DATA SHEET

CISCO CATALYST 6500 SERIES SUPERVISOR ENGINE 1A AND 2

As the Cisco® premier modular multilayer switch, the Cisco Catalyst® 6500 Series delivers secure, converged services from the wiring closet to the core, to the data center to the WAN edge.

The supervisor engines for the Cisco Catalyst 6500 Series deliver the latest advanced switching technology with proven Cisco software to power a new generation of scalable and intelligent multilayer switching solutions for both enterprise and service provider environments. Designed to integrate data, voice, and video into a single platform for fully integrated IP communications, the Cisco Catalyst 6500 Series supervisor engines enable intelligent, resilient, scalable, and secure high performance multilayer switching solutions.

The widely deployed Supervisor Engine 1A and Supervisor Engine 2 are used in wiring closets, distribution/core, data center, and WAN edge configurations enabling the seamless integration of advanced services such as security, voice, and content into a converged network that reduces the total cost of ownership. And the new Supervisor Engine 720 is ideally suited for high performance core, data center, and metro Ethernet deployments with its scalable performance of up to 400 million packets per second using a 720 Gbps switch fabric.

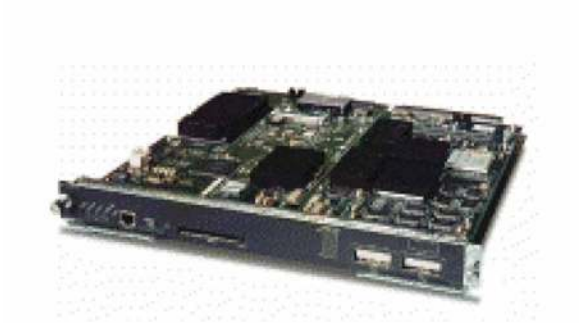
By sharing a common set of interfaces, operating system and management tools, the Cisco Catalyst 6500 Series supervisors provide operational consistency—enabling common sparing and minimizing training requirements; all modules feature predictable performance and a broad range of capabilities. Supervisor Engine 1A and Supervisor Engine 2 highlights include:

- Feature-rich and wire-rate intelligent network services—Support and complement comprehensive security and granular quality of service mechanisms, including identity-based networking capabilities based on IEEE 802.1x extensions and simplified configuration using two AutoQoS commands
- End-to-end flexible deployments—Position anywhere in the network from the wiring closet to the distribution/ core, and from the data center to the WAN edge and the MAN
- Scalable and predictable performance—Feature a flexible switch fabric and forwarding architecture delivering throughput from 15 Mpps/32 Gbps (Classic interface modules), to 30 Mpps/256 Gbps (CEF256 interface modules), to 210 Mpps/256 Gbps (dCEF256 interface modules) for network cores supporting multi-gigabit trunks
- Flexible multilayer switching support and forwarding architectures—Select basic Layer 2 forwarding or feature-rich Cisco Express Forwarding (CEF) using the same supervisor
- Choice of operating system support—Support both Cisco IOS® Software, Cisco Catalyst OS software, and Hybrid (Cisco Catalyst OS software and Cisco IOS Software for the MSFC)
- Operational consistency—Support all 3 generations of Cisco Catalyst 6500 Series interface and services modules in all Cisco Catalyst 6500 3-, 6-, 9-, and 13-slot chassis running Cisco IOS Software and Cisco Catalyst Operating System Software and a common set of Cisco network management tools that support the Cisco Catalyst 6500 Supervisor Engine 1A and 2 as well as many other Cisco Systems® product lines. (13-slot chassis is compatible with Supervisor Engine 2 only).
- Maximum network uptime and user productivity—Provide fault-tolerant network resilience and high availability features including fast 1- to 3-second stateful failover between redundant Cisco Catalyst 6500 supervisor engines enabling near-hitless software upgrades for business-critical network environments, including IP-telephony enabled wiring closets
- Extensive management tools—Support CiscoWorks network management platform, Simple Network Management Protocol (SNMP) versions 1, 2, and 3 and four RMON groups (statistics, history, alarms, and events)

As part of the Cisco Catalyst 6500 Series of modular products, Supervisor Engines 1A and 2 share a common operating system and CLI—encouraging an end-to-end Cisco Catalyst 6500 Series solution for maximum operational consistency, common sparing, and minimized training requirements (Figure 1).

