

JUST HOW BIG CAN 64-BIT STORAGE BE?

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While listening to a call, I started thinking again about the vast size of the 64 bit storage. Some time back I worked up an analogy to try to get a mental handle on the potential amount of new main storage available to us. I can make the math work for 64-bit addresses well enough, but to really grasp the magnitude of the storage increase is a totally different thing. I made an analogy to a parking lot. If a single 10 ft by 20 ft parking space represents all of 24 bit storage, then a parking lot of 128 parking spaces represents all of 31 bit storage. To simplify the analogy, I am totally omitting driveways, so these 128 spaces are adjacent to each other. So, in the first increase from 24 bit to 31 bit storage we go from a space big enough to play marbles on to an area big enough to roller skate or ride a bike. Applying this same analogy, how big is the "parking lot" for 64-bit storage? I thought it would be big, but the resulting size totally surprised me! The area is over twice the size of the entire United States! Now, of course z/Architecture does not actually support that much virtual storage... yet. Verify my math below:

24 bit: 16,777,215 storage locations

31 bit: 2,147,483,647 storage locations is 128 fold increase over 24 bit

$2^{**64} - 1 = 18,446,744,073,709,551,615$

Size of the bar = 2,147,483,647 bytes (X'FFFFFFFF' - X'80000000')

64 bit usable address locations: 18,446,744,071,562,067,968
(18,446,744,073,709,551,615 - 2,147,483,647)

64 bit storage is an 8,589,934,595 fold increase over 31 bit storage

Analogy:

24 bit memory: a parking space 10 X 20 (200 sq ft)

31 bit memory: parking lot with 128 spaces and no driveways (25,600 sq ft or 0.5876928 acre)

64 bit memory: parking lot with 1,099,511,693,184 spaces and no driveways (219,902,338,636,800 sq ft or 5,048,263,054 acres or 7,887,911 sq miles)

USA area (including Alaska and Hawaii) is 3,717,813 sq miles

2.12 times the size of the USA

This is pretty much a mind boggling thing!

If parking spaces aren't your thing, perhaps you prefer cash. All of 24-bit storage is one penny, which is only 1.55 mm thick.

All of 31-bit storage would be a stack 7.811 inches tall.

All of 64-bit storage would be a stack 1058967.582 miles tall (4 stacks reaching to the moon plus nearly half another stack)

Ever wonder how fast we will expand to use all of it?