CISCO SYSTEMS

The **ABCs of Cisco IOS** Software Release

Executive Summary

Cisco® IOS® Software is the world's premiere *network infrastructure software*, delivering seamless integration of technology innovation, business-critical services and hardware support. Currently operating on millions of active systems, from small home office routers to the core systems of the world's largest service provider networks, Cisco IOS Software is the most widely leveraged network operating system in the world.

Optimized for today's IP-based networks and offering fast convergence, Cisco IOS Software provides extraordinary resiliency and advanced networking services by separating control, forwarding, and management planes in order to yield innovative services and high performance. Extremely flexible, adaptable, and scalable, Cisco IOS Software can run on both high-end distributed hardware and low-end single processor systems. It leverages hardware switching using advanced network processors, application-specific integrated circuits, and fast-access memory (content addressable memory) where the stored data item is located by the contents of the memory itself.

Cisco IOS Software minimizes operational expenses, maximizes return on investment, and improves business productivity:

- Minimizes new infrastructure: continuous expansion of features and functionality enables customers to adapt to evolving business needs

- Increases organizational productivity: reliably delivers access to business-critical applications regardless of time or location

- Protects the network from accidental and malicious events, minimizing intervention and operational support costs

In order to select and deploy the most appropriate Cisco IOS Software release, customers must be familiar with the release process and the portfolio of available releases. Use the ABCs of Cisco IOS Software Release to learn the basics of Cisco IOS Software release or to gain a deeper understanding of this sophisticated, feature-rich software.

History of Cisco IOS Software Releases

Early in the history of Cisco, it was possible to satisfy customer requirements via the delivery of a single type of release, which provided incremental software fixes, in addition to new features and functionality. The concept of a "**Train**" was developed to explain the method of delivering a major release. In a very short period of time, it became apparent that there would need to be at least two trains for delivering Cisco IOS Software:

- Major release: A train for software fixes only—which was internally referred to as mainline
- T-release: A train for software fixes and new features—which was internally referred to as *T train*

This system enabled Cisco to introduce new features to a Cisco IOS Software release in one train without affecting the code base of the other train. This innovation allowed customers to choose the software release that best matched their business and networking requirements. Customers who valued stability over the latest features could deploy a *major* release, while those who needed to gain a specific operational or business advantage could choose a T-release.

In recent years, the Internet boom allowed Cisco to add thousands of new features, hundreds of new applications, and a wide array of hardware products. Cisco IOS Software diversified from one to multiple release families, each of which supported different feature sets for different customer needs (ie: E train, S train, and B train releases). This wide array of trains ultimately added complexity to the release selection process.

In an effort to simplify the release selection process for customers, Cisco is introducing the concept of *Release Types*.

Cisco IOS Software Release Types

Three Release types comprise the Cisco IOS Software Portfolio:

- **Maintenance** releases consolidate the new technology introduction releases from the previous release family. They are widely deployable with broad hardware adoption and extensive application support. Maintenance releases receive software fixes on regular basis, but no new features or hardware support. Examples include Major Release 12.2, Major Release 12.3, and Release 12.1E
- **New Technology Introduction** releases are derived from the major release that shares the same number. For example, Release 12.3T is derived from Major Release 12.3. Like maintenance releases, New Technology Introduction releases are widely deployable with broad hardware adoption and extensive application support. In addition to regular software fixes, New Technology Introduction releases provide new features and hardware support. Examples include Release 12.2S and Release 12.3T
- **Application Specific** releases are focused on a single technology or customer. They offer narrow hardware adoption and are intended to have a very limited life. The functionality introduced in an Application Specific release is consolidated into one of the main New Technology Introduction releases at the earliest opportunity. Examples include Release 12.3B, Release 12.1XA, and Release 12.2SX.