Figure 1
Supervisor Engines 1A and Supervisor Engine 2

Supervisor Engine 1-PFC

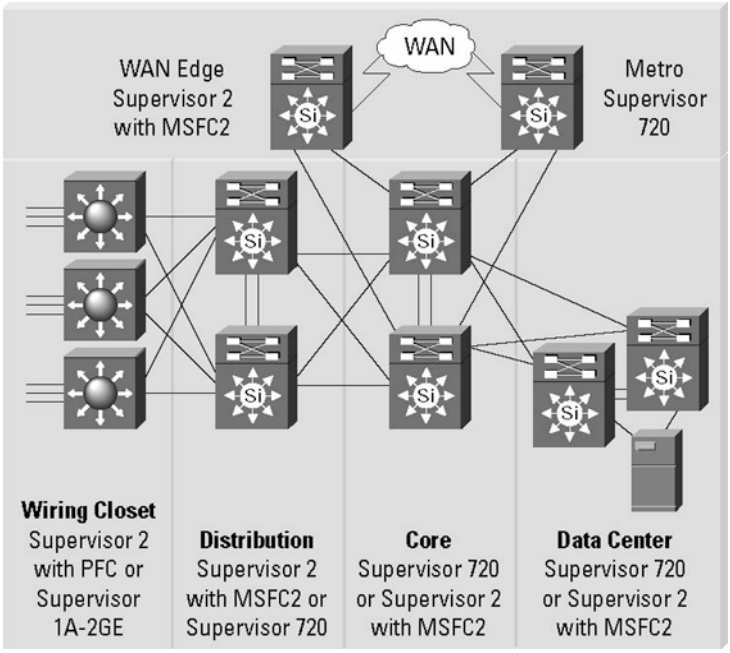


Supervisor Engine 2-MSFC2

SUPERVISOR ENGINE 1A AND SUPERVISOR ENGINE 2 DEPLOYMENT SCENARIOS

With a broad range of interfaces, and services modules, chassis/slot configurations as well as a scalable set of Supervisor Engines, the Cisco Catalyst 6500 can be deployed anywhere in the network. The figure below depicts the Cisco Catalyst 6500 deployed in the wiring closet, distribution, core, data center, WAN edge and Metro and provides recommended supervisor engines for each part of the network.

Figure 2
Cisco Supervisor Engine 1A and Supervisor Engine 2 Deployment Scenarios



The following table outlines the primary deployment scenarios for Cisco Catalyst 6500 Series supervisor engines.

Table 1. Deployment Scenarios for Cisco Catalyst 6500 Series Supervisor Engines

Supervisor Engine	Performance/Features	Recommended Deployments
Supervisor Engine 720	400 Mpps, 720 Gbps Layer 2–4 distributed Cisco Express Forwarding Supports new accelerated Cisco Express Forwarding 720 and distributed Cisco Express Forwarding 720 interface modules	Enterprise core, distribution, and data centers
Supervisor Engine 2 **Policy Feature Card 2 (PFC2)** **Multilayer Switch Feature Card 2 (MSFC2)**	210 Mpps, 256 Gbps Layer 2–4 distributed Cisco Express Forwarding Supports distributed Cisco Express Forwarding 256 interface modules	Enterprise distribution, data centers, and WAN edge
Supervisor Engine 1A **PFC** **MSFC2**	15 Mpps, 32 Gbps Centralized Layer 2–4 forwarding Enhanced security and quality of service (QoS)	Distribution and core
Supervisor Engine 2 PFC2	30 Mpps, 256 Gbps Centralized Layer 2 forwarding and Layer 3–4 services Enhanced security and QoS	Premium wiring closet and data center access
Supervisor Engine 1A PFC	15 Mpps, 32 Gbps Centralized Layer 2 forwarding and Layer 3–4 services Enhanced security and QoS	Enterprise wiring closets

Supervisor Engine	Performance/Features	Recommended Deployments
Supervisor Engine 1A 2GE	15 Mpps, 32 Gbps Centralized Layer 2 forwarding	Value wiring closet

SUPERVISOR ENGINE 1A AND 2 FEATURES

The Supervisor Engine 1A and 2 provide the following features:

- High availability
- Scalable performance
- Wire-rate traffic management
- End-to-end management tools
- Comprehensive security
- Advanced Layer 2, Layer 3, and Layer 4 forwarding

High Availability

Supervisor Engines 1A and 2 can be deployed in dual-supervisor engine configurations in all Cisco Catalyst 6500 Series chassis (6503, 6506, 6509, 6509-NEB, 6509-NEB-A, and 6513 [6513 is compatible with Supervisor Engine 2 only]). The dual-supervisor engine configuration synchronizes protocol states between the primary and the redundant supervisor engine, provides industry-leading network availability with sub-3-second failover, and maximizes network uptime by allowing hot swapping of standby supervisor engines. Important high-availability features include:

- Supervisor engine redundancy—With synchronization of protocol states and support for HSRP and Uplink Fast
- Rapid failover rates—Sub-3-second stateful failover and Layer 3 IP Unicast and Multicast failover
- Hot swapping—Hot swapping of standby supervisors

Scalable Performance

Supervisor Engines 1A and 2 provide scalable performance, from 15 Mpps to 210 Mpps with bandwidth scaling from 32 Gbps to 256 Gbps, that densely populated wiring closets and high-throughput network cores with multigigabit trunks require.

Supervisor Engine 2 uses the Cisco Express Forwarding routing architecture that performs high-speed lookups even with advanced Layer 3 services enabled, and independent of the number of flows through the switch, while maintaining 30 Mpps of centralized performance and 210 Mpps of distributed performance.

- Supervisor Engine 1A—Provides 15-Mpps performance with 32-Gbps bandwidth
- Supervisor Engine 2—Provides 30 Mpps of centralized performance and 210 Mpps of distributed performance with 256-Gbps bandwidth

For details see Table 2—Cisco Catalyst 6500 Supervisor Engine Feature Comparison.

