Cisco IOS Software Early Deployment Release 12.4(15)XF

PB408212
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Introduction

This product bulletin provides content and delivery information for Cisco IOS® Software Special Release 12.4(15)XF. It should be used in conjunction with the release notes for Cisco IOS Software Release 12.4T at http://www.cisco.com/en/US/products/ps6824/index.html, because Release 12.4(15)T is the parent release of 12.4(15)XF.

This product bulletin lists only the features in Cisco IOS Software Release 12.4(15)XF (see Table 1) that are new to the respective routers; more information is available in the release notes at http://www.cisco.com/en/US/products/ps6441/prod_release_notes_list.html. Customers should be prepared to upgrade using the migration path described in the "Upgrade Paths" section.

This release supports Cisco Mobile Ad Hoc Networking (MANET) enhancements for router-to-radio links. These enhancements address the challenges faced when merging IP routing and mobile radio communications in ad hoc networking applications. Features in this release enable faster convergence when nodes join or leave the network, and optimal route selection based on Layer 2 feedback from the radio network. The release also provides a flow-control mechanism between a router and its partner radio, as well as the means for integrating point-to-point directional radio topologies with multi-hop routing environments.

Table 1. Release 12.4(15)XF Features

Feature	Function
Neighbor Up/Down Signaling	Enables Cisco routers to use link establishment or termination signals from the radio to update routing topology, rather than waiting for timers to expire. The routing protocols (OSPFv3 and EIGRP) respond immediately to these link status signals by expediting adjacency formation or tear-down.
Link Quality Metrics Reporting	The PPPoE protocol has been extended to enable a router or radio to query or report link quality metric information. Cisco routers have been enhanced so that OSPFv3 or EIGRP routing protocols can factor link quality metrics into route cost calculations.
PPPoE Credit-based Flow Control	This extension to the PPPoE protocol allows a receiver to control the rate at which a sender can transmit data for each PPPoE session, so that the need for queuing in the radio is minimized.
Virtual Multipoint Interface (VMI)	This Cisco router enhancement maps multiple PPPoE sessions (each representing a point-to-point neighbor connection) into a single broadcast-capable, multi-access interface.

Cisco IOS Release 12.4(15)XF

Cisco IOS 12.4(15)XF is a Special ED release (XED) optimized to support the MANET extensions for router-radio links. This release is based upon the 12.4(15)T maintenance release.

Key Features

Neighbor Up/Down Signaling (OSFPv3 and EIGRP)

MANETs are highly dynamic environments. Nodes may move into, or out of, radio range at a fast pace. Each time a node joins or leaves, the network topology must be logically reconstructed by the routers. Routing protocols normally use timer-driven "hello" messages or neighbor timeouts to

track topology changes, but MANETs reliance on these mechanisms can result in unacceptably slow convergence.

The Cisco solution provides faster network convergence by using link status signals generated by the radio. The radio notifies the router each time a link to another neighbor is established or terminated. In the router, the routing protocols (OSPFv3 or EIGRP) respond immediately to these signals by expediting formation of a new adjacency (for a new neighbor) or tearing down an existing adjacency (if a neighbor is lost). If, for example, a vehicle drives behind a building and loses its connection, the router will immediately sense the loss and establish a new route to the vehicle through neighbors that are not blocked. This high speed network convergence is essential for minimizing dropped voice calls and disruptions to video sessions.

Link Quality Metric Reporting for OSPFv3 and EIGRP

The quality of a radio link has a direct impact on the throughput that can be achieved by router-router traffic. The PPPoE protocol has been extended to provide a process by which a router can request, or a radio can report, link quality metric information. Cisco OSFPv3 and EIGRP implementations have been enhanced so that the route cost to a neighbor is dynamically updated based on metrics reported by the radio. This capability allows the best route to be chosen within a given set of radio links.

The routing protocols receive raw radio link data, and compute a composite quality metric for each link. In computing these metrics, the following factors may be considered:

- **Maximum Data Rate:** the theoretical maximum data rate of the radio link, in bytes per second
- **Current Data Rate:** the current data rate achieved on the link, in bytes per second
- **Latency:** the transmission delay packets encounter, in milliseconds
- **Resources:** a percentage (0-100) that can represent the remaining amount of a resource (such as battery power)
- **Relative Link Quality:** a numeric value (0-100) representing relative quality, with 100 being the highest quality

Metrics can be weighted during the configuration process to emphasize or deemphasize particular characteristics. For example, if throughput is a particular concern, the current data rate metric could be weighted so that it is factored more heavily into the composite metric. Similarly, a metric that is of no concern can be omitted from the composite calculation.