Cisco IOS Software Maintenance and New Technology Releases

The Cisco IOS Software Release Portfolio currently includes the following recent releases:

- **Major Release 12.3** (May 2003) is the latest example of how Cisco software delivers benefits through innovation and integration. It is a consolidated release designed for Enterprise, Access, and Cisco channel partners. It delivers innovative, optimized features that enable easy access to Voice, Security, and Quality of Service (QoS), and the leading-edge functionality and hardware support introduced in Cisco IOS Software Release 12.2T.

- The **Release 12.3T** family (July 2003) delivers advanced technologies that drive business productivity by delivering Security, Voice, and Wireless innovations to Enterprise, Access, and Service Provider Aggregation customers. Cisco is issuing the Release 12.3T family as a series of individual releases, each of which create significant revenue opportunities and include hundreds of new business-critical features, powerful new hardware support, and ongoing quality improvements.

- Designed for the largest Enterprise and Service Provider networks that demand world-class network availability, scalability, security, and IP Services, Release 12.2S is a single release family that delivers a carefully selected combination of leading-edge technologies and high-end hardware support, all built upon the very latest advances in Cisco IOS Software Infrastructure.

Cisco IOS Software Release Process

Cisco IOS Software Parent and Child Relationship

In order to effectively navigate through the various Cisco IOS Software releases, it is important to understand the relationship between each release. This relationship can best be described as parent and child, in which major releases are "parents" and New Technology Introduction releases and Application Specific Releases are "children", derived from the major release that shares the same number. Table 1 demonstrates this relationship in the context of the Cisco IOS Software release portfolio.

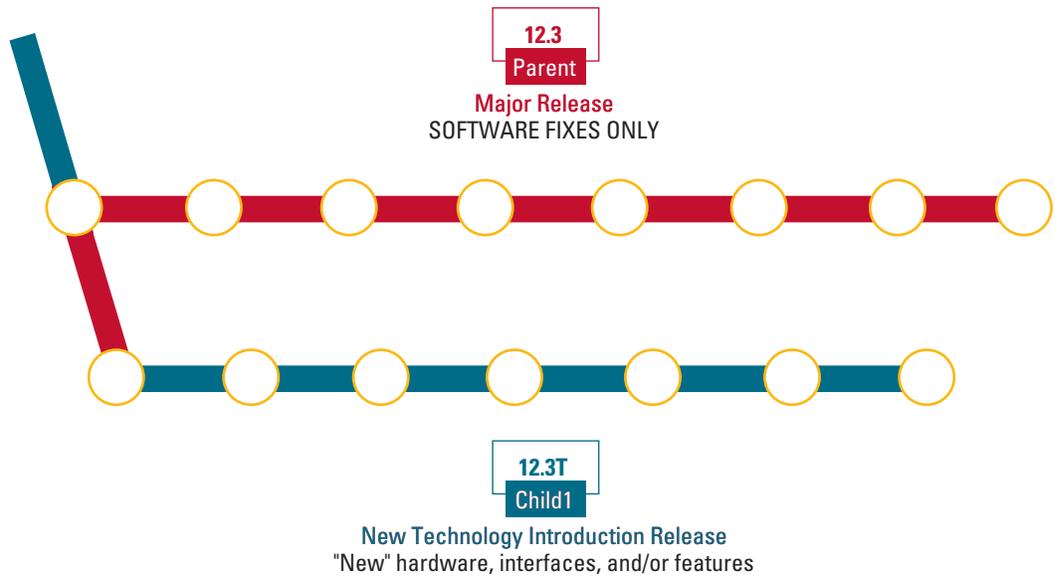**Table 1**   Parent/Child Relationships in the Cisco IOS Software Release Portfolio

Release Family	Parent	Child	
		Name	Type
Release 12.3	Major Release 12.3	12.3T	New Technology Introduction
Release 12.2	Major Release 12.2	12.2T	New Technology Introduction
		12.2S	New Technology Introduction
Release 12.1	Major Release 12.1	12.1E[1]	Application Specific (Enterprise Services)
Release 12.0	Major Release 12.0	12.0T	New Technology Introduction
		12.0S	Application Specific (Service Provider Services)

1. Release 12.1E will become a Maintenance Release beginning with Release 12.1(19)E, as the addition of new functionality will cease with that release.

