OVP VMI/OP Function Overview

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Author:	Imperas Software Limited
Version:	1.2.0
Filename:	OVP_VMI_OP_Function_Overview.doc
Project:	OVP VMI/OP Function Overview
Last Saved:	Monday, 14 August 2023
Keywords:	

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1 Introduction

This document provides a high-level overview of the functional groups implemented in the VMI run time and OP interfaces. The intention is not to describe any functions in detail, but to provide a starting point about where to look for functions required to implement a particular task.

The VMI and OP APIs are intended to perform different tasks. The VMI interface is primarily intended for *modeling of processors*. It therefore contains functions for describing instructions to the JIT translation engine, efficient implementation of memory translation schemes, description of processor registers and so on. The OP API is primarily intended for *description of platform interconnect* and *simulation control*. It therefore contains functions for instantiation of components, executing processors and so on. The great majority of tasks that are done when modeling a processor are inappropriate for use in a platform/simulation context and vice-versa, so they are placed in different APIs to guard against misuse.

There is some overlap in the two interfaces when they are used for *tool development*. Tools are sometimes implemented as intercept libraries on processor objects and sometimes in a simulation harness written using the OP API. Therefore, some functions in these two APIs perform similar purposes: this document indicates which functions fall into such groups.

For detailed information on the VMI Run Time function API, consult the *VMI Run Time Function Reference Manual*. For detailed information on the OP API, consult the Doxygen documentation tree in the Imperas installation.

2 VMI Run Time Functions

2.1 Simulation Environment Access

These functions are used to access simulation environment features:

```
vmirtSuppressStdout
vmirtPlatformName
```

2.2 Processor Simulation Control

These functions control inspection and execution of a processor:

vmirtGetCurrentProcessor	opProcessorCurrent
vmirtCPUId	
vmirtGetProcessorForCPUId	
vmirtProcessorFlags	
vmirtProcessorName	
vmirtSetProcessorName	
vmirtProcessorVariant	opProcessorVariant
vmirtSetProcessorVariant	
vmirtProcessorType	
vmirtProcessorStringAttribute	
vmirtProcessorBoolAttribute	
vmirtProcessorUns32Attribute	
vmirtProcessorUns64Attribute	
vmirtProcessorFlt64Attribute	
vmirtGetCurrentMode	opProcessorModeCurrent
vmirtGetNextMode	opProcessorModeNext
vmirtYield	
vmirtHalt	
vmirtInterrupt	opInterrupt
vmirtYieldControl	opProcessorYield
vmirtExit	opProcessorExit
vmirtFinish	opProcessorFinish
vmirtStop	opInterruptRSP
vmirtAtomic	
vmirtBlock	
vmirtAbortRepeat	
vmirtIsHalted	
vmirtRestartNext	
vmirtRestartNow	
vmirtDoSynchronousInterrupt	

For related OP functions, see section 3.4.21.

2.3 Program Counter and Code Dictionary

These functions handle access to simulated program counter and invalidation of code dictionary:

vmirtGetPC	opProcessorPC
vmirtGetPCDS	opProcessorPCDS
vmirtSetPC	opProcessorPCSet
vmirtSetPCDS	
vmirtSetPCException	

```
vmirtSetPCFlushTarget
vmirtSetPCFlushDict
vmirtFlushTarget
vmirtFlushTargetMode
vmirtFlushTargetModeTagged
vmirtFlushDict
vmirtFlushAllDicts
vmirtAddPCCallback
vmirtRemovePCCallback
vmirtUpdatePCCallbackCondition
vmirtGetPCCallbackCondition
```

For related OP functions, see section 3.2.

2.4 Dictionary and Block Modes

These functions handle mode-specific JIT code:

```
vmirtGetMode
vmirtSetMode
vmirtGetBlockMask
vmirtSetBlockMask
vmirtSetBlockMask32
vmirtSetBlockMask64
```

2.5 Time and Cycle Counts

2.5.1 Instruction/Cycle Counting and Interrupt

These functions handle instruction and cycle counts:

```
vmirtGetProcessorIPS
vmirtGetICount                      opProcessorCycleCount
vmirtGetExecutedICount              opProcessorICount
vmirtSetICountInterrupt
vmirtClearICountInterrupt
vmirtCreateModelTimer
vmirtCreateMonotonicModelTimer
vmirtDeleteModelTimer
vmirtSetModelTimer
vmirtClearModelTimer
vmirtIsModelTimerEnabled
vmirtGetModelTimerCurrentCount
vmirtGetModelTimerExpiryCount
```

For related OP functions, see section 3.3.1.

2.5.2 Simulated Time

These functions handle interaction with simulated time:

```
vmirtGetQuantumStartTime
vmirtGetQuantumEndTime
vmirtGetLocalTime                   opProcessorTime
vmirtGetMonotonicTime
vmirtGetQuantumStartTicks
vmirtGetQuantumEndTicks
vmirtGetLocalTicks                  opProcessorTicks
vmirtGetMonotonicTicks
```

```
vmirtCreateQuantumTimer
vmirtDeleteQuantumTimer
```

For related OP functions, see section 3.3.2.