Link metrics can change rapidly, often by very small degrees, which could result in a flood of meaningless routing updates. In a worst case scenario, the network would be churning almost continuously as it struggled to react to minor variations in link quality. To alleviate this concern, Cisco provides a tunable dampening mechanism that allows the user to configure threshold values. Any metric change that falls below the threshold is ignored.

PPPoE Credit-based Flow Control

Each radio initiates a PPPoE session with its local router as soon as the radio establishes a link to another radio. Once the PPPoE sessions are active for each node, a PPP session is then established end-to-end (router-to-router). This process is duplicated each time a radio establishes a new link.

The carrying capacity of each radio link may vary due to location changes or environmental conditions, and many radio transmission systems have limited buffering capabilities. To minimize

the need for packet queuing in the radio, Cisco has implemented extensions to the PPPoE protocol that enable the router to control traffic buffering in congestion situations. Implementing flow-control on these router-to-radio sessions also will allow use of Quality of Service (QoS) features such as fair queuing.

The solution utilizes a credit-granting mechanism documented in an IETF informational draft. When the PPPoE session is established, the radio can request a flow-controlled session. If the router acknowledges the request, all subsequent traffic must be flow-controlled. If a flow control session has been requested and cannot be supported by the router, the session is terminated. Typically, both the radio and the router initially grant credits during session discovery. Once a device exhausts its credits, it must stop sending until additional credits have been granted. Credits can be added incrementally over the course of a session.

Virtual Multipoint Interface

Directional radios are frequently used in applications that require greater bandwidth, increased power-to-transmission range, or reduced probability of detection. These radios operate in a point-to-point mode, and generally have no broadcast capability. On the other hand, the routing processes in the Cisco MANET solution operate most efficiently when viewing the network link as point-to-multipoint, with broadcast capability. For the router, modeling the MANET as a collection of point-to-point nodes would have a dramatic impact on the size of its internal database.

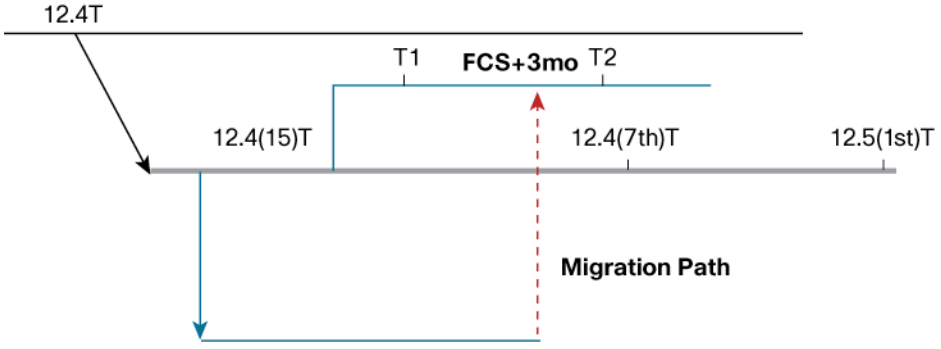
Cisco has developed a Virtual Multipoint Interface (VMI) within the router that aggregates all the per-neighbor PPPoE sessions from the Radio Ethernet connection. The VMI maps these to appear to Layer 3 routing protocols and applications as a single point-to-multipoint, multi-access, broadcast-capable network. However, the VMI preserves the integrity of the PPPoE sessions on the radio side, so that each point-to-point connection can have its own QoS queue.

The VMI also relays the link quality metric and neighbor up/down signaling from the radio to the routing protocols. Currently, VMI signals are used by EIGRP (for IPv4 and IPv6 neighbors) and OSPFv3 (for IPv6 neighbors).

Upgrade Paths

CISCO IOS Software Special Release 12.4(15)XF is a short-lived release. It is based on the sixth release of Release 12.4T, which is Release 12.4(15)T. It will migrate into the sixth release of Release 12.4T. Customers should be prepared to migrate to the sixth release of Release 12.4T when it is available.

Diagram 1 below displays Release 12.4(15)XF functionality relative to Release 12.4T. This diagram also identifies the recommended migration path.



Availability

Cisco IOS Software Special Release 12.4(15)XF is targeted for May 17, 2007.

Ordering Information

Table 2 provides ordering information for Cisco IOS Software Release 12.4(15)XF feature sets, including part numbers for ordering and memory recommendations.

Platform	Software Feature Set	Product Code	Image	Flash	DRAM
3250	Cisco 3250 Series IOS Advanced Enterprise Services	S325AESK9-12415XF	c3250-adventerprisek9-mz	32MB	128MB

For More Information

For more information about the Cisco 12.4(15)XF visit http://www.cisco.com/en/US/products/ps6706/prod_release_notes_list.html or contact your local account.

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