

Architecture Page Table Helpers

Generic MM expects architectures (with MMU) to provide helpers to create, access and modify page table entries at various level for different memory functions. These page table helpers need to conform to a common semantics across platforms. Following tables describe the expected semantics which can also be tested during boot via CONFIG_DEBUG_VM_PGTABLE option. All future changes in here or the debug test need to be in sync.

PTE Page Table Helpers

pte_same	Tests whether both PTE entries are the same
pte_bad	Tests a non-table mapped PTE
pte_present	Tests a valid mapped PTE
pte_young	Tests a young PTE
pte_dirty	Tests a dirty PTE
pte_write	Tests a writable PTE
pte_special	Tests a special PTE
pte_protnone	Tests a PROT_NONE PTE
pte_devmap	Tests a ZONE_DEVICE mapped PTE
pte_soft_dirty	Tests a soft dirty PTE
pte_swp_soft_dirty	Tests a soft dirty swapped PTE
pte_mkyoung	Creates a young PTE
pte_mkold	Creates an old PTE
pte_mkdirty	Creates a dirty PTE
pte_mkclean	Creates a clean PTE
pte_mkwrite	Creates a writable PTE
pte_wrprotect	Creates a write protected PTE
pte_mkspecial	Creates a special PTE
pte_mkdevmap	Creates a ZONE_DEVICE mapped PTE
pte_mksoft_dirty	Creates a soft dirty PTE
pte_clear_soft_dirty	Clears a soft dirty PTE
pte_swp_mksoft_dirty	Creates a soft dirty swapped PTE
pte_swp_clear_soft_dirty	Clears a soft dirty swapped PTE
pte_mknnotpresent	Invalidates a mapped PTE
ptep_clear	Clears a PTE
ptep_get_and_clear	Clears and returns PTE
ptep_get_and_clear_full	Clears and returns PTE (batched PTE unmap)
ptep_test_and_clear_young	Clears young from a PTE
ptep_set_wrprotect	Converts into a write protected PTE
ptep_set_access_flags	Converts into a more permissive PTE

PMD Page Table Helpers

pmd_same	Tests whether both PMD entries are the same
pmd_bad	Tests a non-table mapped PMD
pmd_leaf	Tests a leaf mapped PMD
pmd_huge	Tests a HugeTLB mapped PMD
pmd_trans_huge	Tests a Transparent Huge Page (THP) at PMD
pmd_present	Tests a valid mapped PMD
pmd_young	Tests a young PMD
pmd_dirty	Tests a dirty PMD
pmd_write	Tests a writable PMD
pmd_special	Tests a special PMD
pmd_protnone	Tests a PROT_NONE PMD
pmd_devmap	Tests a ZONE_DEVICE mapped PMD
pmd_soft_dirty	Tests a soft dirty PMD
pmd_swp_soft_dirty	Tests a soft dirty swapped PMD
pmd_mkyoung	Creates a young PMD
pmd_mkold	Creates an old PMD
pmd_mkdirty	Creates a dirty PMD

pmd_mkclean	Creates a clean PMD
pmd_mkwrite	Creates a writable PMD
pmd_wrprotect	Creates a write protected PMD
pmd_mkspecial	Creates a special PMD
pmd_mkdevmap	Creates a ZONE_DEVICE mapped PMD
pmd_mksoft_dirty	Creates a soft dirty PMD
pmd_clear_soft_dirty	Clears a soft dirty PMD
pmd_swp_mksoft_dirty	Creates a soft dirty swapped PMD
pmd_swp_clear_soft_dirty	Clears a soft dirty swapped PMD
pmd_mkinvalid	Invalidates a mapped PMD [1]
pmd_set_huge	Creates a PMD huge mapping
pmd_clear_huge	Clears a PMD huge mapping
pmdp_get_and_clear	Clears a PMD
pmdp_get_and_clear_full	Clears a PMD
pmdp_test_and_clear_young	Clears young from a PMD
pmdp_set_wrprotect	Converts into a write protected PMD
pmdp_set_access_flags	Converts into a more permissive PMD

PUD Page Table Helpers

pud_same	Tests whether both PUD entries are the same
pud_bad	Tests a non-table mapped PUD
pud_leaf	Tests a leaf mapped PUD
pud_huge	Tests a HugeTLB mapped PUD
pud_trans_huge	Tests a Transparent Huge Page (THP) at PUD
pud_present	Tests a valid mapped PUD
pud_young	Tests a young PUD
pud_dirty	Tests a dirty PUD
pud_write	Tests a writable PUD
pud_devmap	Tests a ZONE_DEVICE mapped PUD
pud_mkyoung	Creates a young PUD
pud_mkold	Creates an old PUD
pud_mkdirty	Creates a dirty PUD
pud_mkclean	Creates a clean PUD
pud_mkwrite	Creates a writable PUD
pud_wrprotect	Creates a write protected PUD
pud_mkdevmap	Creates a ZONE_DEVICE mapped PUD
pud_mkinvalid	Invalidates a mapped PUD [1]
pud_set_huge	Creates a PUD huge mapping
pud_clear_huge	Clears a PUD huge mapping
pudp_get_and_clear	Clears a PUD
pudp_get_and_clear_full	Clears a PUD
pudp_test_and_clear_young	Clears young from a PUD
pudp_set_wrprotect	Converts into a write protected PUD
pudp_set_access_flags	Converts into a more permissive PUD

HugeTLB Page Table Helpers

pte_huge	Tests a HugeTLB
pte_mkhuge	Creates a HugeTLB
huge_pte_dirty	Tests a dirty HugeTLB
huge_pte_write	Tests a writable HugeTLB
huge_pte_mkdirty	Creates a dirty HugeTLB
huge_pte_mkwrite	Creates a writable HugeTLB
huge_pte_wrprotect	Creates a write protected HugeTLB
huge_ptep_get_and_clear	Clears a HugeTLB
huge_ptep_set_wrprotect	Converts into a write protected HugeTLB
huge_ptep_set_access_flags	Converts into a more permissive HugeTLB

SWAP Page Table Helpers

__pte_to_swp_entry	Creates a swapped entry (arch) from a mapped PTE
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<code>__swp_to_pte_entry</code>	Creates a mapped PTE from a swapped entry (arch)
<code>__pmd_to_swp_entry</code>	Creates a swapped entry (arch) from a mapped PMD
<code>__swp_to_pmd_entry</code>	Creates a mapped PMD from a swapped entry (arch)
<code>is_migration_entry</code>	Tests a migration (read or write) swapped entry
<code>is_writable_migration_entry</code>	Tests a write migration swapped entry
<code>make_readable_migration_entry</code>	Creates a read migration swapped entry
<code>make_writable_migration_entry</code>	Creates a write migration swapped entry

[1] <https://lore.kernel.org/linux-mm/20181017020930.GN30832@redhat.com/>