

# Enhanced vMotion Compatibility (EVC) processor support

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**Produtos:** VMware vCenter Server, VMware vSphere ESXi

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## Issue/Introduction

EVC stands for Enhanced vMotion Compatibility. This is a vCenter cluster feature which simplifies vMotion compatibility issues across CPU generations. EVC automatically configures server CPUs with Intel FlexMigration or AMD-V Extended Migration technologies to be compatible with older servers.

After EVC is enabled for a cluster in the vCenter Server inventory, all hosts in that cluster are configured to present identical CPU features and ensure CPU compatibility for vMotion. The features presented by each host are determined by selecting a predefined EVC baseline. vCenter Server does not permit the addition of hosts that cannot be automatically configured to be compatible with the EVC baseline.

## Resolution

More recent processor architectures are compatible with EVC. The maximum EVC mode that can be supported by a particular processor is listed in the

Broadcom Compatibility Guide

for that processor. To use EVC, you must run ESX 3.5 Update 2 or higher with VirtualCenter 2.5 Update 2 or higher and have compatible processors in your servers. EVC does not allow for migration with vMotion between Intel and AMD processors.

## EVC capabilities of your server are based on two factors:

The version of vCenter Server that manages the host.

The und

erlying CPU architecture of the host processor.

For more information please refer to your hardware documentation or contact your hardware vendor for more detail information on Intel VT.

How to enable VT on Intel server

## About the tables in this article:

Table 1.1 and 1.2 lists the available EVC baselines and their description

Table 2.1 and 2.2 describes EVC baselines supported by different vCenter Server versions

In general, if a processor can support EVC level

XN

, it can also support levels

XN

-1 to

X

0. For example, a processor that supports the Intel "Sandy Bridge" Generation EVC Baseline has an EVC level of L4. Therefore, it can also support EVC levels L3, L2, L1, and L0. However, it cannot support EVC level L5, which corresponds to the Intel "Ivy Bridge" Generation. Intel EVC Baselines are listed in Table 1.1.

For AMD processors, there are two different sequences of EVC levels: Levels A0 to A3, which support the first 3 generations of AMD Opteron™ processors, and levels B0 and above, which support AMD Opteron™ Generation 3 and later processors.

## Note

: The AMD Opteron™ Generation 3 (no 3DNow!™) EVC baseline is common to both sequences. For example, an AMD processor that supports the AMD Opteron™ Generation 4 EVC baseline supports the AMD Opteron™ Generation 3 (no 3DNow!™) baseline, but not the AMD Opteron™ Generation 3 baseline. An AMD processor that supports the AMD Opteron™ Generation 3 baseline supports the AMD Opteron™ Generation 3 (no 3DNow!™) baseline, but not the AMD Opteron™ Generation 4 baseline.

AMD EVC baselines are listed in Table 1.2.

Table 1.1: Description of Intel EVC Baselines

### EVC Level

### EVC Baseline

### Description

#### L0

Intel "Merom" Gen. (Intel Xeon Core™ 2)

Applies baseline feature set of Intel "Merom" Generation (Intel Xeon Core™ 2) processors to all hosts in the cluster.

#### L1

Intel "Penryn" Gen. (formerly Intel Xeon 45nm Core™ 2)

Applies baseline feature set of Intel "Penryn" Generation (Intel Xeon 45nm Core™ 2) processors to all hosts in the cluster.

Compared to the Intel "Merom" Generation EVC mode, this EVC mode exposes additional CPU features including SSE4.1.

#### L2

Intel "Nehalem" Gen. (formerly Intel Xeon Core™ i7)

Applies baseline feature set of Intel "Nehalem" Generation (Intel Xeon Core™ i7) processors to all hosts in the cluster.

Compared to the Intel "Penryn" Generation EVC mode, this EVC mode exposes additional CPU features including SSE4.2 and POPCOUNT.

#### L3

Intel "Westmere" Gen. (formerly Intel Xeon 32nm Core™ i7)

Applies baseline feature set of Intel "Westmere" Generation (Intel Xeon 32nm Core™ i7) processors to all hosts in the cluster. Compared to the Intel "Nehalem" Generation mode, this EVC mode exposes additional CPU features including AES and PCLMULQDQ.

