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vSphere Resource Management Guide : Using NUMA Systems with ESX/ESXi : How ESX/ESXi NUMA Scheduling Works

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## How ESX/ESXi NUMA Scheduling Works

ESX/ESXi uses a sophisticated NUMA scheduler to dynamically balance processor load and memory locality or processor load balance.

- 1 Each virtual machine managed by the NUMA scheduler is assigned a home node. A home node is one of the system's NUMA nodes containing processors and local memory, as indicated by the System Resource Allocation Table (SRAT).
- 2 When memory is allocated to a virtual machine, the ESX/ESXi host preferentially allocates it from the home node.
- 3 The NUMA scheduler can dynamically change a virtual machine's home node to respond to changes in system load. The scheduler might migrate a virtual machine to a new home node to reduce processor load imbalance. Because this might cause more of its memory to be remote, the scheduler might migrate the virtual machine's memory dynamically to its new home node to improve memory locality. The NUMA scheduler might also swap virtual machines between nodes when this improves overall memory locality.

Some virtual machines are not managed by the ESX/ESXi NUMA scheduler. For example, if you manually set the processor affinity for a virtual machine, the NUMA scheduler might not be able to manage this virtual machine. Virtual machines that have more virtual processors than the number of physical processor cores available on a single hardware node cannot be managed automatically. Virtual machines that are not managed by the NUMA scheduler still run correctly. However, they don't benefit from ESX/ESXi NUMA optimizations.

The NUMA scheduling and memory placement policies in ESX/ESXi can manage all virtual machines transparently, so that administrators do not need to address the complexity of balancing virtual machines between nodes explicitly.

The optimizations work seamlessly regardless of the type of guest operating system. ESX/ESXi provides NUMA support even to virtual machines that do not support NUMA hardware, such as Windows NT 4.0. As a result, you can take advantage of new hardware even with legacy operating systems.

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