

THE RELATIONSHIP BETWEEN SWITCHES, MEDIA CONVERTERS, AND OSI LAYERS

Today's media converters are often switches, and switches often act as media converters. Plus, both switches and media converters are frequently described in terms of layers—Layer 2, Layer 3. How can you tell what the heck you're looking at?

Most of the confusion happens around OSI Layer 2 where Layer 1 media converters have evolved to meet basic switches. And today's switches are rapidly advancing into Layer 3 and 4, territory formerly held by routers, muddying the waters still more.

A clear understanding of what OSI layers do, and what the differences between devices operating at different layers are, will help you select the right device.

OSI is a layered network design framework. The layers are referenced in the Open Systems Interconnection (OSI) Reference Model (which provides a layered network design framework that establishes a standard

so that devices from different vendors work together). The OSI model is hierarchical. The layer at which a switch or a media converter operates determines which addressing detail it reads as data passes through.

Layer 1: media converters

Layer 1 is the Physical Layer. Media converters operating at Layer 1 only convert electrical signals and physical media without doing anything to data coming through the link.

These media converters only have two ports—one in, one out—and convert the incoming electrical signal from one cable type and then transmit it over another type—UTP to fiber, thick coax to Thin, and so on.

Layer 2: switches and media converters

Layer 2 is the Data-Link Layer. Devices operating at Layer 2 sort packets using physical network addresses, also known as MAC addresses. All network hardware is permanently assigned this number during its manufacture.

Both switches and media converters can be Layer 2 devices. Usually the only difference between a Layer 2 switch and a Layer 2 media converter

is the number of ports—a device with two or three ports is called a media converter; four or more ports is called a switch. A media converter operating at Layer 2 may have more than two ports and may have ports operating at different speeds.

Devices operating at Layer 2 are very fast, but aren't very smart because they don't look at data packets closely. A Layer 2 media converter is considered to be fairly advanced for a media converter, but a Layer 2 switch is a basic switch. You follow?

Layer 3: switches

Layer 3 is the Network Layer. Layer 3 switches use network or IP addresses that identify locations on the network. Because they read packets more closely than Layer 2 switches do, they identify network locations as well as physical devices. A location can be a LAN workstation, an address in a computer's memory, or even a different packet of data traveling through a network.

Switches operating at Layer 3 are smarter than Layer 2 devices and incorporate routing functions to actively calculate the best way to send a packet to its destination.

Layer 4: switches

Layer 4—the Transport Layer of the OSI model—coordinates communications between systems. Layer 4 switches are capable of identifying which application protocols (HTTP, SMTP, FTP, and so forth) are included with each packet, and use this information to hand off the packet to the appropriate higher-layer software.

Because Layer 4 devices enable you to establish priorities for network traffic based on application, you can assign a high priority to packets belonging to your vital in-house applications, with different forwarding rules for low-priority packets.

Layer 4 switches also provide an effective wire-speed security shield for a network because any company- or industry-specific protocols can be confined to only authorized switched ports or users. This security feature is often reinforced with traffic filtering and forwarding features.

High-end vs. low-end switches

Switches can also be considered low end or high end. A low-end switch operates in Layer 2 of the OSI model and can also operate in a combination of Layers 2 and 3. High-end switches operate in Layer 3, Layer 4, or a combination of the two.

	OSI Layer 1	OSI Layer 2	OSI Layer 3	OSI Layer 4
Media Converters	<ul style="list-style-type: none">• Convert one media type to another• Don't look at data• Two ports only• Single speed	<ul style="list-style-type: none">• Convert one media type to another• Sort packets by MAC address• Two or more ports• May support multiple network speeds and have autosensing ports	—	—
Switches	—	<ul style="list-style-type: none">• Sort packets by MAC address• More than 2 ports, usually 4 or more• May support multiple network speeds and have autosensing ports• Ports may be the same media type or mixed (copper and fiber)	<ul style="list-style-type: none">• Sort packets by MAC address• Route packets by IP address• More than 2 ports, usually 4 or more• May support multiple network speeds and have autosensing ports• Ports may be the same media type or mixed (copper and fiber)	<ul style="list-style-type: none">• Sort packets by MAC address• Route packets by IP address• Prioritize packets by application• More than 2 ports, usually 4 or more• May support multiple network speeds and have autosensing ports• Ports may be the same media type or mixed (copper and fiber)

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