

ENCOR Study Guide

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September 7, 2024

- 1.0 Architecture (1-6)
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OCG

Chapter 1: Packet Forwarding

The MAC address table resides in content addressable memory (CAM). The CAM uses high-speed memory that is faster than typical computer RAM due to its search techniques. The CAM table provides a binary result for any query of 0 for true or 1 for false. The CAM is used with other functions to analyze and forward packets very quickly. Switches are built with large CAM to accommodate all the Layer 2 hosts for which they must maintain forwarding tables.

Process switching (software switching/slow path) is the fallback CEF because it is dedicated for punted IP packets. In IOS *ip_input* process runs on the general-purpose CPU for processing incoming IP packets. When will packets require software handling?

- 1. packets are sourced/destined to/from the router (control traffic or routing protocols)
- 2. packets that are too complex for the hardware to handle (IP packets with IP options)
- 3. packets that require extra information that is not currently known (for example, unresolved ARP entries)

The general-purpose CPUs on software-based and hardware-based routers are similar and perform all the same functions; the difference is that on software-based routers, the general-purpose CPU is in charge of all operations, including CEF switching (software CEF), and the hardware-based routers do CEF switching using forwarding engines that are implemented in specialized ASICs, ternary content addressable memory (TCAM), and NPUs (hardware CEF). Forwarding engines provide the packet switching, forwarding, and route lookup capability to routers.

A switch's ternary content addressable memory (TCAM) allows for the matching and evaluation of a packet on more than one field. TCAM is an extension of the CAM architecture but enhanced to allow for upper-layer processing such as identifying the Layer 2/3 source/destination addresses, protocol, QoS markings, and so on. TCAM provides more flexibility in searching than does CAM, which is binary. A TCAM search provides three results: 0 for true, 1 false, and X for do not care, which is a ternary combination.

The TCAM entries are stored in Value, Mask, and Result (VMR) format. The value indicates the fields that should be searched, such as the IP address and protocol fields. The mask indicates the field that is of interest and that should

be queried. The result indicates the action that should be taken with a match on the value and mask. Multiple actions can be selected besides allowing or dropping traffic, but tasks like redirecting a flow to a QoS policer or specifying a pointer to a different entry in the forwarding table are possible. Most switches implement multiple TCAM entries so that inbound/outbound security, QoS, and Layer 2 and Layer 3 forwarding decisions occur all at once. TCAM operates in hardware, providing faster processing and scalability than process switching. This allows for some features like ACLs to process at the same speed regardless of whether there are 10 entries or 500. The TCAM is not an infinite resource, and balancing memory allocation between functions has trade-offs.

Chapter 2: Spanning Tree Protocol

1.0 Architecture

1.1 Explain the different design principles used in an enterprise network

- 1.1.a High-level enterprise network design such as 2-tier, 3-tier, fabric, and cloud
- 1.1.b High availability techniques such as redundancy, FHRP, and SSO

1.2 Describe wireless network design principles

- 1.2.a Wireless deployment models (centralized, distributed, controller-less, controller-based, cloud, remote branch)
- 1.2.b Location services in a WLAN design
- 1.2.c Client density

1.3 Explain the working principles of the Cisco SD-WAN solution

- 1.3.a SD-WAN control and data planes elements
- 1.3.b Benefits and limitations of SD-WAN solutions

1.4 Explain the working principles of the Cisco SD-Access solution

- 1.4.a SD-Access control and data planes elements
- 1.4.b Traditional campus interoperating with SD-Access

1.5 Interpret wired and wireless QoS configurations

- 1.5.a QoS components
- 1.5.b QoS policy

1.6 Describe hardware and software switching mechanisms such as CEF, CAM, TCAM, FIB, RIB, and adjacency tables

2.0 Virtualization

2.1 Describe device virtualization technologies

- 2.1.a Hypervisor type 1 and 2
- 2.1.b Virtual machine
- 2.1.c Virtual switching

2.2 Configure and verify data path virtualization technologies

- 2.2.a VRF
- 2.2.b GRE and IPsec tunneling

2.3 Describe network virtualization concepts

- 2.3.a LISP
- 2.3.b VXLAN

3.0 Infrastructure

3.1 Layer 2

- 3.1.a Troubleshoot static and dynamic 802.1q trunking protocols
- 3.1.b Troubleshoot static and dynamic EtherChannels
- 3.1.c Configure and verify common Spanning Tree Protocols (RSTP, MST) and Spanning Tree enhancements such as root guard and BPDU guard

3.2 Layer 3

- 3.2.a Compare routing concepts of EIGRP and OSPF (advanced distance vector vs. link state, load balancing, path selection, path operations, metrics, and area types)
- 3.2.b Configure simple OSPFv2/v3 environments, including multiple normal areas, summarization, and filtering (neighbor adjacency, point-to-point, and broadcast network types, and passive-interface)
- 3.2.c Configure and verify eBGP between directly connected neighbors (best path selection algorithm and neighbor relationships)
- 3.2.d Describe policy-based routing

3.3 Wireless

- 3.3.a Describe Layer 1 concepts, such as RF power, RSSI, SNR, interference, noise, bands, channels, and wireless client devices capabilities
- 3.3.b Describe AP modes and antenna types
- 3.3.c Describe access point discovery and join process (discovery algorithms, WLC selection process)
- 3.3.d Describe the main principles and use cases for Layer 2 and Layer 3 roaming
- 3.3.e Troubleshoot WLAN configuration and wireless client connectivity issues using GUI only
- 3.3.f Describe wireless segmentation with groups, profiles, and tags

3.4 IP Services

- 3.4.a Interpret network time protocol configurations such as NTP and PTP
- 3.4.b Configure NAT/PAT
- 3.4.c Configure first hop redundancy protocols, such as HSRP, VRRP
- 3.4.d Describe multicast protocols, such as RPF check, PIM and IGMP v2/v3