

The Ethernet I/G Bit, and It's Explanation in the [CCIE R/S Cert Guide](#)

Summary:

The I/G bit, when typed or shown on a Cisco device, is on the right side of the left-most byte. Documents that use the terms *Most Significant Bit (msb)* or *Least Significant Bit (lsb)* sometimes vary in whether this I/G bit is lsb or msb, and they may vary as to whether that bit is listed on a doc page on the left side of the byte or the right. Page 16 of the CCIE R/S Certification Guide, Page 16, shows the I/G bit on the right side of the left-most byte, and labeled as msb. The book, particularly compared to other references, causes confusion on this point.

Plan:

Change the wording for the next edition to clarify and to avoid using the terms *msb* or *lsb*.

Discussion:

It appears that some documentation, even from seemingly authoritative sources, will represent the I/G bit differently. In some cases, a doc references the bit as the lsb, and in others, the msb. In some cases, the I/G bit is shown on the left of a drawing or text representation of the first byte, and sometimes it's on the right.

Many reasons exist as to why such references vary. However, whether the bit is shown on the right or left of the first byte, or it is called an lsb or msb in that byte, is (in my opinion) immaterial to how it is used on Cisco devices. As a practical matter, I think clarity is far more important, and in the context of CCIE, terms like "rightmost bit" are much more meaningful and unambiguous.

It may be of some minor interest as to why such differing references exist. I can think of a couple that I've seen over the years, but know that I've not attempted to verify them against any current standards docs. For instance, I believe that the original DEC vs. IBM RAM memory referenced bits in the opposite order inside each byte, so in one case, the lsb was on the left, and for the other vendor, it was on the right. Second, Token Ring MAC addresses and Ethernet MAC addresses in the 1980s and 1990s showed the msb's at opposite ends of a byte as well. Token Ring (pushed by IBM) listed the I/G as msb on the left, and Ethernet (pushed by DEC) listed the I/G as msb on the right of the first byte. Both I/G bits were considered the msb, just in different locations in the first byte depending on the LAN standard. However, from a purely mathematical perspective, in binary, the least significant digits are on the right, so if the Ethernet MAC I/G bit is on the right side of the 1st byte, it seems to make sense to call that bit the lsb in that byte. In short, there is plenty of logic and history to draw the I/G bit on either end of the first byte, and call it the msb or lsb.

But what matters? That when you type MAC addresses on Cisco routers and switches, and look at the output of **show** commands on the same devices, that the I/G bit is the *rightmost bit in the leftmost byte*, regardless of any other terms you use.

As proof of this, a Cisco router allows the user to configure a unicast MAC address, but not a multicast MAC address, on an interface, using the **mac-address** command. This example shows that setting a value of 8000.1111.1111, which sets the left-most bit of the first byte to binary 1, is



accepted. However, a MAC address of 0100.1111.1111, which sets the right-most bit of the first byte to binary 1, is rejected.

```
Router(config-if)#int fa0/0
Router(config-if)#mac-address 8000.1111.1111
Router(config-if)#mac-address 0100.1111.1111
% Malformed hex mac address
Router(config-if)#
```

Edition 4 of the book (published 2010) should be clearer on this point, mainly to make the point that, as typed and displayed on Cisco devices, the I/G bit is the rightmost bit in the leftmost byte.

Example Competing References:

(I/G as lsb on the right side of the leftmost byte) http://en.wikipedia.org/wiki/MAC_address

(I/G as msb on the right side of the leftmost byte)

<http://standards.ieee.org/develop/regauth/tut/lanman.pdf>

