



Enhanced VMotion Compatibility Background and FAQ

What is EVC?

Enhanced VMotion Compatibility (EVC) is a new feature introduced in ESX 3.5 Update 2 and VirtualCenter 2.5 Update 2 which facilitates safe VMotion across a range of CPU generations. With EVC, it is now possible to VMotion between CPUs which previously were considered incompatible. EVC works at the cluster level in the VirtualCenter inventory. Once enabled for a cluster, hosts that are added to the cluster will be automatically configured for CPU compatibility. Hosts which cannot be made compatible with those already in the EVC cluster are not permitted to join the cluster to ensure that VMotion compatibility is always preserved for the cluster.

Benefits of EVC:

EVC makes it much easier to add servers with newer generation CPUs into existing clusters containing older-generation hardware. Servers entering an EVC cluster are automatically configured to be compatible with the hosts already in the clusters. Since this process is automatic, EVC is very simple to use and requires no specialized knowledge about CPU features and masks.

How EVC works:

EVC uses AMD-V Extended Migration and Intel® VT FlexMigration technologies to hide CPU features which might otherwise cause VMotion incompatibilities from the virtual machine. By hiding these incompatible features, it is possible to make newer CPUs compatible with older generation processors. VMware worked closely with AMD and Intel to define how these technologies work. The result of our joint efforts is the ability to VMotion across a range of CPU generations which previously were not compatible.

CPU support:

AMD Opteron™ processors starting with Rev. E/F models (from the K8 family) and Intel® Core™ 2 (Merom) processors may be used in EVC clusters. Note that EVC clusters may contain CPUs that do not have AMD-V Extended Migration or Intel® VT FlexMigration technologies. CPUs that do have these features can be made compatible with older CPUs which lack these features.

For a list of Intel and AMD processors that are EVC capable, see [VMware KB 1003212](#)

Other Considerations:

- Cross-vendor VMotion is not supported. Therefore, Intel and AMD hosts cannot both be present in an EVC cluster.
- EVC addresses only CPU compatibility. Network and Storage compatibility are not covered
- EVC requires that applications follow CPU vendor requirements for CPU feature detection. See [VMware KB 1005763](#) for details
- As support is added for new processor sin ESX updates and new releases, VMware will make every effort to ensure that these new processors can be added to existing EVC clusters. However, it is still possible that CPU vendors could introduce changes which break this compatibility.
- Processor implementations based on the listed processor architectures may be marketed under a range of product names, numbering schemes and may have different number of cores. Despite these differences they are all equivalent from an EVC perspective. For example, Intel® Xeon® E7330 and Intel® Xeon® 5150 are based on the same (Merom) architecture, and are therefore compatible from an EVC perspective, despite containing different number of cores.

More information:

- For information on configuring EVC, see the [Basic System Administration Guide for ESX 3.5 Update 2](#).
- For a list of processors that are EVC capable, see [VMware KB 1003212](#)
- For general information on VMotion see the [VMotion Compatibility Info Guide](#).
- For VMotion and Compatibility FAQ, see [KB 1005764](#).
- For detecting and using CPU Features in applications, see [KB 1005763](#).

FAQ

1. How can a user find out the EVC Cluster baseline supported by their ESX host?

VMware provides a free CPU Identification utility that displays EVC modes, in addition to other CPU features. The user can download this utility and boot the host with the ISO image.

The utility is available at <http://www.vmware.com/download/shared_utilities.html >

