chassis and the 600-watt RPSU module to the Ethernet Routing Switch 5520-48T-PWR, up to 740 watts of power can be supplied to power

devices. This solution will provide 15.4 W per port from the Ethernet Routing Switch 5520-48T-PWR. Without the RPS 15 Power Supply Unit (PSU), the Ethernet Routing Switch 5520-48T-PWR 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 an RPS 15 PSU chassis and the 600-watt RPSU module to the Ethernet Routing Switch 5520-24T-PWR, up to 370 watts of power can be supplied to power devices. This solution will provide 15.4 W per port from the Ethernet Routing Switch 5520-24T-PWR. Without RPS 15 PSU, the Ethernet Routing Switch 5520-24T-PWR 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 an Ethernet Routing Switch 5520 to the RPS 15 RPSU module (see ordering information section for order numbers).

Ethernet Routing Switch 5530-24T-TFD

The Nortel Ethernet Routing Switch 5530-24TFD is a stackable 10/100/1000/10000 Mbps Ethernet Layer 3 routing switch designed to provide Gigabit desktop connectivity, Gigabit fiber connectivity and dual 10 Gigabit connectivity for high-speed uplink. The Ethernet Routing Switch 5530-24TFD provides 24 10/100/1000Base-T RJ-45 ports, 12 shared ports, 10/100/1000Base-T RJ-45 ports or Small Form Pluggable (SFP), and 2 slots for 10 Gigabit Ethernet (XFP) modules. The Ethernet Routing Switch 5530 is ideal for medium and large enterprise customers and can be utilized for server or wiring closet aggregation.

Common features

Dynamic Host Configuration Protocol) Relay

This feature 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.

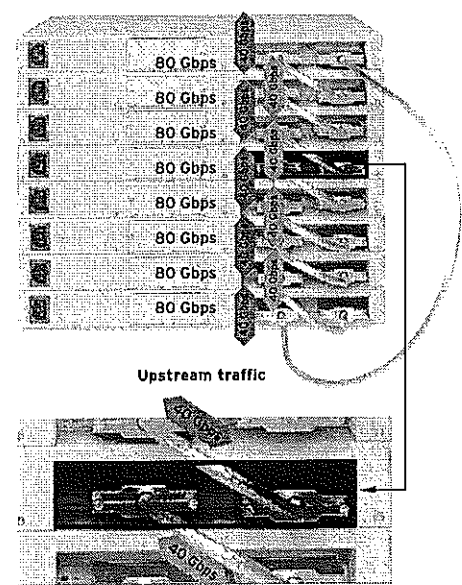
FAST stacking design

Nortel's innovative FAST (Flexible Advanced Stacking Technology) stacking design of the Ethernet Routing Switch 5500 family allows for simultaneous bidirectional traffic flow on each stacking port. In a full stack, this design yields up to 640-Gbps stacking capacity. This 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,

Figure 3 FAST Stacking
640 Gbps maximum stacking capacity for the stack



80 Gbps maximum stacking capacity for the stack

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Table 1. Feature comparison

Features	5510	5520-PWR	5530
Target customer	Mid and large business	Mid and large business	Mid and large business
10/100/1000 ports per unit	24/48	24/48	24 (12 shared)
SFP ports	2	4	12
10 Gbps ports	None	None	2
Power over Ethernet	No	Yes	No
Resilient fail-safe stacking	Yes	Yes	Yes
Stacking capacity	640 Gbps	640 Gbps	640 Gbps
Number of switches supported by an RPS 15 module	Up to 4	1	1
Application	Desktop connectivity	Power to IP devices	Wiring closet and server aggregation

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's 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 (Figure 3. Innovative FAST stacking architecture).

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

All models in the Ethernet Routing Switch 5500 family 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 back-bone or high-speed servers. The switches are shipped with a stacking cable (1.5 foot). In addition, stacking cables are also available in different lengths — 1.5 feet, 10 feet and 5 meters (16.4 feet) — to cover a variety of stacking needs.

Fail-safe stacking

In the unlikely event of a switch failure, the stack integrity is maintained: remaining switches continue to work as a stack providing up to 480 Gbps stacking capacity in a full stack. Fail-safe stacking requires the loopback cable.