2.5.3 Delay Estimation

These functions handle delay estimation:

vmirtSetDerateFactor	opProcessorDerate
vmirtGetDerateFactor	
vmirtAddSkipCount	opProcessorSkipCyclesAdd
vmirtGetSkipCount	opProcessorSkipCycles

For related OP functions, see section 3.3.3.

2.6 Processor Connections and Registers

2.6.1 Register Access

These functions implement access to processor registers:

vmirtGetRegGroupByName	opProcessorRegGroupByName
vmirtGetNextRegGroup	opProcessorRegGroupNext
vmirtGetRegByName	opProcessorRegByName
vmirtGetNextReg	opProcessorRegNext
vmirtGetNextRegInGroup	opRegGroupRegNext
vmirtRegRead	opProcessorRegRead
vmirtRegWrite	opProcessorRegWrite

For related OP functions, see section 3.9.1.

2.6.2 Bus Port Access

These functions implement access to processor bus ports:

```
vmirtGetBusPortByName
vmirtGetNextBusPort
```

For related OP functions, see section 3.4.4.

2.6.3 Net Port Access

These functions implement access to processor net ports:

vmirtGetNetPortByName	
vmirtGetNextNetPort	
vmirtGetNetPortHandle	
vmirtWriteNetPort	opNetWrite
vmirtReadNetPort	opNetValue
vmirtInstallNetCallback	

For related OP functions, see section 3.4.15.

2.6.4 FIFO Port Access

These functions implement access to processor FIFO ports:

```
vmirtGetFifoPortByName
vmirtGetNextFifoPort
```

For related OP functions, see section 3.4.8.

2.6.5 Exception Access

These functions implement access to processor exceptions:

```
vmirtGetCurrentException
vmirtGetNextException
```

For related OP functions, see section 3.9.3.

2.6.6 Connection Objects

These functions are used to query and update connection objects:

```
vmirtConnGetInput
vmirtConnGetOutput
vmirtConnGetInputInfo
vmirtConnGetOutputInfo
vmirtConnGet
vmirtConnPut
vmirtConnNotifyGet
vmirtConnNotifyPut
```

2.7 Memory Operations

2.7.1 Generic Load/Store

These functions implement load and store operations:

```
vmirtRead1ByteDomain
vmirtRead2ByteDomain
vmirtRead4ByteDomain
vmirtRead8ByteDomain
vmirtWrite1ByteDomain
vmirtWrite2ByteDomain
vmirtWrite4ByteDomain
vmirtWrite8ByteDomain
vmirtReadNByteDomain                opMemoryRead
vmirtReadNByteDomainVA
vmirtWriteNByteDomain               opMemoryWrite
vmirtWriteNByteDomainVA
vmirtGetReadNByteSrc
vmirtGetWriteNByteDst
vmirtGetString
```

For related OP functions, see section 3.5.1.

2.7.2 Memory Callbacks

These functions handle installation and removal of callback functions on memory accesses:

vmirtAddReadCallback	opMemoryReadMonitorAdd
vmirtRemoveReadCallback	opMemoryReadMonitorDelete
vmirtAddWriteCallback	opMemoryWriteMonitorAdd
vmirtRemoveWriteCallback	opMemoryWriteMonitorDelete
vmirtAddFetchCallback	opMemoryFetchMonitorAdd
vmirtRemoveFetchCallback	opMemoryFetchMonitorDelete

For related OP functions, see section 3.5.2.

2.7.3 Memory Manipulation

These functions are used to query and manipulate `memDomain` objects:

vmirtGetProcessorCodeEndian	
vmirtGetProcessorDataEndian	
vmirtGetProcessorCodeDomain	
vmirtGetProcessorDataDomain	
vmirtSetProcessorCodeDomain	
vmirtSetProcessorDataDomain	
vmirtGetProcessorExternalCodeDomain	
vmirtGetProcessorExternalDataDomain	
vmirtGetProcessorInternalCodeDomain	
vmirtGetProcessorInternalDataDomain	
vmirtSetProcessorInternalCodeDomain	
vmirtSetProcessorInternalDataDomain	
vmirtSetProcessorCodeDomains	
vmirtSetProcessorDataDomains	
vmirtIsExecutable	
vmirtSetCreateDomainContext	
vmirtNewDomain	
vmirtGetDomainAddressBits	
vmirtGetDomainPrivileges	
vmirtGetDomainMapped	
vmirtGetNextMappedRange	
vmirtAliasMemory	opDynamicBridge
vmirtAliasMemoryPriv	
vmirtUnaliasMemory	opDynamicUnbridge
vmirtIsAlias	
vmirtMapVAToPA	
vmirtMapToDomain	
vmirtProtectMemory	opBusPrivSet
vmirtMapNativeMemory	opMemoryNativeDynamic
vmirtMapMemory	
vmirtMapCallbacks	
vmirtSetLoadStoreMask	
vmirtDebugDomain	opModuleDomainDebug

For related OP functions, see section 3.5.3.