As an example, Figure 1 illustrates the relationship between Major Release 12.3 and Release 12.3T:

Figure 1
Release 12.3 Family

12.3
Parent
Major Release
SOFTWARE FIXES ONLY

12.3T
Child1
New Technology Introduction Release
"New" hardware, interfaces, and/or features

The Cisco IOS Software Release Overview

Figure 2 illustrates that Major Release 12.3 is a consolidation of all features and hardware support in the Release 12.2T family. Major releases receive software fixes on regular basis, but do not get new features or hardware support. It is important to note that the fixes applied to major releases are synchronized with subsequent instances of the child New Technology Introduction release. In Figure 5, the software fixes applied to Major Release 12.2 are synchronized with the subsequent instances of Release 12.2T.

Figure 2

Cisco IOS Software Major Release Overview

Feature Set Frozen - Software Fixes ONLY

Major Release 12.2

FCS

Software Fixes

Release 12.3T

New Features and Hardware

Major Release 12.3

Release 12.3T
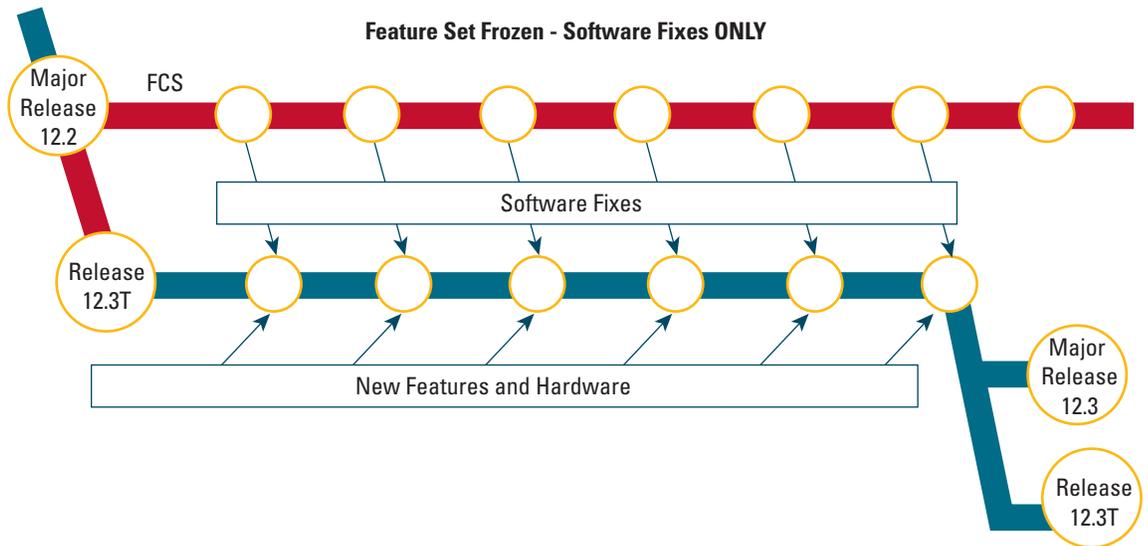
Release Numbering

There are three events that determine the numbering scheme for every release:

- *Release maintenance*
- *Release rebuilds*
- *Interim builds*

Release maintenance is a scheduled revision of Cisco IOS Software that introduces new features and/or bug fixes, depending on the type of release. Release maintenance typically occurs every eight to sixteen weeks, as required by the market and the strict Cisco quality schedule.

- **Maintenance** releases: each instance of release maintenance signifies only the application of software fixes. For example (Figure 6), the formal numbering scheme for the Release 12.2 family is Release 12.2(n), where `n' represents the release maintenance number. Release 12.2(1) represents the first instance of release maintenance.