Single software image

The Ethernet Switch Software for the Ethernet Routing Switch 5500 family is a single software image that allows the Ethernet Routing Switch 5510, 5520 and 5530s to stack together. The Ethernet Switch Software simplifies network operations by reducing the number of steps required for switch software updates. Only a single image needs to be downloaded from the Nortel support site for all Ethernet Routing Switch 5500 types. The image needs to be loaded only to the base unit of the stack which automatically loads it to other switches in the stack.

IPv6 filtering and classification support for future applications

The Ethernet Routing Switch 5500 models 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.

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. The Ethernet Routing Switch 5500 models 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 built-in Web-based management tools to facilitate QoS. Alternatively, the Enterprise Policy Manager can be utilized for dynamic end-to-end enterprise-wide policy and QoS management.

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Queuing function

The Ethernet Routing Switch 5500 provides 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:

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- MAC address-based filtering
- IP ToS/DSCP marking
- IP source address/destination address or subnets
- TCP/UDP source/destination ports/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

The Ethernet Routing Switch 5500 also has the ability to read packets that have been marked from other devices such as the Ethernet Routing Switch 8600. Additionally, weighted round robin prevents normal priority traffic from being starved by expedited traffic (on a per-packet basis). The Ethernet Routing Switch 5500 also supports strict-priority queuing.

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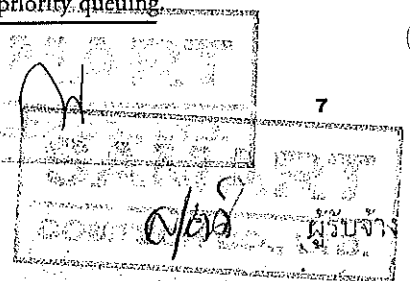
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Quality of Service provisioning

With the Enterprise Policy Manager software, policies can be created through a simple and intuitive drag-and-drop workflow. Enterprise Policy Manager 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 Ethernet Routing Switch 5500. 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. The Ethernet Routing Switch 5500 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 Ethernet Routing Switch 5500

offers the highest level of security with features including Secure Shell (SSH),

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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, Ethernet Routing Switch 5500 supports 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).

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 switch, which is connected to an Ethernet Routing Switch 5500 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 an Ethernet Routing Switch 5500 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 Ethernet Routing Switch 5500 by a defined list of IP addresses or IP address ranges/subnets, providing greater network security and manageability.

Power redundancy

Redundant power support

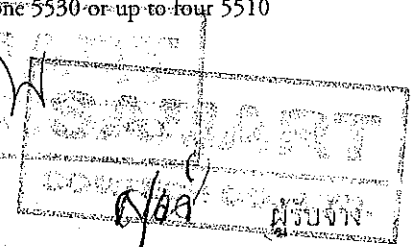
For mission-critical environments, the RPS 15 PSU (Power Supply Unit) and RPSU module provide redundant power supply support to the Ethernet Routing Switch 5500 family. Nortel's RPS 15 Power Supply Unit is capable of having up to three 600-watt power supply modules. Each power module can provide redundant power supply support to one 5520 or one 5530 or up to four 5510

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Technical specifications

Interfaces

ERS 5510

- 24/48-port 10/100/1000Base-T
- 2-port 1000 SFP

ERS 5520

- 24/48-port 10/100/1000Base-T with 802.3af Power over Ethernet
- 4-port 1000 SFP

ERS 5530

- 24-port 10/100/1000Base-T (12 shared)
- 12-port SFP 1000Base-X Ethernet
- 2-port 10 Gigabit XFP LAN PHY

Performance specifications

ERS 5510 and 5520

- **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 5510 or 5520
- **Frame forwarding rate:** 71.4 Mpps (million packets per second) for 48-port model and 35.7 Mpps for 24-port. 571.4 Mpps for a full stack of 8 48-port units

ERS 5530

- **Switch fabric bandwidth:** 192 Gbps for the switch; Up to 1,563 Gbps for the full stack
- **Stacking bandwidth:** 80 Gbps for the switch; Up to 640 Gbps for the full stack
- **Maximum data throughput:** 704 Gbps for a full stack of 5530s
- **Frame forwarding rate:** 65.5 Mpps (million packets per second); 523.8 Mpps for a full stack of 8 5530s

