

Note: for replacement action for blocks in S or F, CCE can alternatively send an Invalidate command and wait for Invalidate Ack (if using unordered network)

Note: for replacement action for blocks in S or F, CCE can alternatively send an Set State / I command (if using ordered network)

MOESIF - Directory Controller / CCE

	Coherence Request			CCE Action
State	Read Request	Non-Exclusive Read Request	Write Request	Replacement
Invalid (I)	Read memory, Set Tag + Data / E	Read memory, Set Tag + Data / S	Read memory, Set Tag + Data / M	
Shared (S)	Read memory, Set Tag + Data / S	Read memory, Set Tag + Data / S	Invalidate sharers, Set State + Wakeup / M ; Invalidate sharers, read memory, Set Tag + Data / M	No message required - block overwritten by fill
Exclusive (E)	Set State + Transfer (S) + Writeback / F	Set State + Transfer (S) + Writeback / F	Set State (I) + Transfer (M) / M	Set State + Writeback / I
Modified (M)	Set State + Transfer (S) / O	Set State + Transfer (S) / O	Set State (I) + Transfer (M) / M	Set State + Writeback / I
Owned (O)	Transfer (S) / O	Transfer (S) / O	Invalidate sharers, Set State (I) + Transfer (M) / M	Set State + Writeback / I
Forward (F)	Transfer (S) / F	Transfer (S) / F	Invalidate sharers, Set State (I) + Transfer (M) / M	No message required - block overwritten by fill

Note: write request with requestor in S and directory in F results in downgrade F to I, upgrade S to M

Note: write request with requestor in S and directory in O results in downgrade O to I, upgrade S to M

MI - Directory Controller / CCE

	Coherence Request			CCE Action
State	Read Request	Non-Exclusive Read Request	Write Request	Replacement
Invalid (I)	Read memory, Set Tag + Data / M	Read memory, Set Tag + Data / M	Read memory, Set Tag + Data / M	
Modified (M)	Set State (I) + Transfer (M) / M	Set State (I) + Transfer (M) / M	Set State (I) + Transfer (M) / M	Set State + Writeback / I

MSI - Directory Controller / CCE

	Coherence Request			CCE Action
State	Read Request	Non-Exclusive Read Request	Write Request	Replacement
Invalid (I)	Read memory, Set Tag + Data / S	Read memory, Set Tag + Data / S	Read memory, Set Tag + Data / M	
Shared (S)	Read memory, Set Tag + Data / S	Read memory, Set Tag + Data / S	Invalidate sharers, Set State + Wakeup / M ; Invalidate sharers, read memory, Set Tag + Data / M	No message required - block overwritten by fill
Modified (M)	Set State (S) + Transfer (S) + Writeback / S	Set State (S) + Transfer (S) + Writeback / S	Set State (I) + Transfer (M) / M	Set State + Writeback / I

MESI - Directory Controller / CCE

	Coherence Request			CCE Action
State	Read Request	Non-Exclusive Read Request	Write Request	Replacement
Invalid (I)	Read memory, Set Tag + Data / E	Read memory, Set Tag + Data / S	Read memory, Set Tag + Data / M	
Shared (S)	Read memory, Set Tag + Data / S	Read memory, Set Tag + Data / S	Invalidate sharers, Set State + Wakeup / M ; Invalidate sharers, read memory, Set Tag + Data / M	No message required - block overwritten by fill
Exclusive (E)	Set State (S) + Transfer (S) + Writeback / S	Set State (S) + Transfer (S) + Writeback / S	Set State (I) + Transfer (M) / M	Set State + Writeback / I
Modified (M)	Set State (S) + Transfer (S) + Writeback / S	Set State (S) + Transfer (S) + Writeback / S	Set State (I) + Transfer (M) / M	Set State + Writeback / I