Figure 3

Release Numbering Convention for Maintenance Releases
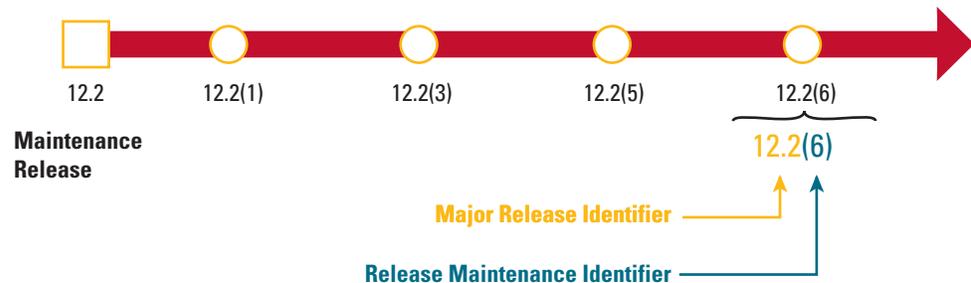
- New Technology Introduction releases: each instance of release maintenance signifies the application of software fixes as well as the introduction of new software features and/or hardware product support. For example (Figure 7), the formal numbering scheme for the Release 12.2T family is Release 12.2(n)T, where `n' represents the release maintenance number. Release 12.2(2)T is the second instance of release maintenance.

- **New Technology Introduction** releases build each instance of release maintenance upon the previous release. For example, Release 12.2(4)T is built upon Release 12.2(2)T. Release 12.3(4)T takes all the functionality and software fixes in Release 12.2(2)T and adds even more leading-edge technologies and features.

Due to separate maintenance schedules, Maintenance releases and New Technology Introduction releases seldom share the same release maintenance number. If a major release and a new technology release have the same maintenance number (the number in the parenthesis), this means that they are "fix for fix" equivalent, or they have incorporated the same software fixes.
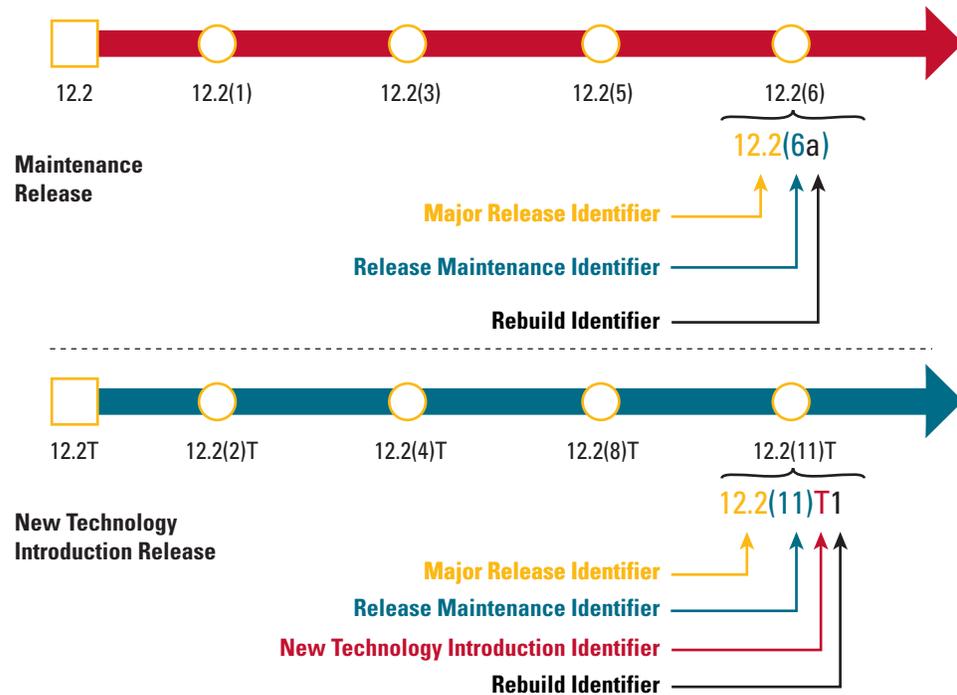
Release 12.3(2)T is the first release of the Release 12.3T family; however, it contains software fixes that were not incorporated in Major Release 12.3(1). Since these releases are not software "fix for fix" equivalent, it would be misleading to number this first release as 12.3(1)T.