Common performance specifications

- **Frame length:** 64 to 1,518 bytes (IEEE 802.1Q Untagged); 64 to 1,522 bytes (IEEE 802.1Q Tagged)
- **Jumbo frame support:** Up to 9,216 bytes
- **Multi-Link Trunks:** 32 trunks, 8 members per trunk
- **VLANs:** 256 port- or protocol-based; per VLAN Tagging option
- **Multiple Spanning Tree Groups:** Up to 8 STGs
- **Port forwarding:**
 - For 10 Mbps: 14,880 pps maximum (64-byte packets)
 - For 100 Mbps: 148,810 pps maximum
 - For 1,000 Mbps: 1,488,100 pps maximum
 - For 10 Gbps: 14,880 pps maximum (5530 only)
- **Address database size:** 16,000 entries at line rate (16,000 entries without flooding)
- **Addressing:** 48-bit MAC address

Network protocol and standards compatibility

- IEEE 802.1d MAC Bridges (ISO/IEC 10038)
- IEEE 802.1D Spanning Tree Protocol
- IEEE 802.1p Prioritizing
- IEEE 802.1Q VLAN Tagging
- IEEE 802.1s
- IEEE 802.1w
- IEEE 802.3 10Base-T (ISO/IEC 8802 3, Clause 14)
- IEEE 802.3ad LACP
- IEEE 802.3ad manual/static
- IEEE 802.3ae 10 Gigabit XFP (5530 only)
- IEEE 802.3af Power over Ethernet (only)
- 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 10/100 Flow Control
- IEEE 802.3z 1000Base-SX and 1000Base-LX
- IETF DiffServ

RFC support

- RFC 768 UDP
- RFC 783 TFTP
- RFC 791 IP
- RFC 792 ICMP
- RFC 793 TCP
- RFC 826 ARP
- RFC 854 Telnet
- RFC 894 IP over Ethernet
- RFC 951 BootP
- RFC 1213 MIB-II
- RFC 1058 / RFC 1723 RIP v1/v2
- RFC 1112 IGMPv1
- RFC 1157 SNMP
- RFC 1271 RMON
- RFC 1493 Bridge MIB
- RFC 1573 IF-MIB
- RFC 1757 RMON
- RFC 1945 HTTP v1.0
- RFC 2030 SNTP (Simple NTP)
- RFC 2138 RADIUS
- RFC 2236 IGMPv2
- RFC 2570 SNMPv3
- RFC 2571 SNMP Frameworks
- RFC 2572 SNMP Message Processing
- RFC 2573 SNMPv3 Applications
- RFC 2574 SNMPv3 USM
- RFC 2575 SNMPv3 VACM
- RFC 2576 SNMPv3
- RFC 2665 Ethernet MIB
- RFC 2674 Q MIB
- RFC 2737 Entity MIBv2
- RFC 2819 RMON MIB
- RFC 2863 Interfaces Group MIB

Physical specifications

Weight:

- ERS 5510: 24T: 5.8 kg (12.78 lb); 48T: 6.0 kg (13.2 lb)
 - ERS 5520: 24T-PWR: 8.4 kg (18.5 lb); 48T-PWR: 8.8 kg (19.5 lb)
 - ERS 5530-TFD: 6.5 kg (14.5 lb)
- Height: 4.45 cm (1.75 in)
Width: 43.82 cm (17.25 in)
Depth: 38.74 cm (15.25 in)

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)

Environmental specifications

- Operating temperature:
 - 5510 and 5520: 0° to 45°C (32° to 113°F)
 - 5530: 0° to 50°C (32° to 122°F)
- Storage temperature: -40° to +85°C (-40° to 185°F)
- Operating humidity: 85% maximum relative humidity, non-condensing
- Storage humidity: 95% maximum relative humidity, non-condensing
- Operating altitude: Up to 3,024m (10,000-ft.) above sea level
- Storage altitude: 3,024m (10,000-ft.) above sea level

Electromagnetic emissions summary

Meets the following standards

- US: CFR 47, Part 15 Subpart B, Class A
- Canada: ICES-003, Issue 2, 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
- EN 55022:1998/A1:2000
- EN 61000-3-2:2000
- EN 61000-3-3:1995/A1:2001
- Electromagnetic immunity: Meets the EN 55024:1998/A1:2001 standard

As stated in the Declaration of Conformity, Ethernet Routing Switches 5510, 5520 and 5530 comply with the provisions of Council Directives 89/336/EEC and 73/23/EEC.