Wire-Rate Traffic Management

Supervisor Engines 1A and 2 provide wire-rate traffic management using Layer 2, 3, and 4 QoS and security checks, including ACL policy enforcement, as part of their forwarding process to protect and secure content. These traffic management features enable efficient handling of converged networks that carry a mix of mission-critical, time-sensitive, and bandwidth-intensive multimedia applications.

- Advanced QoS tools such as packet classification and marking and congestion avoidance based on Layer 2, Layer 3, and Layer 4 header information.
- QoS scheduling rules with thresholds can be configured in the switch for multiple receive and transmit queues.
- Rate limiting can be used to police traffic on a per-flow or aggregate basis with a very fine granularity.

For details see Table 3—QoS Features Comparison.

End-to-End Management Tools

Managed with CiscoWorks2000, Cisco Catalyst 6500 Series switches can be configured and managed to deliver end-to-end device, VLAN, traffic, and policy management. Cisco Resource Manager, a Web-based management tool that works with CiscoWorks2000, provides: automated inventory collection, software deployment, easy tracking of network changes, views into device availability, and quick isolation of error conditions.

Supervisor Engines 1A and 2 provide a comprehensive set of management tools to provide the required visibility and control in the network.

- Console management—Provide shared interface to the Supervisor Engine 2 and the Multilayer Switch Feature Card 2 (MSFC2) available out-of-band from a local terminal or remote terminal connected through a modem to the console or auxiliary interface
- In-band management—Provide shared interface to the Supervisor Engine 2 and the MSFC2 available in-band through SNMP, Telnet client, Bootstrap Protocol (BOOTP), and Trivial File Transfer Protocol (TFTP)
- SPAN—Allow management and monitoring of switch traffic
- RSPAN—Allow centralized management and monitoring by aggregating and directing traffic from multiple distributed hosts and switches to a remotely located switch through a trunk link
- VACL Capture—Direct traffic to a network analysis port using an ACL

For details see Table 4—Management Tools Comparison.

Comprehensive Security

The advanced security capabilities of Supervisor Engines 1A and 2 can reduce the threats of malicious attacks while enabling authentication, authorization, and accounting. With support for up to 32K ACL entries, IP/IPX security ACLs in hardware, and advanced features such as port security, Supervisor Engines 1A and 2 offer a superior set of Layer 2–4 network traffic security capabilities:

- Layer 2 security features—Include private VLANs and port security, to help the network architect properly partition and control the utilization of the switch resources.
- Layer 2, 3, and 4 hardware filters—Can work on the forwarding engine and in conjunction with optional integrated services modules to inspect each forwarded packet and permit or deny all the streams of traffic according to the network administrator's rules.

For details see Table 5—PFC and PFC2 Security Features Comparison.

SUPERVISOR ENGINE 1A AND 2 ARCHITECTURE

Cisco Catalyst 6500 Series Supervisor Engines 1A and 2 manage the system by storing and running the system software, controlling the various modules in the chassis, performing basic forwarding, and providing the Gigabit uplinks that allow redundant supervisor engine connections.

Supervisor Engine 2 offers an improved forwarding design. The Supervisor Engine 1A CPU performs Layer 2 forwarding, but Supervisor Engine 2 performs Cisco Express Forwarding (CEF) and distributed CEF, doubling the forwarding performance. As shown in Table 2, Supervisor Engines 1A and 2 offer choices in operating characteristics, including forwarding architecture, performance, bandwidth, DRAM and boot Flash sizes, and support for chassis, Policy Feature Card/Policy Feature Card 2 (PFC/PFC2), MSFC2, and Switch Fabric Module (SFM).

Table 2. Cisco Catalyst 6500 Supervisor Engine Feature Comparison

Feature	Supervisor Engine 2 *Supervisor Engine-PFC2* *Supervisor Engine-MSFC2*	Supervisor Engine 1A *Supervisor Engine 1A-2GE* *Supervisor Engine 1A-PFC* *Supervisor Engine 1A-MSFC*
Cisco Express Forwarding (CEF)	Yes	No
Performance	30 Mpps—*Supervisor Engine 2-PFC2 and Supervisor Engine 2-MSFC2* up to 210 Mpps—*Supervisor Engine 2-MSFC2 with SFM and DFCs*	15 Mpps
Maximum bandwidth	256 Gbps (with distributed forwarding)	32 Gbps
DRAM	128 MB, 256 MB, 512 MB	128 MB
Onboard Flash (BootFlash)	32 MB	16 MB
Chassis supported	6006, 6009, 6503, 6506, 6509, 6509-NEB, 6509-NEB-A, 6513 7603, 7606, 7609, OSR-7609, 7613	6006, 6009, 6503, 6506, 6509, 6509-NEB, 6509-NEB-A 7603, 7606, 7609, OSR-7609
PFC daughter card available	Yes (PFC2); Standard with Supervisor Engine 2	Yes (PFC); Not field upgradable
MSFC2 daughter card available	Yes, and field upgradable	Yes, not field upgradable
SFM supported	Yes	No

The PFC/PFC2 and MSFC2 daughter cards and the SFM increase Supervisor Engines 1A and 2 functions:

- PFC and PFC2—Perform hardware-based Layer 2, Layer 3, and Layer 4 packet forwarding as well as packet classification, traffic management, and policy enforcement
- MSFC2—Performs Layer 3 control plane functions including address resolution and routing protocols
- SFM 2—Provides 256 Gbps dedicated bandwidth to all slots in the chassis and requires Supervisor Engine 2-MSFC2. The SFM 2 will not operate in the same chassis with Supervisor Engine 720.