Release rebuilds are a Cisco IOS Software vehicle delivering software fixes on an accelerated schedule, which occurs when circumstances require that images from a Cisco IOS Software release be rebuilt and posted prior to the next planned maintenance instance.

A lowercase alphabetic suffix within the parenthesis of a release name, such as Release 12.2(6a), indicates a rebuild of a Maintenance Release (see Figure 4).

Figure 4

Release Numbering Convention for New Technology Introductions

12.2   12.2(1)   12.2(3)   12.2(5)   12.2(6)

**Maintenance
Release**

12.2(6a)

Major Release Identifier

Release Maintenance Identifier

Rebuild Identifier

12.2T   12.2(2)T   12.2(4)T   12.2(8)T   12.2(11)T

**New Technology
Introduction Release**

12.2(11)T1

Major Release Identifier

Release Maintenance Identifier

New Technology Introduction Identifier

Rebuild Identifier

A numeric suffix outside the parenthesis of a release name, such as 12.2(11)T1, indicates a rebuild of a New Technology Introduction release.

Please note that there can be several rebuilds of the same revision. For example: Releases 12.2(6a), 12.2(6b), 12.2(6c) OR 12.2(11)T1, 12.2(11)T2, and 12.2(11)T3.

An *Interim build* is software from an internal Cisco engineering build process. The Cisco Technical Assistance Center (TAC) provides this for customers to use on a temporary basis to address a specific issue. Customers who have an interim build installed on their network should contact TAC for assistance in replacing the interim build.

Figure 5 illustrates that a release maintenance identifier with a decimal indicates an interim build (ie: Release 12.2(3.1).

Figure 5

Release Number Convention for Interim Builds
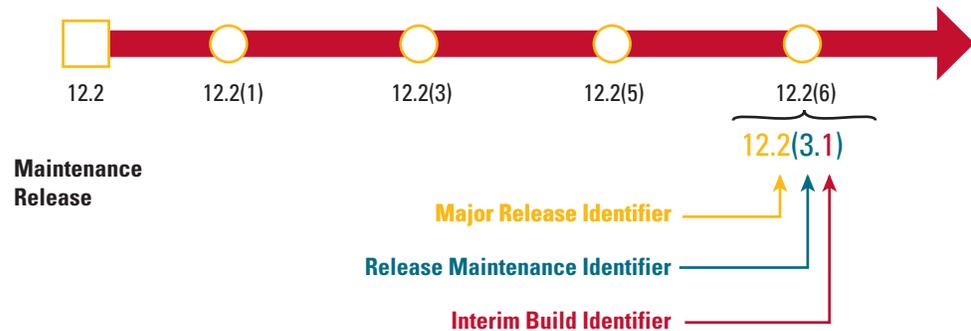
Important Release Communications

Cisco issues many software advisories to customers for informational purposes only. Often, software advisories describe problems with Cisco IOS Software that are hardware-specific or occur under unusual circumstances, and therefore, do not affect most customers. Critical communications about releases from Cisco that do require action include:

- **Security Advisory**—Product Security Incident Response Team (PSIRT) issues a security advisory to alert customers to security issues that directly impact Cisco products and to help customers repair the Cisco product.
- **Security Notices**—Cisco issues Security Notices about issues that require a response to information posted to a public forum, or to make recommendations to mitigate general problems affecting network stability.
- **Software Advisory**—Cisco issues a Software Advisory to announce the introduction of a solution to a defect, which will affect certain customers running specific network architectures. Cisco has determined that the defect does not impact the general use of the Cisco IOS Software release. When the Software Advisory regarding a Cisco IOS Software image is posted, customers who run the affected image(s) are should upgrade to the rebuild or maintenance release that contains the replacement image(s). Customers who are not impacted by the defect still have the option of downloading the affected image(s).
- **Deferral Advisory**—Cisco issues a deferral advisory to announce the removal of a Cisco IOS Software from Cisco.com, and to introduce a replacement image. A deferral advisory is most often issued to correct a defect. At the time that the deferral of a Cisco IOS Software image is advised, customers are strongly urged to migrate from the affected image to the replacement image.
- **Obsolescence Advisory**—Cisco issues an Obsolescence Advisory to remove older Cisco IOS Software maintenance releases that have become outdated and are not recommended for new installations. As the affected release(s) are removed, Cisco will no longer ship them.

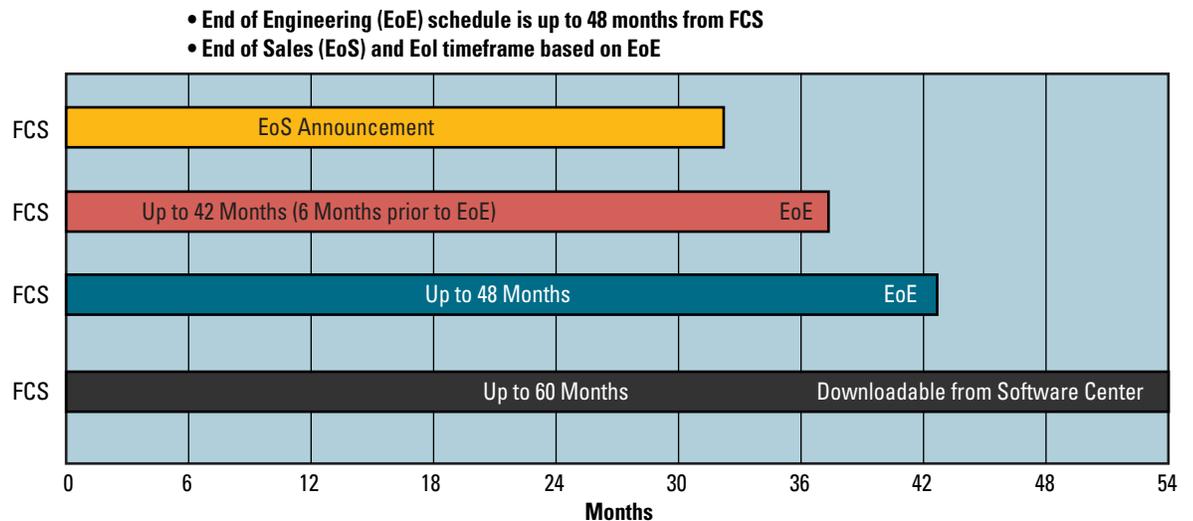**Cisco IOS Software Release Policy**

The Cisco IOS Software Release Policy is a structured plan that addresses the Cisco IOS Software Lifecycle from First Commercial Shipment (FCS) through End of Life (EoL). The Release Policy addresses lifecycle guidelines and migration planning.

There are six key milestones in the Cisco IOS Software Release Lifecycle:

- First Commercial Shipment (FCS)—Release is first available to customers on Cisco.com
- General Deployment Certification—Major release is appropriate for general, unconstrained use in customer networks
- End of Sale (EoS)—Customers can no longer order a release from Cisco manufacturing, but maintenance releases are available to download from Software Center
- End of Engineering (EoE)—No new software fixes are provided by engineering and no new functionality will be added; Cisco TAC continues to offer customer support for the release
- Archive—Images are removed from Software Center and customers cannot download the release
- End of Life (EoL)— Cisco TAC ends support for the release and will only open cases on the release to recommend an upgrade

Figure 6

Major Release Lifecycle Timeline

- **End of Engineering (EoE) schedule is up to 48 months from FCS**
- **End of Sales (EoS) and EoI timeframe based on EoE**