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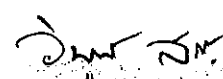
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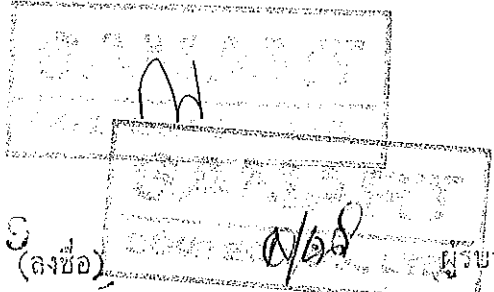
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Ordering information

Ethernet Routing Switch 5510

Order Code	Description
AL1001*03-E5	Ethernet Routing Switch 5510-48T with 48 10/100/1000 ports plus 2 fiber mini-GBIC ports and a 1.5 foot Stacking Cable.
AL1001*04-E5	Ethernet Routing Switch 5510-24T with 24 10/100/1000 ports plus 2 fiber mini-GBIC ports and a 1.5 foot Stacking Cable. No Power Cord.

Ethernet Routing Switch 5520

Order Code	Description
AL1001*05-E5	Ethernet Routing Switch 5520-48T-PWR with 48 10/100/1000 IEEE 802.3af Power over Ethernet ports plus 4 fiber mini-GBIC ports and a 1.5 foot Stacking Cable
AL1001*06-E5	Ethernet Routing Switch 5520-24T-PWR with 24 10/100/1000 IEEE 802.3af Power over Ethernet ports plus 4 fiber mini-GBIC ports and a 1.5 foot Stacking Cable.

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Ethernet Routing Switch 5530

Order Code	Description
AL1001*07-E5	Ethernet Routing Switch 5530-24TFD Switch (24 10/100/1000Base-T ports, 12 shared fiber mini-GBIC switch ports, 2 built-in XFP 10 Gig ports, and built-in stacking ports and a 1.5 foot Stacking Cable.

Cables and Power supply

Order Code	Description
AL2018009-E6	Ethernet Routing Switch 5000-SRC Cascade Return Cable (3 foot)
AL2018010-E6	Ethernet Routing Switch 5000-SSC Cascade Cable (1 foot)
AL2018011-E6	Ethernet Routing Switch 5510-SSC Cascade Cable (1.5 feet)
AL2018013-E6	Ethernet Routing Switch 5510-SSC Cascade Cable (10 feet)
AL2018014-E6	Ethernet Routing Switch 5510-SSC Cascade Cable (5 meter/ 16.4 feet)
AL2011013-E6	Console cable for use with Ethernet Switches and Ethernet Routing Switches
AA0005017-E5	Ethernet Routing Switch RPS 15 Chassis (up to three RPS 15 modules can be installed in the chassis)
AA0005019-E5	Ethernet Routing Switch RPS 15 600-watt RPS module (1 DC cable per RPS module required)
AA0005018-E6	Redundant Power Supply 15 - Connecting Cable (6ft / 1.8m) for a Single ERS 5520-5530
AA0005020-E6	Redundant Power Supply 15 - Long Connecting Cable (7.6m/25ft) for up to 4 x ERS 5510
AA0005021-E6	Redundant Power Supply 15 - Short Connecting Cable (3m/10ft) for up to 4 x ERS 5510
AL1904007-E6	-48 V DC-to-DC converter, for installation in the ERS 5510-48T and 5510-24T

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SFP (Short-form Factor Pluggable) Transceivers