2.7.4 ASID Memory Management

These functions are used to implement ASID-based memory mappings:

```
vmirtSetProcessorASID
vmirtGetProcessorASID
vmirtAliasMemoryVM
vmirtUnaliasMemoryVM
vmirtGetDomainMappedASID
vmirtGetMRUStateTable
vmirtGetNthStateIndex
```

2.8 Floating Point

2.8.1 Floating-Point Operation Control

These functions are used to control the behavior of floating-point operations:

```
vmirtSetSIMDMaxUnroll
vmirtConfigureFPU
vmirtGetFPControlWord
vmirtSetFPControlWord
vmirtRestoreFPState
```

2.8.2 Floating-Point Operations

These functions are used to implement floating-point operations:

```
vmirtGetFConvertRRDesc
vmirtGetFUnopRRDesc
vmirtGetFBinopRRRDesc
vmirtGetFTernopRRRRDesc
vmirtGetFCompareRRDesc
vmirtGetFCompareRRCDesc
vmirtFConvertSimdRR
vmirtFUnopSimdRR
vmirtFBinopSimdRRR
vmirtFTernopSimdRRRR
vmirtFCompareSimdRR
```

2.9 SMP Processor Hierarchy

These functions are used to traverse SMP processor hierarchy:

vmirtGetSMPParent	opProcessorParent
vmirtSetSMPParent	
vmirtGetSMPChild	opProcessorChild
vmirtGetSMPPrevSibling	opProcessorSiblingPrevious
vmirtGetSMPNextSibling	opProcessorSiblingNext
vmirtGetSMPActiveSibling	
vmirtGetSMPCpuType	
vmirtGetSMPIndex	opProcessorIndex
vmirtSetSMPIndex	
vmirtIterAllChildren	opProcessorIterChildren
vmirtIterAllDescendants	opProcessorIterDescendants
vmirtIterAllProcessors	opProcessorIterAll

For related OP functions, see section 3.6.

2.10 Object File Access

For related OP functions, see section 3.7.

2.10.1 Translation between Object File Addresses and Names

These functions handle translation between object file addresses and names:

```
vmirtAddressLookup
vmirtSymbolLookup
```

2.10.2 Add and Access Object Files

These functions are used to add and access object files:

```
vmirtAddSymbolFile
vmirtNextSymbolFile
vmirtGetSymbolFileName
```

2.10.3 Query Object File Symbols

These functions are used to query symbol information in object files:

```
vmirtGetSymbolByName
vmirtGetSymbolByNameFile
vmirtGetSymbolByAddr
vmirtGetSymbolByAddrFile
vmirtNextSymbolByName
vmirtNextSymbolByAddr
vmirtPrevSymbolByAddr
vmirtNextSymbolByNameFile
vmirtNextSymbolByAddrFile
vmirtPrevSymbolByAddrFile
vmirtGetSymbolName
vmirtGetSymbolAddr
vmirtGetSymbolLoadAddr
vmirtGetSymbolType
vmirtGetSymbolBinding
vmirtGetSymbolSize
```

2.10.4 Query Object File File/Line

These functions are used to query file/line information in object files:

```
vmirtGetFLByAddr
vmirtGetFLByAddrFile
vmirtNextFLByAddr
vmirtPrevFLByAddr
vmirtNextFLByAddrFile
vmirtPrevFLByAddrFile
vmirtGetFLFileName
vmirtGetFLLineNumber
vmirtGetFLAddr
```

2.11 Range Table Hash

These functions are used to implement address range hash tables:

```
vmirtNewRangeTable
vmirtFreeRangeTable
vmirtInsertRangeEntry
vmirtRemoveRangeEntry
vmirtGetFirstRangeEntry
vmirtGetNextRangeEntry
```

```
vmirtGetRangeEntryLow
vmirtGetRangeEntryHigh
vmirtGetRangeEntryUserData
vmirtSetRangeEntryUserData
```

2.12 Shared Data

These functions are used to access shared data:

vmirtFindSharedData	opSharedDataFind
vmirtFindAddSharedData	opSharedDataFindAdd
vmirtFindProcessorSharedData	
vmirtFindAddProcessorSharedData	
vmirtRemoveSharedData	opSharedDataDelete
vmirtSetSharedDataValue	opSharedDataValueSet
vmirtGetSharedDataValue	opSharedDataValueSet
vmirtRegisterListener	opSharedDataListenerRegister
vmirtUnregisterListener	opSharedDataListenerUnregister
vmirtWriteListeners	opSharedDataListenersWrite

For related OP functions, see section 3.8.