## Note

: Intel i3/i5 Xeon Clarkdale Series processors that do not support AESNI and PCLMULQDQ cannot be admitted to EVC modes higher than the Intel "Nehalem" Generation mode.

## Note

: Intel Atom™ C2300-C2700 processors support the Intel "Westmere" Gen. EVC baseline although their architecture is different from the architecture of the Intel "Westmere" Generation processors.

#### L4

Intel "Sandy Bridge" Generation

Applies baseline feature set of Intel "Sandy Bridge" Generation processors to all hosts in the cluster.

Compared to the Intel "Westmere" Generation mode, this EVC mode exposes additional CPU features including AVX and XSAVE.

## Note

: Intel "Sandy Bridge" processors that do not support AESNI and PCLMULQDQ cannot be admitted to EVC modes higher than the Intel "Nehalem" Generation mode.

#### L5

##### Intel "Ivy Bridge" Generation

Applies baseline feature set of Intel "Ivy Bridge" Generation processors to all hosts in the cluster. Compared to the Intel "Sandy Bridge" Generation EVC mode, this EVC mode exposes additional CPU features including RDRAND, ENFSTRG, FSGSBASE, SMEP, and F16C.

#### Note

: Some Intel "Ivy Bridge" processors do not provide the full "Ivy Bridge" feature set. Such processors cannot be admitted to EVC modes higher than the Intel "Nehalem" Generation mode.

#### L6

##### Intel "Haswell" Generation

Applies baseline feature set of Intel "Haswell" Generation processors to all hosts in the cluster. Compared to the Intel "Ivy Bridge" Generation EVC mode, this EVC mode exposes additional CPU features including ABMX2,AVX2, MOVBE, FMA, PERMD, RORX/MULX, INVPCID, VMFUNC.

#### L7

##### Intel "Broadwell" Generation

Applies the baseline feature set of Intel "Broadwell" Generation processors to all hosts in the cluster. Compared to the Intel® "Haswell" Generation EVC mode, this EVC mode exposes additional CPU features including Transactional Synchronization Extensions, Supervisor Mode Access Prevention, Multi-Precision Add-Carry Instruction Extensions, PREFETCHW and RDSEED

#### L8

##### Intel "Skylake" Generation

Applies the baseline feature set of Intel "Skylake" Generation processors to all hosts in the cluster. Compared to the Intel® "Broadwell" Generation EVC mode, this EVC mode exposes additional CPU features including Advanced Vector

Extensions 512, Persistent Memory Support Instructions, Protection Key Rights, Save Processor Extended States with Compaction, and Save Processor Extended States Supervisor

#### L9

##### Intel "Cascade Lake" Generation

Applies the baseline feature set of Intel® "Cascade Lake" Generation processors to all hosts in the cluster. Compared to the Intel® "Skylake" Generation EVC mode, this EVC mode exposes additional CPU features including VNNI and XGETBV with ECX = 1.

Table 1.2: Description of AMD EVC Baselines

#### EVC Level

#### EVC Baseline

#### Description

#### A0

##### AMD Opteron™ Generation 1

Applies baseline feature set of AMD Opteron™ Generation 1 (Rev. E) processors to all hosts in the cluster.

#### A1

##### AMD Opteron™ Generation 2

Applies baseline feature set of AMD Opteron™ Generation 2 (Rev. F) processors to all hosts in the cluster.

Compared to the AMD Opteron™ Generation 1 EVC mode, this EVC mode exposes additional CPU features including CPMXCHG16B and RDTSCP.

#### A3

##### AMD Opteron™ Generation 3

Applies baseline feature set of AMD Opteron™ Generation 3 (Greyhound) processors to all hosts in the cluster.

Compared to the AMD Opteron™ Generation 2 EVC mode, this EVC mode exposes additional CPU features including SSE4A, MisAlignSSE, POPCOUNT and ABM (LZCNT).

#### Note

: Due to 3DNow!™ support being removed from AMD processors after mid 2010, use AMD Opteron™ Generation 3 (no 3DNow!™) when possible to avoid compatibility issues with future processor generations.