For additional information about the Cisco IOS Software release lifecycle, please consult Product Bulletin No. 2214, Cisco IOS Software Product Lifecycle Dates & Milestones:

http://www.cisco.com/en/US/products/sw/iosswrel/ps5187/prod_bulletin09186a00801a1349.html

General Deployment Certification

A Cisco IOS Software release achieves the General Deployment certification milestone when it has demonstrated the maturity of extensive deployment in diverse customer networks, over extended periods of time. The Cisco IOS Software development process maintains continuous improvement efforts on Cisco IOS Software releases. Applied improvements address industry best practices and metrics for software quality.

Through General Deployment certification, Cisco extends the Cisco IOS Software development process to include unique customer applications and experiences to assist in maturing the code.

Cisco IOS Packaging

Today's customers need more flexible and consistent software packaging to address their complex network environment. Cisco is delivering a new software packaging framework via the Release 12.3 Family, creating a foundation for new features and functionality that better suits customer needs.

Cisco IOS Packaging redefines and simplifies the current Cisco IOS Software feature sets. It greatly improves the customer software selection experience by reducing the number of packages from forty-four to eight. Four packages have been designed to satisfy requirements in four typical service categories: IP data, converged voice and data, Security and VPN, and Enterprise protocols. Three additional premium packages offer new Cisco IOS Software feature combinations that address more complex network requirements. All features merge in the most premium package, Advanced Enterprise Services, which integrates support for all routing protocols with Voice, Security, and VPN capabilities.

Cisco IOS Packaging is available for customers running Major Release 12.3 on the Cisco 1700, 2600XM, and 37000 Series Routers, and the Cisco 2691 Router. Most Cisco access, aggregation, and core routers will support this model in the future.

Cisco IOS Packaging is fundamentally based on a feature inheritance model, as illustrated by Figure 7. Each new package inherits all of the Cisco IOS Software features and services available in the packages below it, offering customers a clear migration and upgrade path.

Cisco IOS Packaging also simplifies image naming. Each name has been designed to effectively convey the high-level feature content of, and the inheritance characteristics for, the new packages. The new package names emphasize the inheritance characteristics of Cisco IOS Packaging. They also provide a high-level feature content description of the new packages, which further simplifies the image selection process.

The following categories summarize the new naming convention:

- **Base:** entry level image, (ie: IP Base, Enterprise Base)
- **Services:** addition of IP Telephony Service, MPLS, NetFlow, Voice over IP, Voice over Frame Relay, and ATM (ie: SP Services, Enterprise Services)
- **Advanced:** addition of VPN, Cisco IOS Firewall, 3DES encryption, Secure Shell, Cisco IOS IPsec and Intrusion Detection Systems (ie: Advanced Security, Advanced IP Services)
- **Enterprise:** addition of multi-protocols, including IBM, IPX, AppleTalk (ie: Enterprise Base, Enterprise Services)