2.13 Notifiers

2.13.1 Register Update Notifiers

These functions are used to handle notifiers when registers are written:

```
vmirtAddRegisterWatchCallback
vmirtDeleteRegisterWatchCallback
```

2.13.2 Branch Reason Notifiers

These functions are used to handle notifiers when branch events occur:

```
vmirtRegisterBranchNotifier
vmirtUnregisterBranchNotifier
```

2.14 Save/Restore Support

These functions implement save and restore of processor state:

vmirtSave	opStateItemSave
vmirtRestore	opStateItemRestore
vmirtSaveElement	
vmirtRestoreElement	
vmirtSaveModelTimer	
vmirtRestoreModelTimer	
vmirtSaveDomain	opMemoryStateSave
vmirtRestoreDomain	opMemoryStateRestore
vmirtGetPostSlotCB	
vmirtSetPostSlotCB	

For related OP functions, see section 3.11.

2.15 Debug View Support

These functions implement debug view objects:

```
vmirtGetProcessorViewObject
vmirtSetViewObjectUserData
vmirtGetViewObjectUserData
vmirtAddViewObject
vmirtSetViewObjectConstValue
vmirtSetViewObjectRefValue
vmirtSetViewObjectValueCallback
vmirtAddViewAction
vmirtAddViewEvent
vmirtNextViewEvent
vmirtTriggerViewEvent
vmirtDeleteViewObject
```

2.16 Instruction Attributes

These are instruction attributes interface functions (some in `vmiInstructionAttrs.h`):

```
vmiiaGetAttrs                       opProcessorInstructionAttributes
vmiiaConvertRegInfo                 opRegConvert
vmirtRegImplRaw
vmirtEvaluateCondition
```

For related OP functions, see section 3.12.

2.17 Shared Object / Dynamic Linked Library Loading

These functions implement loading of shared objects:

```
vmirtDLOpen
vmirtDLError
vmirtDLSymbol
vmirtDLClose
```

2.18 Command Interpreter

These functions implement access to the standard command interpreter:

```
vmirtAddCommand
vmirtAddCommandParse
vmirtAddArg
vmirtAddArgEnum
vmirtFindArgValue
```

For related OP functions, see section 3.13.

2.19 Debugger Integration

These functions implement integration with debug:

```
vmirtGetProcessorScope
vmirtEvaluateGDBExpression
vmirtEvaluateCodeLocation
vmirtDisassemble                    opProcessorDisassemble
vmirtDisassembleInstr               opProcessorDisassembleInstruction
vmirtInstructionBytes               opProcessorInstructionBytes
```

For related OP functions, see section 3.14.

2.20 Trace Integration

These functions implement integration with trace:

vmirtTraceOnAfter	opProcessorTraceOnAfter
vmirtTraceOffAfter	opProcessorTraceOffAfter

For related OP functions, see section 3.18.

2.21 Documentation

These functions implement processor documentation (in `vmiDoc.h`):

vmidocAddSection	opDocSectionAdd
vmidocAddText	opDocTextAdd
vmidocProcessor	
vmidocAddFields	
vmidocAddField	
vmidocAddConstField	

For related OP functions, see section 3.19.

2.22 Messages

These functions implement messaging and output (in `vmiMessage.h`):

vmiMessage	opMessage
vmiVMessage	opVMessage
vmiPrintf	opPrintf
vmiVPrintf	opVPrintf
vmiAbort	

For related OP functions, see section 3.20.

2.23 HTTP Interface

This function implements the HTTP interface (in `vmiHTTP.h`):

vmihttpOpen	opModuleHTTPOpen

For related OP functions, see section 3.21.

2.24 Licensing

These functions are used to implement licensing:

```
vmirtGetLicense
vmirtGetLicenseErrString
```

2.25 Encapsulated Model

These functions implement encapsulated model semihosting:

```
vmirtEncapIntercept
```

3 OP Functions

3.1 Simulation

3.1.1 Session Control

These functions control the simulation session:

```
opSessionAtExit
opSessionBuildDate
opSessionCancelTextRedirect
opSessionDebuggerNotifiersAdd
opSessionDestFnSet
opSessionExit
opSessionFeaturesSet
opSessionInit
opSessionProductName
opSessionProductVersion
opSessionTerminate
opSessionTextRedirect
```

3.1.2 Execution Control

These functions control simulation flow:

```
opProcessorSimulate
opRootModuleSetSimulationRandomSeed
opRootModuleSetSimulationStopTime
opRootModuleSetSimulationStopTicks
opRootModuleSetSimulationTimePrecision
opRootModuleGetSimulationTimePrecision
opRootModuleSetSimulationTimeSlice
opRootModuleSetWallClockFactor
opRootModuleSimulate
opRootModuleStopReason
opRootModulePostElaborate
opRootModulePostSimulate
opRootModulePreSimulate
opRootModuleSetDebugStopTime
opRootModuleSetDebugStopTicks
opRootModuleTimeAdvance
opRootModuleTicksAdvance
opObjectSimulatorPhase
opObjectSimulatorPhaseString
opStopReasonString
```