Policy Feature Card (PFC and PFC2)

The Policy Feature Card provides quality of service (QoS) and policy based intelligent networking capabilities to the Cisco Catalyst 6500 Series. Recommended for premier wiring closets, backbone, data center and WAN edge deployments, the PFC identifies and classifies traffic applying the appropriate QoS priority level and Security Policies as defined by the network administrator configured ACLs. The PFC also helps to prevent unauthorized applications from being allowed on the network.

The Supervisor Engine PFC daughter card makes the packet forwarding decision in its application-specific integrated circuit (ASIC) complex. In distributed forwarding implementations, an identical ASIC complex located on an interface module's DFC daughter card allows the interface

module to make packet-forwarding decisions locally. After the PFC or DFC makes the forwarding decision for the interface module, it sends the forwarding result to the interface module that does all packet buffering, queuing, and delivery.

In addition to packet forwarding, the PFC performs the following major functions at wire-rate:

- Layer 3 packet classification—Using QoS access-control entries
- Traffic management (rate limiting)—Using ingress policing
- Security policy enforcement—Within subnets or VLANs
- Intelligent multicast forwarding—Efficient replication of multicast streams, supplied to appropriate end-user stations
- NetFlow data export—Collecting IP flow statistics for inter-subnet flows

QoS

The following table shows the PFC and PFC2 QoS features.

Table 3. QoS Features Comparison

Feature	PFC2 *Supervisor Engine 2-PFC2 Supervisor Engine 2-MSFC2*	PFC *Supervisor Engine 1A-PFC Supervisor Engine 1A-PFC/MSFC2*	No PFC *Supervisor Engine 1A-2GE*
Layer 2 classification and marking	Yes	Yes	Yes
Layer 3 classification and marking/	Yes	Yes	None
Access Control Entries (ACEs)	32K	16K	
Rate limiting location (port)	Ingress port, VLAN	Ingress port, VLAN	None
Rate Limiting Level Types	CIR[1], PIR[2]	CIR	None
Aggregate traffic rate limiting/	Yes	Yes	None
number of policers	1023 policers	1023 policers	
Flow-based rate limiting method/ number of rates	Full flow; 64 rates	Full flow; 64 rates	None

[1] CIR = Committed Information Rate

[2] PIR = Peak Information Rate

Management Tools

The following table compares the management tools that are available with Supervisor Engines 1A and 2.

Table 4. Management Tools Comparison

Feature	PFC *Supervisor Engine 1A-PFC Supervisor Engine 1A-PFC/MSFC2 Supervisor Engine 2-PFC2 Supervisor Engine 2-MSFC2*	No PFC *Supervisor Engine 1A-2GE*
SPAN	Yes	Yes
RSPAN	Yes	No
ERSPAN	No	No
VACL Capture	Yes	No

Security

Table 5 shows the PFC and PFC2 security features.

Table 5. PFC and PFC2 Security Features Comparison

Feature	With PFC2 *Supervisor Engine 2-PFC2 Supervisor Engine 2-MSFC2*	With PFC *Supervisor Engine 1A-PFC Supervisor Engine 1A-PFC/MSFC2*	Without PFC *Supervisor Engine 1A-2GE*
Port security	Yes	Yes	Yes
TCP intercept hardware acceleration	Yes	Yes	No
IEEE 802.1X and 802.1X extensions	Yes	Yes	No
IP security ACLs in hardware	Yes	Yes	No
IPX security ACLs in hardware	Yes	Yes	No
Security ACL entries	32K	16K	No
Reflexive ACLs	128K	512K	No
Unicast Reverse Path Forwarding (uRPF) check-in hardware	Yes	No	No
CPU rate limiters	1	None	None

Multilayer Switch Fabric Card2 (MSFC2)

Supported on both Supervisor 1A and Supervisor 2 as an option the MSFC2 acts as the Layer 3 forwarding routing engine. On its Layer 3 forwarding routing engine, the MSFC2 builds the CEF Forwarding Information Base (FIB) table in software and then downloads this table to the ASICs on the PFC or DFC that make the forwarding decisions for IP Unicast and Multicast traffic. For more information see How Cisco Express Forwarding Works.

Layer 3 Switching

Table 6 shows the MSFC2 Layer 3 switching features.