#### A2, B0

##### AMD Opteron™ Generation 3 (no 3DNow!™)

Applies baseline feature set of AMD Opteron™ Generation 3 (Greyhound) processors with 3DNow!™ support removed, to all hosts in the cluster.

This mode allows you to prepare clusters containing AMD hosts to accept AMD processors without 3DNow!™ support.

#### B1

##### AMD Opteron™ Generation 4

Applies baseline feature set of AMD Opteron™ Generation 4 (Bulldozer) processors to all hosts in the cluster.

Compared to the AMD Opteron™ Generation 3 (no 3DNow!™) EVC mode, this EVC mode exposes additional CPU features including SSSE3, SSE4.1, AES, AVX, XSAVE, XOP, and FMA4.

#### B2

##### AMD Opteron™ "Piledriver" Generation

Applies baseline feature set of AMD Opteron™ "Piledriver" Generation processors to all hosts in the cluster.

Compared to the AMD Opteron™ Generation 4 EVC mode, this EVC mode exposes additional CPU features including FMA, TBM, BMI1, and F16C.

#### B3

##### AMD Opteron™ "Steamroller" Generation

Applies baseline feature set of AMD Opteron™ "Steamroller" Generation processors to all hosts in the cluster.

Compared to the AMD Opteron™ "Piledriver" EVC mode, this EVC mode exposes additional CPU features including XSAVEOPT, RDFSBASE, RDGSBASE, WRFSBASE, WRGSBAS and FSGSBASE.

#### B4

##### AMD "Zen" Generation

Applies baseline feature set of AMD "Zen" Generation processors to all hosts in the cluster.

Compared to the AMD Opteron™ "Steamroller" EVC mode, this EVC mode exposes additional CPU features including RDRAND, SMEP, AVX2, BMI2, MOVBE, ADX, RDSEED, SMAP, CLFLUSHOPT, XSAVES, XSAVEC, SHA, and CLZERO

#### B5

##### AMD "Zen 2" Generation

Applies the baseline feature set of AMD "Zen 2" Generation processors to all hosts in the cluster.

Compared to the AMD "Zen" Generation EVC mode, this EVC mode exposes additional CPU features including CLWB, UMIP, RDPID, XGETBV with ECX = 1, WBNOINVD, and GMET.

An older release of vSphere supports a new processor but not the corresponding new EVC baseline that exposes the maximum guest-visible features of that processor. A newer vSphere release usually supports both the processor and the new EVC baseline. This is because the older release can only support those features of the new processor that are in common with older processors. Therefore, support of an EVC baseline is not identical to the support of the corresponding processor. Table 2.1 and 2.2 indicate the earliest vSphere release that supports each EVC baseline.

For example, consider the Intel "Sandy Bridge" Generation EVC baseline and the Intel Xeon e5-2400 (a processor based on the Intel "Sandy Bridge" architecture). The processor is supported by both vSphere 4.1 Update 2 (and later) and vSphere 5.0 (and later). But because vSphere 4.1 update 2 lacks support for advanced "Sandy Bridge" features such as AVX, the Intel "Sandy Bridge" Generation EVC baseline is only supported starting with the vSphere 5.0 release. However, vSphere 4.1 Update 2 does support lower level EVC baselines on the Intel Xeon e5-2400, such as Intel "Westmere" Generation and Intel "Merom" Generation.

Not all members of a given processor generation can support the same maximum EVC baseline. Either because of BIOS configuration or branding decisions made by OEM or CPU vendors, some members of that generation may lack a feature required to participate at the maximum EVC baseline. For example, some Intel Xeon i3/i5 Clarkdale processors (based on the Intel "Westmere" processor architecture) do not have AESNI capability, which is required for the Intel "Westmere" Generation EVC baseline. Therefore, these processors cannot support that EVC baseline and must use lower levels of EVC baselines. Another example is where AESNI is disabled by BIOS in an Intel Xeon 5600 processor (also based on the Intel "Westmere" processor architecture); as a result, this processor also cannot support the Intel "Westmere" EVC baseline and must use lower levels of EVC baselines.

The

Broadcom Compatibility Guide

always correctly lists the maximum EVC baseline for a processor assuming that no BIOS disablement of features has been enforced. As disabling of features by BIOS is OEM and customer specific, the guide cannot address these cases.