3.1.3 Environment Access

These functions are used to access simulation environment features:

```
opBanner
opErrors
opLicPersonalitySet
opNoBanner
opProductSet
```

3.1.4 Module Simulation

These functions control execution of a module:

```
opModuleFinish
opModuleFinishStatus
```

3.2 Program Counter and Code Dictionary

These functions handle access to simulated program counter and invalidation of code dictionary:

```
opMemoryFlush
opMemoryNativeFlush
opProcessorFlush
opProcessorPC                       vmirtGetPC
opProcessorPCDS                     vmirtGetPCDS
opProcessorPCInDS
opProcessorPCNext
opProcessorPCSet                    vmirtSetPC
```

For related VMI functions, see section 2.3.

3.3 Time and Cycle Counts

3.3.1 Instruction/Cycle Counting and Interrupt

These functions handle instruction and cycle counts:

```
opProcessorClocks
opProcessorCycleCount               vmirtGetICount
opProcessorICount                   vmirtGetExecutedICount
```

For related VMI functions, see section 2.5.1.

3.3.2 Simulated Time

These functions handle interaction with simulated time:

```
opProcessorClocksUntilTime
opProcessorClocksUntilTicks
opProcessorTime                     vmirtGetLocalTime
opProcessorTicks                    vmirtGetLocalTicks
opEventTimeNext
opEventTicksNext
opModuleCurrentTime
opModuleCurrentTicks
```

For related VMI functions, see section 2.5.2.

3.3.3 Delay Estimation

These functions handle delay estimation:

```
opProcessorDelay
opProcessorDelayAdd
opProcessorDerate                   vmirtSetDerateFactor
```

opProcessorSkipCyclesAdd	vmirtAddSkipCount
opProcessorSkipCycles	vmirtGetSkipCount

For related VMI functions, see section 2.5.3.

3.4 Platform Component Creation, Connection and Query

3.4.1 Bus Bridges

These functions operate on bus bridges:

```
opBridgeBusConnect
opBridgeNew
opBridgeNext
```

3.4.2 Buses

These functions operate on buses:

```
opBusAddrBits
opBusMappedRangeNext
opBusMaxAddress
opBusNew
opBusNext
opBusShow
```

3.4.3 Bus Slaves

These functions operate on bus slaves:

```
opBusSlaveAddrHi
opBusSlaveAddrLo
opBusSlaveNew
opBusSlaveNext
```

3.4.4 Bus Ports

These functions operate on bus ports:

```
opBusPortAddrBitsDefault
opBusPortAddrBitsMax
opBusPortAddrBitsMin
opBusPortAddrHi
opBusPortDescription
opBusPortDomainType
opBusPortDomainTypeString
opBusPortIsDynamic
opBusPortMMRegisterNext
opBusPortMustConnect
opBusPortType
opBusPortTypeString
```

For related VMI functions, see section 2.6.2.

3.4.5 Bus Port Connections

These functions operate on bus port connections:

```
opBusPortConnAddrHi
```

```
opBusPortConnAddrLo
opBusPortConnBus
opBusPortConnIsDynamic
opBusPortConnMapNotify
opBusPortConnNext
opBusPortConnType
opBusPortConnTypeString
```

3.4.6 Extensions

These functions operate on processor extensions:

```
opExtElabExtension
opExtensionNew
opExtensionPath
```

3.4.7 FIFOs

These functions operate on FIFOs:

```
opFIFODepth
opFIFONew
opFIFONext
opFIFOShow
```

3.4.8 FIFO Ports

These functions operate on FIFO ports:

```
opFIFOPortDescription
opFIFOPortMustConnect
opFIFOPortType
opFIFOPortTypeString
opFIFOPortWidth
```

For related VMI functions, see section 2.6.4.

3.4.9 FIFO Port Connections

These functions operate on FIFO port connections:

```
opFIFOPortConnFIFO
opFIFOPortConnNext
opFIFOPortConnWidth
```

3.4.10 MMCs

These functions operate on memory model components:

```
opMMCBusConnect
opMMCNew
opMMCNext
opMMCPath
opMMCTransparent
```

3.4.11 Memory-Mapped Registers

These functions operate on memory-mapped registers:

```
opMMRegisterBits
```

```
opMMRegisterDescription
opMMRegisterFieldBits
opMMRegisterFieldDescription
opMMRegisterFieldNext
opMMRegisterFieldOffset
opMMRegisterFieldReadable
opMMRegisterFieldReset
opMMRegisterFieldWritable
opMMRegisterIndex
opMMRegisterIsVolatile
opMMRegisterName
opMMRegisterOffset
opMMRegisterReadable
opMMRegisterView
opMMRegisterWritable
```