Table 6. Layer 3 Switching Feature Comparisons

Feature	MSFC2 *Supervisor Engine 1A-PFC/MSFC2 Supervisor Engine 2-MSFC2*	No MSFC2 *Supervisor Engine 2-PFC2*	No MSFC2 *Supervisor Engine 1A-2GE Supervisor Engine 1A-PFC*
IPv4 routing	Yes	Yes, with MSFC2 upgrade	No, not upgradable
MPLS	Yes, through OSM	Yes, through OSM	No
IPv6	Yes, in software (only on Supervisor Engine 2-MSFC2	No, requires MSFC2 upgrade	No

Note: Refer to the release notes for up-to-date software version information.

SWITCH FABRIC MODULES (SFM AND SFM2)

Designed to support distributed forwarding, the Cisco Catalyst 6500 Series SFM (WS-X6500-SFM) and SFM2 (WS-X6500-SFM2) provide dedicated bandwidth to each slot up to 256 Gbps per system. For distributed forwarding to work, an interface module must have a Distributed Forwarding Card (DFC) and must be installed in the chassis with either a Supervisor Engine 2-MSFC2 and an SFM or SFM2, or a Supervisor Engine 720. The SFM works with Cisco Catalyst 6506, 6509, 6509-NEB, and 6509-NEB-A chassis and can occupy any slot. The SFM2 works with 6506, 6509, 6509-NEB, 6509-NEB-A, 6513, 7603, 7606, 7609, OSR-7609, and 7613 chassis; and it can occupy any slot, except in the 6513 and 7613 where it must occupy slot 7 or 8.

The Cisco Catalyst 6503 does not currently support the SFM modules as this would leave one slot open after configuring the supervisor and SFM in two of the three available slots. However, the Supervisor 720 provides full CEF256, dCEF256, aCEF720, and dCEF720 capabilities to the Cisco Catalyst 6503 chassis with its slot-efficient integration of the supervisor engine and switch fabric in a single module.

Switch Fabric Module Architecture

Providing access to the switch fabric through dual 8-Gbps serial channels, the SFM or SFM2 performs all switching on the module ndependent of the passive backplane. For more information see How Distributed Cisco Express Forwarding (dCEF) Works.

High Availability

Two SFM and SFM2 modules can be configured in a system for high availability with 1-to-1 redundancy, where one SFM or SFM2 is operational and one serves as a backup.

Note: The SFM and SFM2 cannot operate in the same chassis with a Supervisor Engine 720.

SUPERVISOR ENGINE 2-MSFC2

Suited for deployment in the distribution/core with Classic interface modules, CEF256 interface modules and dCEF256 interface modules, Supervisor 1A-2GE provides Layer 2/3/4 forwarding with the following operational advantages:

- Layer 2–4 forwarding—Performs Layer 2–4 forwarding with Layer 2, 3, 4 features; supports dCEF256 interface modules
- Media Access Control (MAC) addresses—128K
- Forwarding rate—Up to 30 Mpps per system
- Bandwidth—32 Gbps per system; 256 Gbps with SFM in chassis
- Layer 2, 3 traffic classification and marking—Layer 2 and Layer 3 (See Table 3—QoS Features Comparison for details)
- Multilayer (Layer 3) switching—IPv4 supported (See Table 6 for details)
- Distributed forwarding—Requires Switch Fabric Module and interface modules with Distributed Forwarding Cards (DFCs); for details, see section titled How Distributed Cisco Express Forwarding (dCEF) Works
- Operating system—Cisco Catalyst OS with Cisco IOS on the MSFC and Cisco IOS Software
- Management tools—SPAN, RSPAN, VACL capture
- DRAM—128, 256, 512 MB
- Onboard flash (BootFlash)—32 MB
- Chassis supported—Cisco Catalyst 6006, 6009, 6503, 6506, 6509, 6509-NEB, 6509-NEB-A, and 6513; 7603, 7606, 7609, OSR-7609, and 7613
- Slot requirements—Slots 1 or 2 of any chassis
- Upgrade support—None required

Figure 3

Cisco Catalyst 6500 Series Supervisor Engine 2-MSFC2

SUPERVISOR ENGINE 2-PFC2

Suited for deployment in wiring closets with Classic and CEF256 interface modules, Supervisor Engine 2-PFC2 provides basic Layer 2 forwarding with the following operational advantages:

- Layer 2 forwarding—Performs Layer 2 forwarding with Layer 2, 3, 4 features; requires MSFC2 upgrade to support Layer 3, 4 forwarding
- MAC addresses—128K
- Forwarding rate—Up to 30 Mpps per system
- Bandwidth—32 Gbps per system; 256 Gbps with SFM in chassis
- Layer 2, 3 traffic classification and marking—Layer 2 and Layer 3 (See Table 3—QoS Features Comparison for details)
- Multilayer (Layer 3) switching—Requires MSFC2 upgrade (See Table 6 for details)

- Distributed forwarding—Requires MSFC2 upgrade, SFM, and interface modules with DFCs (for details, see section titled How Distributed Cisco Express Forwarding Works).
- Operating system—Cisco Catalyst OS only (Cisco IOS Software supported with MSFC2 upgrade)
- Management tools—SPAN, RSPAN, VACL capture
- DRAM—128, 256, 512 MB
- Onboard flash (BootFlash)—32 MB
- Chassis supported—Cisco Catalyst 6006, 6009, 6503, 6506, 6509, 6509-NEB, 6509-NEB-A, and 6513; 7603, 7606, 7609, OSR-7609, and 7613
- Slot requirements—Slots 1 or 2 of any chassis
- Upgrade support—MSFC2 upgrade