Table 2.1: Intel EVC Baselines supported in vCenter Server releases

EVC Cluster Baseline

vCenter Server Release

Intel "Merom" Generation

Intel "Penryn" Generation

Intel "Nehalem" Generation

Intel "Westmere" Generation

Intel "Sandy Bridge" Generation

Intel "Ivy Bridge" Generation

Intel "Haswell" Generation

Intel "Broadwell" Generation

Intel "Skylake" Generation

Intel "Cascade Lake" Generation

vCenter Server 5.5

Yes

Yes

Yes

Yes

Yes

Yes

No

No

No

No

vCenter Server 6.0

Yes

Yes

Yes

Yes

Yes

Yes

Yes

No

No

No

vCenter Server 6.5

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

No

No

vCenter Server 6.7

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

No

vCenter Server 7.0

Yes

Yes  
Yes  
Yes  
Yes  
Yes  
Yes  
Yes  
Yes  
Yes  
Yes

Table 2.2: AMD EVC Baselines supported in vCenter Server releases

EVC Cluster Baseline

v

Center Server Release

AMD Opteron™ Gen. 1

AMD Opteron™ Gen. 2

AMD Opteron™ Gen. 3

AMD Opteron™ Gen. 3 (no 3DNow!™)

AMD Opteron™ Gen. 4

AMD Opteron "Piledriver" Gen.

AMD Opteron™ "Steamroller"

Gen.

AMD "Zen"

Gen.

AMD "Zen 2" Generation

vCenter Server 5.5

Yes

Yes

Yes

Yes

Yes

Yes

No

No

No

vCenter Server 6.0

Yes

Yes

Yes

Yes

Yes

Yes

Yes

No

No

vCenter Server 6.5

Yes

Yes

Yes

Yes

Yes

Yes

Yes

No

No

vCenter Server 6.7

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

No

vCenter Server 7.0

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

## Notes

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For more information on supported servers and processor models, see the [Broadcom Compatibility Guide](#) for your ESX version.

Verify that the BIOS settings for host processors enable Hardware Virtualization (if available) and Execute Protection. Default BIOS settings might not always enable these features. Hardware Virtualization is Intel VT on Intel processors and AMD-V on (supported) AMD processors. Execute Protection is Intel eXecute Disable (XD) on Intel processors and AMD No eXecute (NX) on AMD processors. For machines with AMD processors, under Processor Options, set No-Execute Page-Protection to Enabled. Until these CPU features are enabled, ESX hosts with EVC supported CPU types listed below will be unsupported.

## Note

: XD is also listed as Execute Memory Protection under the processor option within the server BIOS.

For Intel "Westmere" EVC Mode, some server OEMs might require you to enable the AES instructions in the BIOS.

Host's CPU hardware should support the cluster's current Enhanced vMotion Compatibility mode, but if some of the necessary CPU features are missing from the host then it may give an error. Check the host's BIOS configuration to ensure that no necessary features are disabled (such as XD, VT, AES, or PCLMULQDQ for Intel, or NX for AMD).

if you would add a newer host to the cluster, containing newer CPU packages, EVC would potentially hide the new CPU instructions/features to the virtual machines. By doing so, EVC ensures that all VM in the cluster are running on the same CPU instructions allowing for VM to be vMotion between the ESXi hosts. Hosts with Intel Penryn-E processors that are running virtual machines at the ESXi 5.0 compatibility level (hardware version 8) or higher cannot be added to Penryn EVC clusters. The ESXi 5.0 virtual machine compatibility level and higher compatibility levels expose the XSAVE feature to virtual machines running on Penryn-E hosts. The XSAVE feature is masked out in the Penryn EVC mode, causing a virtual machine feature incompatibility with these virtual machines.

Changing EVC modes on a cluster require the host to be in maintenance mode to take affect. Ensure that virtual machine is powered off

## References:

[Enable EVC on Existing Cluster](#)

[Change the EVC mode for a cluster](#)

For a list of servers supported in an ESXi/ESX release, see the [Broadcom Compatibility Guide](#)

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For information on configuring EVC, see the [Migrating Virtual Machines](#)

For vMotion and Compatibility FAQs, see [EVC and CPU Compatibility FAQ](#)

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