3.4.12 Memories

These functions operate on memories:

```
opMemoryBusConnect
opMemoryMaxAddress
opMemoryNativeNew
opMemoryNew
opMemoryNext
opMemorySpecParse
```

3.4.13 Modules

These functions operate on modules:

```
opFixedModuleNew
opModuleBusShow
opModuleNew
opModuleNewFromAttrs
opModuleNext
opModuleObject
opModulePath
opModulePurpose
opModuleShow
opRoot
opRootModuleDelete
opRootModuleNew
```

3.4.14 Nets

These functions operate on nets:

```
opNetNew
opNetNext
opNetShow
opNetValue
opNetValuePrevious
opNetWrite
opNetMonitorNext
opNetWriteMonitorAdd
```

3.4.15 Net Ports

These functions operate on net ports:

```
opNetPortDescription
opNetPortMustConnect
opNetPortType
opNetPortTypeString
```

For related VMI functions, see section 2.6.3.

3.4.16 Net Port Connections

These functions operate on net port connections:

```
opNetPortConnNet
opNetPortConnNext
opNetPortConnType
```

3.4.17 Objects

These functions operate on generic objects:

```
opObjectBusPortConnNext
opObjectBusPortNext
opObjectByName
opObjectClass
opObjectClassSet
opObjectExtElabNext
opObjectExtensionNext
opObjectFIFOPortConnNext
opObjectFIFOPortNext
opObjectHierName
opObjectModule
opObjectName
opObjectNetConnect
opObjectNetPortConnNext
opObjectNetPortNext
opObjectPacketnetPortConnNext
opObjectPacketnetPortNext
opObjectParent
opObjectReleaseStatus
opObjectReleaseStatusString
opObjectRootModule
opObjectType
opObjectVLNV
opObjectVisibility
opObjectVisibilityString
opVoidParent
opVoidByName
```

3.4.18 Packet Nets

These functions operate on packet nets:

```
opPacketnetMaxBytes
opPacketnetNew
opPacketnetNext
opPacketnetShow
opPacketnetWrite
opPacketnetMonitorNext
opPacketnetWriteMonitorAdd
```

3.4.19 Packet Net Port Connections

These functions operate on packet net port connections:

```
opPacketnetPortConnNext
opPacketnetPortConnPacketnet
opPacketnetPortDescription
opPacketnetPortMustConnect
```

3.4.20 Peripherals

These functions operate on peripherals:

```
opPeripheralBusConnectMaster
opPeripheralBusConnectSlave
opPeripheralBusConnectSlaveDynamic
opPeripheralExtensionNew
opPeripheralFIFOConnect
opPeripheralNew
opPeripheralNext
opPeripheralPacketnetConnect
opPeripheralPath
opPeripheralSerialNotify
opPeripheralStopReason
```

3.4.21 Processors

These functions operate on processors:

```
opProcessorAMP
opProcessorAlternateName
opProcessorBusConnect
opProcessorBusConnectMaster
opProcessorBusConnectSlave
opProcessorDefaultSemihost
opProcessorDescription
opProcessorElfCodes
opProcessorEndian
opProcessorExceptionCurrent
opProcessorExceptionNext
opProcessorExtensionNew
opProcessorFIFOConnect
opProcessorFamily
opProcessorFaultAddress
opProcessorGroupH
opProcessorGroupL
opProcessorHelper
opProcessorLoadPhysical
opProcessorModeCurrent                vmirtGetCurrentMode
opProcessorModeNext                   vmirtGetNextMode
opProcessorNew
opProcessorNewFromAttrs
opProcessorNewWithSemihost
opProcessorNext
opProcessorPath
opProcessorQLQualified
opProcessorStopReason
opProcessorCurrent                    vmirtGetCurrentProcessor
opProcessorVariant                    vmirtProcessorVariant
opProcessorExit                       vmirtExit
opProcessorFinish                     vmirtFinish
opProcessorFreeze
```

opProcessorFrozen	
opProcessorUnfreeze	
opProcessorYield	vmirtYieldControl
opInterrupt	vmirtInterrupt
opInterruptRSP	vmirtStop

For related VMI functions, see section 2.2.

3.4.22 VLNV

These functions operate on VLNV entries:

```
opVLNVIter
opVLNVLibrary
opVLNVName
opVLNVNew
opVLNVOld
opVLNVString
opVLNVVendor
opVLNVVersion
```

3.5 Memory Operations

3.5.1 Generic Load/Store

These functions implement load and store operations:

opBusRead	
opBusWrite	
opMemoryRead	vmirtReadNByteDomain
opMemoryWrite	vmirtWriteNByteDomain
opProcessorRead	
opProcessorReadAbort	
opProcessorWrite	
opProcessorWriteAbort	

For related VMI functions, see section 2.7.1.