The following details are displayed

```
TEST: 56983: CPUID CHANGE: 6
Random_Init: Using random seed: -248375491 (0xf132173d)
Reporting CPUID for 8 logical CPUs...

All CPUs are identical

Family: 06 Model: 17 Stepping: 6

ID1ECX    ID1EDX    ID81ECX    ID81EDX
0x0000ce3bd 0xbfefbfff 0x00000001 0x20100000

Vendor          : Intel
Processor Cores : 4
Brand String    : "Intel(R) Xeon(R) CPU           E5440  @ 2.83GHz"
SSE Support     : SSE1, SSE2, SSE3, SSSE3, SSE4.1
Supports NX / XD : Yes
Supports CMPXCHG16B : Yes
Supports RDTSCP : No
Hyperthreading  : Yes
Supports Flex Migration : Yes
Supports 64-bit Longmode : Yes
Supports 64-bit VMware : Yes
Supported EVC modes : Core2, 45nm Core2

More
```

```
TEST: 56983: CPUID CHANGE: 675417
Random_Init: Using random seed: -1119256614 (0xbd497fda)
Reporting CPUID for 8 logical CPUs...

All CPUs are identical

Family: 1f Model: 02 Stepping: 3

ID1ECX    ID1EDX    ID81ECX    ID81EDX
0x00002009 0x178bffff 0x000007ff 0xefd3fbff

Vendor          : AMD
Processor Cores : 4
Brand String    : "Quad-Core AMD Opteron(tm) Processor 2350"
SSE Support     : SSE1, SSE2, SSE3, SSE4A
Supports NX / XD : Yes
Supports CMPXCHG16B : Yes
Supports RDTSCP  : Yes
Supports 3DNow! Prefetch : Yes
Supports FFXSR  : Yes
Supports Extended Migration : Yes
Supports 64-bit Longmode : Yes
Supports 64-bit VMware : Yes
Supported EVC modes : Second Gen. Opteron, Third Gen. Opteron
```

2. **Will EVC allow VMotion between AMD and Intel hosts and vice versa?**
No. EVC will not allow a mix of Intel and AMD hosts in the same EVC cluster.
3. **Can a user add an Intel 45nm Core™ 2 (Penryn) host into an EVC Cluster containing Intel Core™ 2 (Merom) hosts?**
Yes. EVC allows Penryn hosts to be added to an EVC cluster containing Merom hosts. In ESX 3.5 Update 2, EVC will automatically configure the Penryn hosts to expose only those features that are present in Merom, thus ensuring all hosts expose the same set of CPU features.
4. **Can a user add a Merom host into an EVC cluster containing Penryn hosts?**
Yes. In ESX 3.5 Update 2, the default Intel EVC cluster baseline configures Penryn hosts to present features that are on a Merom host. Consequently, Merom hosts will be permitted into this cluster, and all hosts will still expose the same set of CPU features.
5. **Can a user add an AMD 3rd Generation Opteron™ host (such as the quad-core Barcelona) into an EVC cluster containing AMD Rev. E/F hosts?**
Yes. EVC allows Barcelona hosts to be added to an EVC cluster containing Rev. E/F hosts. In ESX 3.5 Update 2, EVC will automatically configure the Barcelona host to expose only those features that are present in Rev. E/F thus ensuring all hosts expose the same set of CPU features.
6. **Can a user add an AMD Rev. E/F host into an EVC cluster containing Barcelona hosts?**
Yes. In ESX 3.5 Update 2, the default AMD EVC cluster baseline configures Barcelona hosts to present features that are on a Rev. E/F host. Consequently, Rev. E/F hosts will be permitted into this cluster, and all hosts will still expose the same set of CPU features.
7. **Can you create an EVC cluster if some of the hosts you wish to add do not have AMD-V Extended Migration and Intel® VT FlexMigration?**
Yes. EVC clusters may contain hosts which do not feature AMD-V Extended Migration and Intel® VT FlexMigration technology. For example, Merom CPUs do not have Intel® VT FlexMigration technology but are permitted into EVC clusters.
8. **Can a user add ESX 3.5 Update 1 or lower hosts to an EVC cluster?**
No. EVC is supported only on ESX 3.5 Update 2 and later. VirtualCenter will not permit the addition of hosts which do not provide support for EVC into an EVC-enabled cluster.
9. **When adding newer hardware into an EVC cluster with a lower CPU baseline do I lose performance?**
Only CPU instructions which are unique to the new CPU are hidden from VMs once the host joins the cluster. Typically this will include new SIMD instructions such as the latest SSE additions. CPU optimizations for instruction virtualization such as Intel VT-x and AMD-V or facilities for MMU virtualization such as nested paging will still be used by the hypervisor.