AMD64 Page Modification Logging

Future AMD APM releases that describe this feature supersede the information in this document

Revision History

Date	Revision	Change Description
March 2026	1.00	Initial release

Page Modification Logging

This document describes Page Modification Logging (PML), which is a feature available on some Zen6 products. With PML, the processor logs guest physical addresses that set the Dirty bit of a nested page-table entry.

Support for PML is indicated by CPUID Fn8000_0000A_ECX[PML] (bit 4) = 1.

Page Modification Logging (PML) is enabled on VMRUN when bit 11 in VMCB control area at offset 90h is set and nested paging is enabled. When a guest memory write access sets the Dirty bit of a nested page table entry, the processor writes the 4-Kbyte aligned guest physical address (bits 11:0 cleared) to the PML buffer. The PML buffer is a 4-Kbyte memory region located at the PML_BASE address configured at offset 1C8h in the VMCB control area. The processor maintains a PML buffer index which points to the next PML buffer entry to be written. Before the write access is allowed and the nested page table Dirty bit is set, the processor checks if the PML buffer index is in the range between 0 and 1FFh. If it is, the processor allows the write access, sets the Dirty bit and writes the guest physical address (as specified above) into the PML buffer. Specifically, to address PML_BASE + PML_INDEX * 8. The PML index is then decremented. On #VMEXIT the current PML index is written to PML_INDEX (offset 1D0h) in the VMCB control area.

If the PML buffer index is outside the range between 0 and 1FFh, the write access is not performed, and the Dirty bit is not set. Instead, the processor performs a #VMEXIT with exit code VMEXIT_PML_FULL (407h). VMEXIT_PML_FULL does not advance the rIP in the guest and is AE (Automatic Exit) for SEV-ES and SEV-SNP guests.

After handling the VMEXIT_PML_FULL event and when configuring PML, hypervisor software should write 1FFh to PML_INDEX (offset 1D0h in the VMCB control area) to empty the buffer.

Since PML also tracks writes to guest page table entries, a single guest write access may result in multiple guest physical addresses being logged.

VMCB Entries Related to Page Modification Logging

VMCB Layout, Control Area

Byte Offset	Bit(s)	Function
090h	11	Page Modification Logging Enable
1C8h	63:0	PML_BASE – Page Modification Logging buffer system physical starting address
1D0h	15:0	PML_INDEX - Page Modification Logging buffer quadword index.