3.5.2 Memory Callbacks

These functions handle installation and removal of callback functions on memory accesses:

opBusFetchMonitorAdd	
opBusFetchMonitorDelete	
opBusReadMonitorAdd	
opBusReadMonitorDelete	
opBusWriteMonitorAdd	
opBusWriteMonitorDelete	
opMemoryFetchMonitorAdd	vmirtAddFetchCallback
opMemoryFetchMonitorDelete	vmirtRemoveFetchCallback
opMemoryReadMonitorAdd	vmirtAddReadCallback
opMemoryReadMonitorDelete	vmirtRemoveReadCallback
opMemoryWriteMonitorAdd	vmirtAddWriteCallback
opMemoryWriteMonitorDelete	vmirtRemoveWriteCallback
opProcessorFetchMonitorAdd	
opProcessorFetchMonitorDelete	
opProcessorReadMonitorAdd	
opProcessorReadMonitorDelete	

```
opProcessorWriteMonitorAdd
opProcessorWriteMonitorDelete
```

For related VMI functions, see section 2.7.2.

3.5.3 Memory Manipulation

These functions are used to query and manipulate `memDomain` objects:

opDynamicBridge	vmirtAliasMemory
opDynamicUnbridge	vmirtUnaliasMemory
opMemoryNativeDynamic	vmirtMapNativeMemory
opBusPrivSet	vmirtProtectMemory
opBusSlavePriv	
opMemoryPriv	
opModuleDomainDebug	vmirtDebugDomain

For related VMI functions, see section 2.7.3.

3.6 SMP Processor Hierarchy

These functions are used to traverse SMP processor hierarchy:

opProcessorChild	vmirtGetSMPChild
opProcessorIndex	vmirtGetSMPIndex
opProcessorIsLeaf	
opProcessorIterAll	vmirtIterAllProcessors
opProcessorIterChildren	vmirtIterAllChildren
opProcessorIterDescendants	vmirtIterAllDescendants
opProcessorParent	vmirtGetSMPParent
opProcessorSiblingNext	vmirtGetSMPNextSibling
opProcessorSiblingPrevious	vmirtGetSMPPrevSibling

For related VMI functions, see section 2.9.

3.7 Application File Access

These functions are used to access application files:

```
opApplicationControls
opApplicationElfCode
opApplicationEndian
opApplicationEntry
opApplicationHeaderRead
opApplicationLoaderInstall
opApplicationOffset
opApplicationPath
opBusApplicationLoad
opMemoryApplicationLoad
opObjectApplicationNext
opProcessorApplicationLoad
opProcessorApplicationRead
opProcessorApplicationSymbolAdd
```

For related VMI functions, see section 2.10.

3.8 Shared Data

These functions are used to access shared data:

opSharedDataDelete	vmirtRemoveSharedData
opSharedDataFind	vmirtFindSharedData
opSharedDataFindAdd	vmirtFindAddSharedData
opSharedDataListenerRegister	vmirtRegisterListener
opSharedDataListenerUnregister	vmirtUnregisterListener
opSharedDataListenersWrite	vmirtWriteListeners
opSharedDataValueGet	vmirtSetSharedDataValue
opSharedDataValueSet	vmirtSetSharedDataValue

For related VMI functions, see section 2.12.

3.9 Processor Registers, Exceptions and Modes

3.9.1 Processor Registers

These functions are used to access processor registers:

opProcessorRegByIndex	
opProcessorRegByName	vmirtGetRegByName
opProcessorRegByUsage	
opProcessorRegDump	
opProcessorRegGroupByName	vmirtGetRegGroupByName
opProcessorRegGroupNext	vmirtGetNextRegGroup
opProcessorRegIsExtension	
opProcessorRegNext	vmirtGetNextReg
opProcessorRegNextGPacket	vmirtGetNextReg
opProcessorRegNextPPacket	vmirtGetNextReg
opProcessorRegRead	vmirtRegRead
opProcessorRegReadByName	
opProcessorRegWrite	vmirtRegRead
opProcessorRegWriteByName	
opRegAccessEnum	
opRegAccessString	
opRegBits	
opRegDescription	
opRegGroup	
opRegGroupName	
opRegGroupRegNext	vmirtGetNextRegInGroup
opRegIndex	
opRegIsAlias	
opRegName	
opRegReadOnly	
opRegUsageEnum	
opRegUsageString	

For related VMI functions, see section 2.6.1.

3.9.2 Mode Access

These functions implement access to processor modes:

```
opModeCode
opModeDescription
opModeName
```

3.9.3 Exception Access

These functions implement access to processor exceptions:

```
opExceptionCode
opExceptionDescription
opExceptionName
```

For related VMI functions, see section 2.6.5.

3.10 Parameters

These functions implement object parameters.

