Using Cisco Catalyst 3750-E Series Switches for Converged Applications

Applications such as IP telephony are becoming increasingly popular as a growing number of organizations realize the cost and productivity benefits achieved by the convergence of voice, video, and data networks. At the same time, successful deployment and operation rely on the network being able to provide certain crucial capabilities. An important part of IP telephony deployment is the selection of equipment suitable for the task. Cisco® Catalyst® 3750-E Series Switches represent a resilient and scalable switching solution appropriate for IP telephony deployments because they provide:

- Specialized capabilities needed for a successful deployment of IP telephony
- Reduced operating costs
- Investment protection

Enabling Successful IP Telephony Deployment

Cisco Catalyst 3750-E Series Switches are suitable for IP telephony because they deliver important capabilities in the areas of quality of service (QoS), availability, security, and Power over Ethernet (PoE).

QoS

Delivering high-quality voice in packet-oriented data networks requires that a certain amount of network resources are available for voice traffic. In particular, voice quality is sensitive to such network characteristics as packet discards, delay, and delay variation. In networks migrating to converged data, voice, and video applications, the ability to separate voice traffic and afford it with a priority treatment is essential. The Cisco Catalyst 3750-E meets these requirements by offering numerous QoS mechanisms for marking, classification, and scheduling to deliver best-in-class performance for data, voice, and video traffic, all at wire speed.

- Separate voice VLAN isolates voice traffic from other traffic.
- Per packet 802.1p class of service (CoS) and differentiated services code point (DSCP) classification or reclassification based on L2, L3, or L4 information in the packet signals the priority of a particular flow to the rest of the network. This enables the selective discard of lower priority traffic in case of congestion.
- Four egress queues per port allow differentiated treatment for four traffic types.
- Cisco committed information rate (CIR) function permits bandwidth allocation in granular increments of 8 Kbps.
- Shaped Round Robin (SRR) scheduling helps ensure differential prioritization of packet flows by intelligently servicing the ingress queues and egress queues.
- Automatic QoS (AutoQoS) and Cisco SmartPorts simplify QoS configuration in voice-over-IP (VoIP) networks by issuing interface and global switch commands to detect Cisco IP phones, classify traffic, and help enable egress queue configuration.

Availability

Traditional voice services are ubiquitous and always available. In order for IP telephony to provide services with similar reliability, it is important that networking devices remain operational and that failures are imperceptible to the user. Cisco Catalyst 3750-E Series Switches address both of these concerns by utilizing redundant hardware and customized software.

Hardware support for high availability includes:

- Cisco RPS 2300: As many as six Cisco Catalyst 3750-E Series Switches can be connected to the Cisco RPS 2300, greatly improving the uptime of the switches. To further decrease the probability of disruption, the Cisco RPS 2300 has two power supplies and can supply power for up to two switches at the same time.

- New modular power supplies available on the Cisco Catalyst 3750-E Series Switches dramatically improve availability. A power supply can be replaced without any interruption of network traffic, while the switch is being backed up by the RPS. After replacement is made, the switch transparently transitions to drawing power from the new power supply. As a result, both the failure of power supply and the recovery from power supply failure are completely invisible to end users.

- StackWise™ Plus high-bandwidth stacking technology, which allows for up to nine Cisco Catalyst 3750-E Series Switches to be connected into a switch stack. A switch stack appears as a single device to management applications and to other devices in the network. However, if a switch in the switch stack fails, StackWise Plus technology helps ensure that the rest of the switch stack continues to operate. One of the switches in the stack operates as the master controller, while others operate as subordinate forwarding processors. Each switch in the stack is able to operate as the master controller. As a result, the switch stack provides 1:N redundancy because one active master controller is backed up by a number of standby devices ready to take over if the master controller fails.

Also minimizing traffic disruption are several software features designed to maintain network availability in case the master controller does fail and a new one takes over. At Layer 2, the following features help ensure nonstop forwarding:

- FlexLink provides link redundancy with a convergence time of less than 100ms.

- IEEE 802.1s/w Rapid Spanning Tree Protocol (RSTP) and Multiple Spanning Tree Protocol (MSTP) provide rapid spanning-tree convergence independent of spanning-tree timers and also offer the benefit of Layer 2 load balancing and distributed processing. Stacked units behave as a single spanning-tree node.

- Cross-Stack EtherChannel® allows multiple switches in a stack to create an EtherChannel connection. Loss of an individual switch will not affect connectivity for the other switches.