MESIF - Directory Controller / CCE

	Coherence Request			CCE Action
State	Read Request	Non-Exclusive Read Request	Write Request	Replacement
Invalid (I)	Read memory, Set Tag + Data / E	Read memory, Set Tag + Data / S	Read memory, Set Tag + Data / M	
Shared (S)	Read memory, Set Tag + Data / S	Read memory, Set Tag + Data / S	Invalidate sharers, Set State + Wakeup / M ; Invalidate sharers, read memory, Set Tag + Data / M	No message required - block overwritten by fill
Exclusive (E)	Set State + Transfer (S) + Writeback / F	Set State + Transfer (S) + Writeback / F	Set State (I) + Transfer (M) / M	Set State + Writeback / I
Modified (M)	Set State + Transfer (S) + Writeback / F	Set State + Transfer (S) + Writeback / F	Set State (I) + Transfer (M) / M	Set State + Writeback / I
Forward (F)	Transfer (S) / F	Transfer (S) / F	Invalidate sharers, Set State (I) + Transfer (M) / M	Set State / I

MOSI - Directory Controller / CCE

	Coherence Request			CCE Action
State	Read Request	Non-Exclusive Read Request	Write Request	Replacement
Invalid (I)	Read memory, Set Tag + Data / S	Read memory, Set Tag + Data / S	Read memory, Set Tag + Data / M	
Shared (S)	Read memory, Set Tag + Data / S	Read memory, Set Tag + Data / S	Invalidate sharers, Set State + Wakeup / M ; Invalidate sharers, read memory, Set Tag + Data / M	No message required - block overwritten by fill
Modified (M)	Set State + Transfer (S) / O	Set State + Transfer (S) / O	Set State (I) + Transfer (M) / M	Set State + Writeback / I
Owned (O)	Transfer (S) / O	Transfer (S) / O	Invalidate sharers, Set State (I) + Transfer (M) / M	Set State + Writeback / I

MOSIF - Directory Controller / CCE

	Coherence Request			CCE Action
State	Read Request	Non-Exclusive Read Request	Write Request	Replacement
Invalid (I)	Read memory, Set Tag + Data / S	Read memory, Set Tag + Data / S	Read memory, Set Tag + Data / M	
Shared (S)	Read memory, Set Tag + Data / S	Read memory, Set Tag + Data / S	Invalidate sharers, Set State + Wakeup / M ; Invalidate sharers, read memory, Set Tag + Data / M	No message required - block overwritten by fill
Modified (M)	Set State + Transfer (S) / O	Set State + Transfer (S) / O	Set State (I) + Transfer (M) / M	Set State + Writeback / I
Owned (O)	Transfer (S) / O	Transfer (S) / O	Invalidate sharers, Set State (I) + Transfer (M) / M	Set State + Writeback / I
Forward (F)	Transfer (S) / F	Transfer (S) / F	Invalidate sharers, Set State (I) + Transfer (M) / M	No message required - block overwritten by fill

MOESI - Directory Controller / CCE

	Coherence Request			CCE Action
State	Read Request	Non-Exclusive Read Request	Write Request	Replacement
Invalid (I)	Read memory, Set Tag + Data / E	Read memory, Set Tag + Data / S	Read memory, Set Tag + Data / M	
Shared (S)	Read memory, Set Tag + Data / S	Read memory, Set Tag + Data / S	Invalidate sharers, Set State + Wakeup / M ; Invalidate sharers, read memory, Set Tag + Data / M	No message required - block overwritten by fill
Exclusive (E)	Set State + Transfer (S) + Writeback / S	Set State + Transfer (S) + Writeback / S	Set State (I) + Transfer (M) / M	Set State + Writeback / I
Modified (M)	Set State + Transfer (S) / O	Set State + Transfer (S) / O	Set State (I) + Transfer (M) / M	Set State + Writeback / I
Owned (O)	Transfer (S) / O	Transfer (S) / O	Invalidate sharers, Set State (I) + Transfer (M) / M	Set State + Writeback / I