SUPERVISOR ENGINE 1A-PFC/MSFC2

Suited for deployment in the distribution/core with Classic interface modules, Supervisor Engine 1A-2GE provides Layer 2–4 forwarding with the following operational advantages:

- Layer 2–4 forwarding—Performs Layer 2–4 forwarding with Layer 2–4 features
- MAC addresses—128K
- Forwarding rate—Up to 15 Mpps per system
- Bandwidth—32 Gbps per system
- Layer 2, 3 traffic classification and marking—Layer 2 and Layer 3 (see Table 3—QoS Features Comparison for details)
- Multilayer (Layer 3) switching—IPv4 supported (See Table 6 for details)
- Distributed forwarding—Unsupported
- Operating system—Cisco Catalyst OS with Cisco IOS on the MSFC and Cisco IOS Software
- Management tools—SPAN, RSPAN, VACL capture
- DRAM—128 MB
- Onboard flash (BootFlash)—16 MB
- Chassis supported—Cisco Catalyst 6006, 6009, 6503, 6506, 6509, and 6509-NEB, 6509-NEB-A (6513 not supported); 7603, 7606, 7609, and OSR-7609 (7613 not supported)
- Slot requirements—Slots 1 or 2 of any chassis
- Upgrade support—None

Figure 4

Cisco Catalyst 6500 Supervisor Engine 1A-PFC/MSFC2

SUPERVISOR ENGINE 1A-PFC

Suited for deployment in wiring closets with Classic interface modules, Supervisor Engine 1A-2GE provides basic Layer 2 forwarding with the following operational advantages:

- Layer 2 forwarding—Performs basic Layer 2 forwarding with no Layer 2–4 features
- MAC addresses—128K
- Forwarding rate—Up to 15 Mpps per system
- Bandwidth—32 Gbps per system
- Layer 2, 3 traffic classification and marking—Layer 2 and Layer 3 (See Table 3—QoS Features Comparison for details)
- Multilayer (Layer 3) switching—Unsupported
- Distributed forwarding—Unsupported
- Operating system—Cisco Catalyst OS only
- Management tools—SPAN, RSPAN, VACL capture
- DRAM—128 MB
- Onboard flash (BootFlash)—16 MB
- Chassis supported—Cisco Catalyst 6006, 6009, 6503, 6506, 6509, and 6509-NEB, 6509-NEB-A (6513 not supported); 7603, 7606, 7609, and OSR-7609 (7613 not supported)
- Slot requirements—Slots 1 or 2 of any chassis
- Upgrades—None

Figure 5

Cisco Catalyst 6500 Supervisor Engine 1A-PFC

SUPERVISOR ENGINE 1A-2GE

Suited for deployment in wiring closets with Classic interface modules, Supervisor Engine 1A-2GE provides basic Layer 2 forwarding with the following operational advantages:

- Layer 2 forwarding—Performs Layer 2 forwarding with Layer 4 features
- MAC addresses—128K
- Forwarding rate—Up to 15 Mpps per system
- Bandwidth—32 Gbps per system
- Layer 2, 3 traffic classification and marking—Layer 2 only, not upgradable to support Layer 3 (for details, see Table 3—QoS Features Comparison)
- Multilayer (Layer 3) switching—Unsupported

- Distributed forwarding—Unsupported
- Operating system—Cisco Catalyst OS only
- Management tools—SPAN only
- DRAM—128 MB
- Onboard flash (BootFlash)—16 MB
- Chassis supported—Cisco Catalyst 6006, 6009, 6503, 6506, 6509, and 6509-NEB, 6509-NEB-A (6513 not supported); 7603, 7606, 7609, and OSR-7609 (7613 not supported)
- Slot requirements—Slots 1 or 2 of any chassis
- Upgrade support—None

HOW CISCO EXPRESS FORWARDING WORKS

Cisco Express Forwarding (CEF) is a Layer 3 technology that provides increased forwarding scalability and performance to handle many short-duration traffic flows common in today's enterprise and service provider networks. To meet the needs of environments handling large amounts of short-flow, Web-based, or highly interactive types of traffic, CEF forwards all packets in hardware, and maintains its forwarding rate completely independent of the number of flows going through the switch.

On the Cisco Catalyst 6500 Series, the CEF Layer 3 forwarding engine is located centrally on the supervisor engine's PFC2 or PFC3—the same device that performs hardware-based Layer 2 and 3 forwarding, ACL checking, QoS policing and marking, and NetFlow statistics gathering.

Using the routing table that Cisco IOS Software builds to define configured interfaces and routing protocols, the CEF architecture creates CEF tables and downloads them into the hardware-forwarding engine before any user traffic is sent through the switch. The CEF architecture places only the routing prefixes in its CEF tables—the only information it requires to make the Layer 3 forwarding decisions—relying on the routing protocols to do route selection. By performing a simple CEF table lookup, the switch forwards packets at wire-rate, independent of the number of flows transiting the switch.