- At Layer 3, high availability in routing during the change in masters is achieved through Routing Processor Redundancy + (RPR+) where each subordinate switch contains routing capability and remains ready to take over routing functions if the master fails. Reestablishment of routes and links is less disruptive than in normal Layer 3 devices because forwarding is not interrupted during route relearning.

Security

Security is a concern as organizations build communication systems that enable them to take advantage of converged voice, data, and video networks. Fortunately, the same principles, tools, and techniques used to protect data networks apply to voice, which is essentially another application carried on the existing data network infrastructure. Cisco Catalyst 3750-E Series Switches support a broad set of security features, including Network Admission Control (NAC), ACLs, authentication, port-level security, and identity-based network services with 802.1x and extensions. This wide-ranging set of features not only helps prevent external attacks, but also defends the network against "man-in-the-middle" attacks, which is a primary concern in today's business environment. Some of the most prominent security features available on the Cisco Catalyst 3750-E Series Switches are described below.

- Network Admission Control (NAC), a set of technologies and solutions built on an industry initiative led by Cisco, uses the network infrastructure to enforce security policy compliance on all devices seeking to access network computing resources, thereby limiting damage from emerging security threats. Customers using NAC can allow network access only to compliant and trusted endpoint devices (PCs, servers, and PDAs, for example) and can restrict the access of noncompliant devices. Cisco Catalyst 3750-E Series Switches support the NAC framework, which integrates an intelligent network infrastructure with solutions from more than 75 manufacturers of leading antivirus and other security and management software solutions.
- Access control lists (ACLs), the most flexible and powerful filtering tool, help ensure that only users with authorized IP address, protocol, and port information are allowed entry into a VLAN.
- IEEE 802.1x helps ensure that all access to the network infrastructure requires authentication.
- 802.1x with voice VLAN permits an IP phone to access the voice VLAN irrespective of the authorized or unauthorized state of the port.
- Multi-Domain Authentication allows an IP phone and a PC to authenticate on the same switch port.
- MAC Auth Bypass (MAB) for voice allows third-party IP phones without 802.1x supplicant to get authenticated using their MAC address.
- Root Guard and BPDU Guard protect from attacks on Spanning Tree Protocol.
- Port-level security features provide a powerful defense against some of the most damaging voice network attacks, such as a "man-in-the-middle" attack where an intruder could capture packets being sent from one end device to another and use them to eavesdrop on a conversation or establish a new connection. Features such as DHCP snooping, dynamic ARP inspection, and IP Source Guard work together to thwart such attacks by positively authenticating each end-user device.

Power over Ethernet

PoE provides a universal low-voltage power distribution system that dramatically lowers power provisioning and administration costs in IP telephony deployments and enables high-availability network designs. PoE offers several benefits that greatly simplify the electrical wiring requirements for IP telephony deployments:

- Eradicates the inconvenience of separate wall power, especially in places that are harder to access
- Eliminates the expense and efforts for obtaining building permits or engaging electricians

The Cisco Catalyst 3750-E offers expandable and flexible PoE capabilities. A range of power supplies is available to meet specific customer needs. The 1150WAC power supply in the Cisco Catalyst 3750-E Series Switches delivers full 15.4W of power to all 48 PoE ports at the same time, while maintaining a 1 rack unit form factor. The 750WAC power supply provides full power to 24 PoE ports. It can also be used in 48-port PoE switches when the maximum PoE output is not required on all ports. In this case, using the 750W power supply provides the benefit of lower power consumption. Other, more energy-efficient, power supply models are available for non-PoE versions of the Cisco Catalyst 3750-E Series Switches.

Cisco Discovery Protocol Version 2 allows the Cisco Catalyst 3750-E Series Switch to negotiate a more granular power setting compared to the IEEE power classification, when connecting to a Cisco powered device such as Cisco IP Phones or Cisco Wireless Access Points.

Operating Cost Reduction

While the Cisco Catalyst 3750-E Series Switches possess highly desirable capabilities to warrant their deployment, they also prove advantageous by reducing costs during operation. The reduction of operating expenses is achieved through the introduction of more serviceable modular power supplies and through the automation of configuration tasks.

Modular Power Supplies

Modular power supplies cut down costs by enabling a more efficient recovery from failures and by reducing the number of spare parts.

The power supplies are hot swappable, allowing a failed power supply to be replaced in the field. Recovery from a failed power supply happens much faster since it does not involve replacing the old switch with the new one. Users also save time by not having to wait for the replacement parts to be shipped to them. Moreover, if the switch is connected to the Cisco RPS 2300, the repairs could be done without causing any traffic disruption. This further improves availability, and it cannot be accomplished on a switch with a fixed power supply.

