

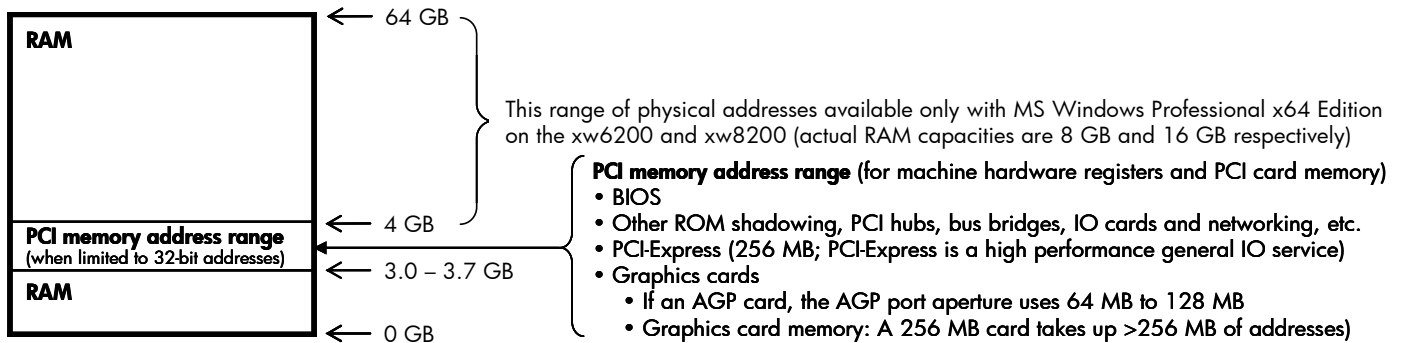


RAM Allocation with Microsoft® Windows® XP Professional

To access more than 4 GB of memory the Windows client OS (Windows XP Professional) needs to be upgraded to the future 64-bit version of Windows. In addition, while the current 32-bit client versions of Windows for x86-based computers can access 4 GB of virtual memory with today's large disk drives, less than 4 GB of physical RAM can be accessed. Below we describe how physical addresses are allocated with Windows and how RAM is made available for the user.

Designed as a 32-bit OS, Windows XP Professional supports an address range from 0 to 4096 MB or 4 GB. This allows Windows to allocate 4 GB of virtual memory addresses and also up to 4 GB of physical memory addresses. Physical memory addresses are allocated to manage both the computer's resources (machine hardware) and RAM: (See figure below)

- The PCI memory addresses starting down from 4 GB are used for things like the BIOS, IO cards, networking, PCI hubs, bus bridges, PCI-Express, and video/graphics cards. The BIOS takes up about 512 KB starting from the very top address. Then each of the other items mentioned are allocated address ranges below the BIOS range. The largest block of addresses is allocated for today's high performance graphics cards. AGP needs addresses for its port aperture and all graphics cards need addresses for at least the amount of memory on the graphics card. The net result is that a high performance x86-based computer may allocate 512 MB to 1 GB for the PCI memory address range before any RAM (physical user memory) addresses are allocated.
- RAM starts from address 0. The Windows OS allocates RAM from 0 up to the bottom of the PCI memory addresses mentioned above. Because up to a gigabyte of the PCI memory addresses can be allocated for the above items, the available addresses for RAM may be limited to about 3.1 GB. Thus if a computer is loaded with 4 GB of RAM or more, some of the RAM will not be available. (The OS still has access to 4 GB of virtual memory via disk paging.)



How much RAM will you be able to access with the current 32-bit Windows XP Professional? If you are selecting a high end graphics card with 256 MB of memory, the limit may be about 3.1 GB of RAM. If you are choosing a graphics card with less memory, the limit may be 3.7 GB of RAM.

The opportunity to purchase just the amount of RAM that can be allocated is limited by the architectures of industry standard chipsets and DIMMs. Today's high performance chipsets use dual channel memory which requires matched pairs of DIMMs for the best performance. On a 4 DIMM slot computer, the 3 to 4 GB capacity choices fall to 3 GB (two 1 GB DIMMs + two 512 MB DIMMs) or 4 GB (four 1 GB DIMMs).

When the future Windows XP Professional x64 Edition with 64-bit drivers is installed on your HP xw6200 or xw8200 EM64T-enabled workstation virtually all of the RAM will become available (the BIOS on these workstations allocates RAM to addresses above the 4 GB barrier, even re-mapping the PCI memory address range). The HP Workstation xw4200 with Windows XP Professional x64 Edition installed, like all EM64T-enabled computers based on 32-bit chipsets like the Intel 925X Express, will continue to allocate between 3 and 3.4 GB of RAM; the benefit is that you will be able to take advantage of larger virtual memory and process sizes¹.

If you are planning to upgrade your HP xw6200 or xw8200 EM64T-enabled workstation to Windows x64 when it becomes available, buy as much RAM as you would like up to the physical limit of your HP workstation, 8 GB on the xw6200, and 16 GB on the xw8200².

¹ Windows XP Professional x64 Edition will enable 32-bit applications/processes to access up to 4 GB of virtual memory (assumes the process/application was compiled with the LargeAddressAware switch which also allows up to 3 GB process sizes on today's 32-bit OS).

² 16 GB capacity when 2 GB DIMMs become available late in 2004.