CEF-based forwarding requirements: Requires a Cisco Catalyst Supervisor Engine 2 or Cisco Catalyst Supervisor Engine 720.

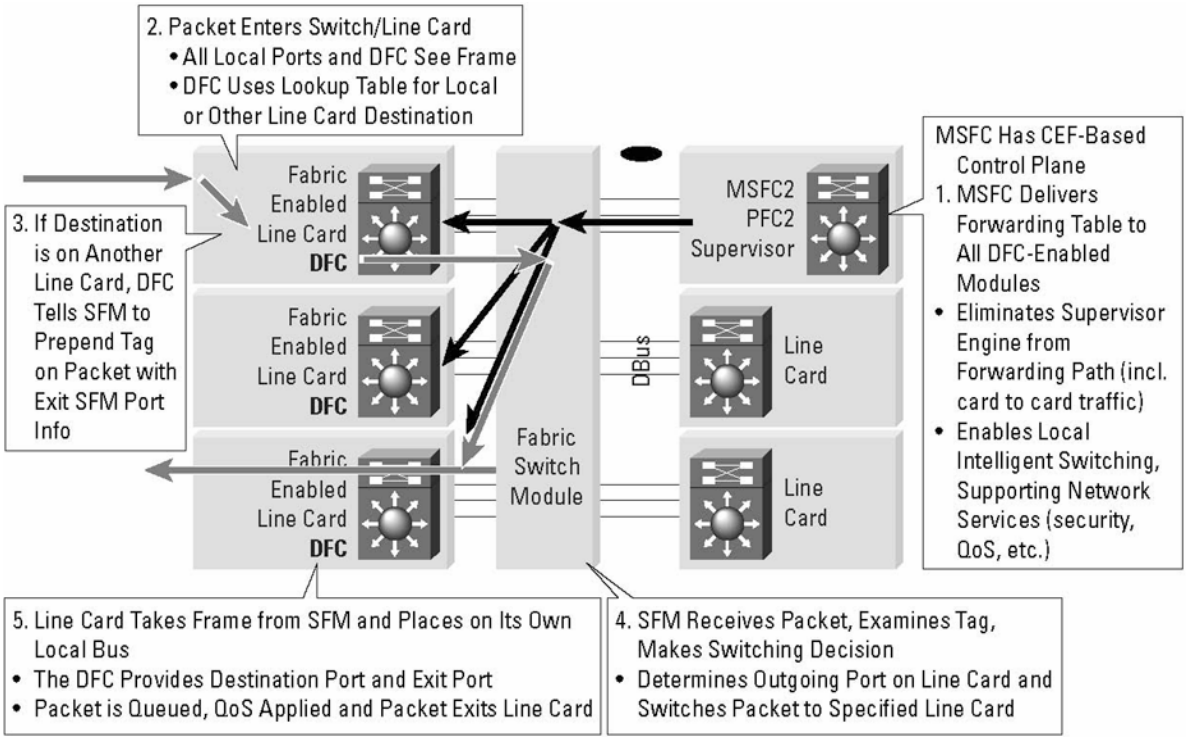
HOW DISTRIBUTED CISCO EXPRESS FORWARDING WORKS

With Distributed Cisco Express Forwarding (dCEF), forwarding engines located on the interface modules make forwarding decisions locally and in parallel, allowing the Cisco Catalyst 6500 Series to achieve the highest forwarding rates in the industry. With dCEF, forwarding occurs on the interface modules in parallel and system performance scales up to 400 Mpps—the aggregate of all forwarding engines working together.

Using the same ASIC engine design as the central PFCx, DFCs located on the interface modules forward packets between two ports, directly or across the switch fabric, without involving the supervisor engine. With the DFC, each interface module has a dedicated forwarding engine complete with the full forwarding tables. dCEF forwarding works like this:

- As in standard CEF forwarding, the central PFC3 located on the supervisor engine and the DFC engines located on the interface modules are loaded with the same CEF information derived from the forwarding table before any user traffic arrives at the switch.
- As a packet arrives at an interface module, its DFC engine inspects the packet and uses the information in the CEF table (including Layer 2, Layer 3, ACLs, and QoS) to make a completely hardware-based forwarding decision for that packet.
- The dCEF engine handles all hardware-based forwarding for traffic on that module, including Layer 2 and Layer 3 forwarding, ACLs, QoS policing and marking, and NetFlow.
- Because the DFCs make all the switching decisions locally, the supervisor engine is freed from all forwarding responsibilities and can perform other software-based functions, including routing, management, and network services.

Figure 6
Distributed Cisco Express Forwarding Packet Flow



dCEF-based forwarding requirements: Requires a Cisco Catalyst Supervisor Engine 720 for dCEF720 interface modules; requires either a Cisco Catalyst Supervisor Engine 720 or a Cisco Catalyst Supervisor Engine 2-MSFC2 and a SFM for dCEF256 interface modules.