In addition to being modular, the power supplies are also interchangeable. The same 1150WAC and 750WAC power supply models can be used in the Cisco Catalyst 3750-E Series Switches and in the Cisco RPS 2300. As a result, maintenance is simplified because fewer spare power supply models need to be stored.

Automated Configuration

Ease-of-use features available on the Cisco Catalyst 3750-E Series Switches offer another way to lower costs. AutoQos and SmartPorts reduce the time spent on the administrative task of configuring a switch.

In general, QoS network design and implementation over multiple LAN and WAN sites to establish end-to-end traffic prioritization are fairly complex and labor intensive. AutoQos allows users to reduce deployment time, provisioning errors, and operating expenses needed to optimize their network for the applications, while retaining the flexibility to subsequently fine-tune QoS.

SmartPorts is a Cisco Catalyst solution that simplifies the configuration of critical features for Ethernet networks. SmartPorts makes available Cisco AVVID (Architecture for Voice, Video and Integrated Data) configuration best practices with pretested switch port configurations or "templates" recommended by Cisco. With these templates, users are able to consistently and reliably configure essential features such as QoS, availability, and security with minimal effort and expertise.

Manageability

A primary element to success in network deployments is manageability, not just related to individual infrastructure components but also at the level of the entire Cisco Unified Communications solution.

CiscoWorks LAN Management Solution (LMS) is a suite of powerful management tools that simplify the configuration, administration, monitoring, and troubleshooting of network elements such as the Cisco Catalyst 3750-E Series Switches and Integrated Services Routers.

The Cisco Unified Communications Management Suite (UCMS) is a suite of products that provide complete lifecycle management for Cisco Unified Communications solutions in enterprise deployments. Cisco UCMS does this by evaluating the end-user experience by monitoring voice quality for the entire solution. It also provides contextual diagnostic tools to facilitate trouble isolation and troubleshooting.

Investment Protection

In addition to reducing operating costs, the Cisco Catalyst 3750-E Series Switches represent a significant protection for existing and future infrastructure investment. Specifically, the Cisco Catalyst 3750-E Series Switches offer the scalability to address the growing future needs and also provide the ability to stack with the Cisco Catalyst 3750 Series Switches to protect existing investment.

Scalability to Address Future Needs

The Cisco Catalyst 3750-E Series Switches are well positioned to accommodate both the growing number of end devices and the increasing amount of traffic. Up to nine switches can be stacked together using Cisco StackWise Plus technology. As a result, a switch stack can be gradually expanded to contain as many as 432 access ports, although from the network management perspective the switch stack remains a single device.

Introduction of high-speed devices such as Cisco Unified IP Phone 7971G-GE, the Cisco Gigabit Ethernet IP phone, intensifies the need for scalability. In order to handle increased amounts of network traffic, the Cisco Catalyst 3750-E Series Switches support two wire speed 10 Gigabit Ethernet uplinks. However, users are not forced to use the high-bandwidth uplinks or adopt 10 Gigabit Ethernet optics immediately. The innovative TwinGig converter module enables users to migrate to 10 Gigabit Ethernet as their business demands change. The TwinGig converter module allows users to utilize their current Gigabit Ethernet links in wiring closets until they are ready to upgrade to 10 Gigabit Ethernet links. As a result, current investment in SFP modules can be used, and investment in the new 10 Gigabit Ethernet modules can be postponed.

Compatibility with Cisco Catalyst 3750 Series Switches

Compatibility between the StackWise Plus technology in the Cisco Catalyst 3750-E Series Switches and the StackWise technology in the Cisco Catalyst 3750 Series Switches allows users to maximize their current infrastructure investment. The Cisco Catalyst 3750-E Series Switches stack with the Cisco Catalyst 3750 Series Switches, offering the added benefits of the increased 10 Gigabit Ethernet port density and PoE enhancements in the Cisco Catalyst 3750-E Series Switches, while continuing to use their existing investment in the Cisco Catalyst 3750 Series Switches.

The Cisco Catalyst 3750-E Series Switches deliver a resilient and scalable switching solution that protects existing and future infrastructure investments for users who are investing in converged voice and data networks to optimize business processes and real-time applications.

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

Asia Pacific Headquarters
Cisco Systems, Inc.
168 Robinson Road
#28-01 Capital Tower
Singapore 068912
www.cisco.com
Tel: +65 6317 7777
Fax: +65 6317 7799

Europe Headquarters
Cisco Systems International BV
Haarlerbergpark
Haarlerbergweg 13-19
1101 CH Amsterdam
The Netherlands
www-europe.cisco.com
Tel: +31 0 800 020 0791
Fax: +31 0 20 357 1100

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