Figure 7

Cisco IOS Packaging Feature Inheritance Model
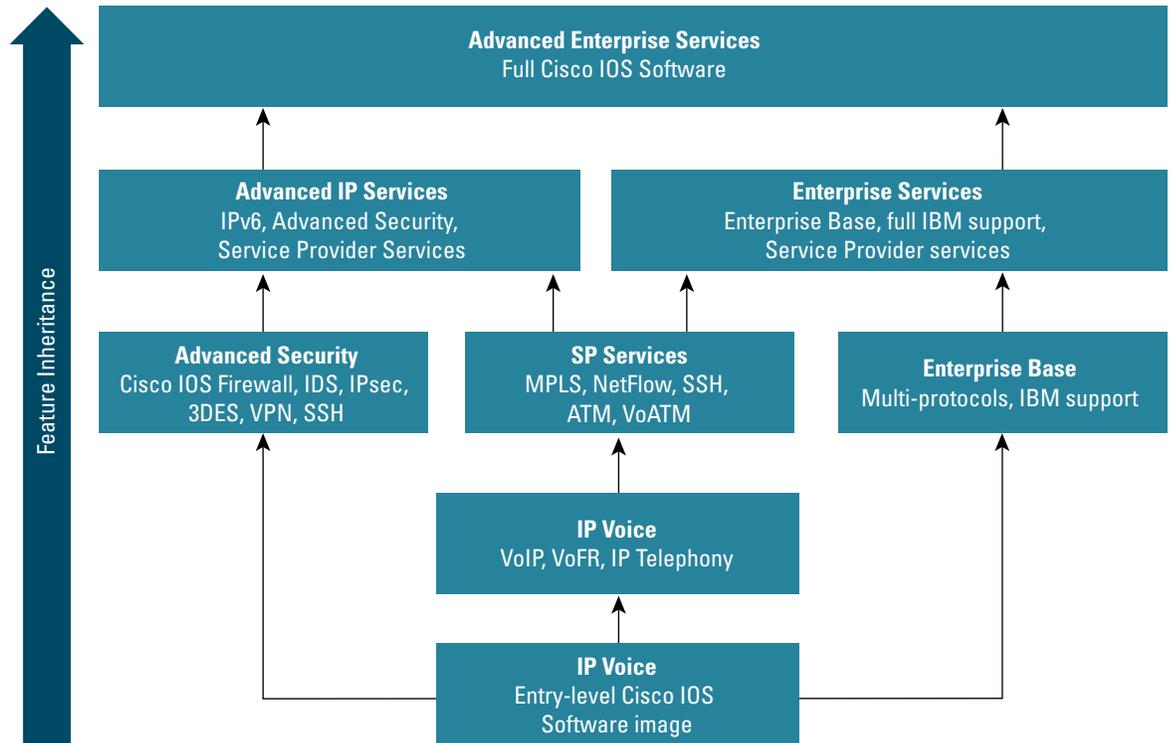
Eight new Packages:

- **IP** *Base*
- **IP Voice**
- **Enterprise** Base
- *Advanced Security*
- **SP** *Services*
- *Advanced IP Services*
- *Enterprise Services*
- *Advanced Enterprise Services*

The new packages have been specifically designed to satisfy requirements of four typical service categories:

- IP data services
- Converged voice and data services
- Security and VPN services
- Multi-protocol services (ie: IPX, AppleTalk, and various IBM protocols)

Cisco IOS Packaging provides a focused package as an entry point for each category. As customers progress up the pyramid, comprehensive packages provide additional functionality and combine features from different categories to meet required combinations. All packages converge in the Advanced Enterprise Services, integrating all mainstream functionality.

For additional information about Cisco IOS Packaging, please visit:

- http://www.cisco.com/warp/public/732/releases/packaging/
- http://www.cisco.com/en/US/products/sw/iosswrel/ps5460/ prod_bulletin09186a00801af451.html

Tools and Resources

It can sometimes be daunting to navigate through Cisco IOS Software releases. With this in mind, Cisco has developed a world-class suite of resources to help customers to choose the optimal release to meet their network needs.

Cisco IOS Software

- Cisco IOS Software Release
- Cisco IOS Technologies
- Questions and Feedback

Cisco IOS Software Tools:

- Cisco Feature Navigator: web-based application that quickly matches the right Cisco IOS Software release for the features you want to run on your Network.
- Cisco IOS Software Bug Toolkit: search for known bugs based on software release, feature set, and keywords
- Cisco IOS Software Upgrade Planner: choose a hardware product, a maintenance release, or a software feature and automatically limit the other menu choices based on this selection, until you arrive at your preferred software.
- Software Advisor: match Cisco IOS Software releases and Cisco Catalyst® O/S features and releases, and determine which software release supports a given hardware device
- Software Selector: determine the right Cisco IOS Software release and the amount of memory needed to run the required Cisco IOS Software features on a Cisco hardware product

Cisco IOS Software Resources

- Software Center
- Cisco Technical Assistance Center

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