Order Code	Description	Order Code	Description
AA1419013-E5	1-port 1000Base-SX SFP GBIC (LC connector)	AA1419032-E5	1-port 1000Base-CWDM SFP GBIC - 1610nm Wavelength (40km), LC connector
AA1419014-E5	1-port 1000Base-SX SFP GBIC (MT-RJ connector)	AA1419033-E5	1-port 1000Base-CWDM SFP GBIC - 1470nm Wavelength (70km), LC connector
AA1419015-E5	1-port 1000Base-LX SFP GBIC (LC connector)	AA1419034-E5	1-port 1000Base-CWDM SFP GBIC - 1490nm Wavelength (70km), LC connector
AA1419043-E5	1-port 1000Base-T Small Form Pluggable (SFP), 8-pin modular connector (RJ-45)	AA1419035-E5	1-port 1000Base-CWDM SFP GBIC - 1510nm Wavelength (70km), LC connector
AA1419025-E5	1-port 1000Base-CWDM SFP GBIC - 1470nm Wavelength (40km), LC connector	AA1419036-E5	1-port 1000Base-CWDM SFP GBIC - 1530nm Wavelength (70km), LC connector
AA1419026-E5	1-port 1000Base-CWDM SFP GBIC - 1490nm Wavelength (40km), LC connector	AA1419037-E5	1-port 1000Base-CWDM SFP GBIC - 1550nm Wavelength (70km), LC connector
AA1419027-E5	1-port 1000Base-CWDM SFP GBIC - 1510nm Wavelength (40km), LC connector	AA1419038-E5	1-port 1000Base-CWDM SFP GBIC - 1570nm Wavelength (70km), LC connector
AA1419028-E5	1-port 1000Base-CWDM SFP GBIC - 1530nm Wavelength (40km), LC connector	AA1419039-E5	1-port 1000Base-CWDM SFP GBIC - 1590nm Wavelength (70km), LC connector
AA1419029-E5	1-port 1000Base-CWDM SFP GBIC - 1550nm Wavelength (40km), LC connector	AA1419040-E5	1-port 1000Base-CWDM SFP GBIC - 1610nm Wavelength (70km), LC connector
AA1419030-E5	1-port 1000Base-CWDM SFP GBIC - 1570nm Wavelength (40km), LC connector		
AA1419031-E5	1-port 1000Base-CWDM SFP GBIC - 1590nm Wavelength (40km), LC connector		

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XFP Transceivers for 10 Gbps uplink (for 5530)

Order Code	Description
AA1403001-E5	10GBase-LR XFP (1310nm, Single mode fiber, up to 10Km, LC connector)
AA1403003-E5	10GBase-ER XFP (155 Onm, Single mode fiber, up to 40Km, LC connector)
AA1403005-E5	10GBase-SR XFP (850nm, Multi-mode fiber, up to 300m, LC connector)

Advanced Routing License

Order Code	Description
AL1016001	Advanced Routing License for single stack/standalone unit
AL1016002	Advanced Routing License for 10 stacks/standalone units
AL1016003	Advanced Routing License for 50 stacks/standalone units
AL1016004	Advanced Routing License for 100 stacks/standalone units

Maintenance Services

Order Code	Description
GE5300xxx	Technical Support Service
GL5300xxx	Return & Replace Service
GF5300xxx	Managed Spares Services Pack – Next Business Day
GG5300xxx	Managed Spares Second Business Day
GH5300xxx	Managed Spares Services Pack – 4 Hour 7x24
GJ5300xxx	Managed On-Site with Spares Services Pack-Next Business Day
GK5300xxx	Managed Onsite with Spares SBD Svc Pack
GN5300xxx	Managed On-Site with Spares Services Pack – 4 Hour 7x24

Note: Replace xxx with 549 for 5510-48T, 550 for 5510-48T, 846 for 5520-48T-PWR, 846 for 5520-24T-PWR and A08 for 5530.

The seventh character (*) of the switch order number is replaced with the proper code to indicate nationalization:

- "A" – No power cord included
- "B" – European "schuko" power cord common in Austria, Belgium, Finland, France, Germany, The Netherlands, Norway, and Sweden.
- "C" – Power cord commonly used in the United Kingdom and Ireland.
- "D" – Power cord commonly used in Japan.
- "E" – North American power cord.
- "F" – Australian power cord, also commonly used in New Zealand and the People's Republic of China.

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