SOFTWARE REQUIREMENTS

Depending on its configuration, a supervisor engine will operate with one or more of the following operating systems:

- Cisco IOS Software for the supervisor engine (native Cisco IOS Software)
- Cisco Catalyst OS software
- Hybrid, Cisco Catalyst OS software and Cisco IOS Software for the MSFC **Notes:** Refer to the release notes for up-to-date software version information.

ORDERING INFORMATION

Table 7 lists the ordering information for the Supervisor Engines 1A and 2.

Table 7. Product Numbers for Ordering

Product Number	Description
WS-X6K-SUP1A-2GE	Cisco Catalyst 6500 Supervisor Engine1A, 2GE
WS-X6K-SUP1A-PFC	Cisco Catalyst 6500 Supervisor Engine1A, 2GE, plus PFC
WS-X6K-S1A-MSFC2	Cisco Catalyst 6500 Supervisor Engine1A, 2GE, plus MSFC-2 and PFC
WS-X6K-S2-PFC2	Cisco Catalyst 6500 Supervisor Engine 2, 2GE, plus PFC-2
WS-X6K-S2-MSFC2	Cisco Catalyst 6500 Supervisor Engine 2, 2GE, plus MSFC-2/PFC-2
WS-X6K-S2U-MSFC2	Cisco Catalyst 6500 Supervisor Engine2, 2GE, plus MSFC-2/PFC-2 with 512MB for MSFC-2
WS-X6K-S1A-MSFC2	Supervisor Engine 1A with PFC+MSFC2
WS-X6K-S1A-MSFC2=	Supervisor Engine 1A with PFC+MSFC2=
WS-X6K-S1A-MSFC2/2	Supervisor Engine 1A with PFC+MSFC2/2
WS-F6K-MSFC2	Cisco Catalyst 6500 Multilayer Switch Feature Card 2
MEM-MSFC2-128MB=	Cisco Catalyst 6500 MSFC2 Memory, 128 MB DRAM Spare
MEM-MSFC2-256MB	Cisco Catalyst 6500 MSFC2 Memory, 256 MB DRAM Option
MEM-MSFC2-256MB=	Cisco Catalyst 6500 MSFC2 Memory, 256 MB DRAM Spare
MEM-MSFC2-512MB	Cisco Catalyst 6500 MSFC2 Memory, 512 MB DRAM Option
MEM-MSFC2-512MB=	Cisco Catalyst 6500 MSFC2 Memory, 512 MB DRAM Spare
WS-X6500-SFM	Cisco Catalyst 6500 Switch Fabric Module
WS-X6500-SFM2	Cisco Catalyst 6500 Switch Fabric Module 2

Dimensions

- (H x W x D): 1.6 x 15.3 x 16.3 in. (4.0 x 37.9 x 40.3 cm)

Environmental Conditions

- Operating temperature: 32 to 104°F (0 to 40°C)
- Storage temperature: –40 to 167°F (–40 to 75°C)
- Relative humidity: 10 to 90%, noncondensing
- Regulatory compliance

Safety Certifications

- UL 1950
- EN 60950

- CSA-0C22.2 No. 950
- IEC 950

Electromagnetic Emissions Certifications

- FCC 15J Class A
- VCCI CE II
- CE mark
- EN 55022 Class B
- CISPR 22 Class B

Technical Support Services

Whether your company is a large organization, a commercial business, or a service provider, Cisco Systems is committed to maximizing the return on your network investment. Cisco offers a portfolio of Technical Support Services to ensure that your Cisco products operate efficiently, remain highly available, and benefit from the most up-to-date system software.

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- Makes Cisco technical knowledge and resources available to you on demand
- Augments the resources of your operations technical staff to increase productivity
- Complements remote technical support with onsite hardware replacement
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Additional Cisco Catalyst 6500 Series Information

For additional information about the Cisco Catalyst 6500 Series, supervisor engines, interface modules, SFM, and services modules, visit: http://www.cisco.com/en/US/products/hw/switches/ps708/products_data_sheets_list.html

- Cisco Catalyst 6500 Series Data Sheet
- Cisco Catalyst 6500 Supervisor Engine 720 Data Sheet
- Cisco Catalyst 10/100 and 10/100/1000 Ethernet Data Sheet
- Cisco Catalyst 6500 Gigabit Ethernet Interface Modules Data Sheet
- Cisco Catalyst 6500 10 Gigabit Ethernet Interface Modules Data Sheet
- Cisco Catalyst 6500 FlexWAN Interface Modules Data Sheet
- Cisco Catalyst 6500 Switch Fabric Interface Modules Data Sheet
- Cisco Catalyst 6500 Content Services Module (CSM) Data Sheet
- Cisco Catalyst 6500 Firewall Services Module Data Sheet
- Cisco Catalyst 6500 Network Application Module (NAM) Data Sheet
- Cisco Catalyst 6500 Intrusion Detection (IDS) Module Data Sheet
- Cisco Catalyst 6500 IP Sec/VPN Services Module Data Sheet

- Cisco Catalyst 6500 SSL Services Module Data Sheet

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