3.10.1 Formal Parameters

```
opFormalBoolDefaultValue
opFormalDescription
opFormalEnumDefault
opFormalEnumDescription
opFormalEnumNext
opFormalEnumValue
opFormalGroup
opFormalGroupDescription
opFormalGroupName
opFormalInt32Limits
opFormalInt64Limits
opFormalStringDefaultValue
opFormalStringMaxLength
opFormalSystem
opFormalType
opFormalTypeString
opFormalUns32Limits
opFormalUns64Limits
opFormalValueOrigin
opFormalValueOriginString
opFormaldoubleLimits
opModuleFormalsShow
opObjectFormalGroupNext
opObjectFormalNext
```

3.10.2 Actual Parameters

```
opObjectParamBoolValue
opObjectParamDoubleValue
opObjectParamEndianValue
opObjectParamEnumValue
opObjectParamInt32Value
opObjectParamInt64Value
opObjectParamNext
opObjectParamPtrValue
opObjectParamStringValue
opObjectParamUns32Value
opObjectParamUns64Value
opParamBoolOverride
opParamBoolSet
opParamDoubleOverride
opParamDoubleSet
opParamEndianOverride
opParamEndianSet
opParamEnumOverride
opParamEnumSet
```

```
opParamInt32Override
opParamInt32Set
opParamInt64Override
opParamInt64Set
opParamListFromArray
opParamPtrOverride
opParamPtrSet
opParamPtrValue
opParamStringOverride
opParamStringSet
opParamType
opParamTypeString
opParamUns32Override
opParamUns32Set
opParamUns64Override
opParamUns64Set
```

3.11 Save/Restore Support

These functions implement save and restore of processor state:

```
opFIFOStateRestore
opFIFOStateRestoreFile
opFIFOStateSave
opFIFOStateSaveFile
opMMCStateRestore
opMMCStateRestoreFile
opMMCStateSave
opMMCStateSaveFile
opMemoryStateRestore                vmirtRestoreDomain
opMemoryStateRestoreFile
opMemoryStateSave                   vmirtSaveDomain
opMemoryStateSaveFile
opNetStateRestore
opNetStateRestoreFile
opNetStateSave
opNetStateSaveFile
opObjectSaveRestoreSupported
opProcessorStateRestore
opProcessorStateRestoreFile
opProcessorStateSave
opProcessorStateSaveFile
opRootModuleStateRestore
opRootModuleStateRestoreFile
opRootModuleStateSave
opRootModuleStateSaveFile
opStateItemRestore                  vmirtRestore
opStateItemSave                     vmirtSave
```

For related VMI functions, see section 2.14.

3.12 Instruction Attributes

These are instruction attributes interface functions:

```
opProcessorInstructionAttributes    vmiiaGetAttrs
opRegConvert                        vmiiaConvertRegInfo
```

For related VMI functions, see section 2.16.

3.13 Command Interpreter

These functions implement access to the standard command interpreter:

```
opCmdArgUsed
opCmdDefaultApplication
opCmdErrorHandler
opCmdParseArgs
opCmdParseFile
opCmdParseStd
opCmdParserAdd
opCmdParserDelete
opCmdParserNew
opCmdParserReplace
opCmdUsageMessage
opCommandArgDescription
opCommandArgIterAll
opCommandArgName
opCommandArgType
opCommandArgTypeString
opCommandCall
opCommandCallByName
opCommandHelp
opCommandIterAll
opCommandStringCall
opModuleCommandsShow
opObjectCommandNext
opProcessorCommandIterAll
```

For related VMI functions, see section 2.18.

3.14 Debugger Integration

These functions implement integration with debuggers such as gdb:

```
opProcessorDebug
opProcessorDebugHelper
opProcessorDisassemble              vmirtDisassemble
opProcessorGdbFlags
opProcessorGdbPath
opProcessorInstructionBytes         vmirtInstructionBytes
```

For related VMI functions, see section 2.19.

3.15 Breakpoints

These functions implement support for breakpoints:

```
opProcessorBreakpointAddrClear
opProcessorBreakpointAddrSet
opProcessorBreakpointICountClear
opProcessorBreakpointICountSet
```

3.16 Watchpoints

These functions implement support for watchpoints:

```
opBusAccessWatchpointNew
opBusReadWatchpointNew
```

```
opBusWriteWatchpointNew
opMemoryAccessWatchpointNew
opMemoryReadWatchpointNew
opMemoryWriteWatchpointNew
opProcessorAccessWatchpointNew
opProcessorExceptionWatchpointNew
opProcessorModeWatchpointNew
opProcessorReadWatchpointNew
opProcessorRegWatchpointNew
opProcessorWriteWatchpointNew
opRootModuleWatchpointNext
opWatchpointAddressHi
opWatchpointAddressLo
opWatchpointDelete
opWatchpointReg
opWatchpointRegCurrentValue
opWatchpointRegPreviousValue
opWatchpointReset
opWatchpointTriggeredBy
opWatchpointType
opWatchpointUserData
```

3.17 Triggers

These functions implement triggers on module and stop reason events:

```
opModuleTriggerAdd
opModuleTriggerAddTicks
opModuleTriggerDelete
opProcessorStopHandlerAdd
opProcessorStopHandlerDelete
```

3.18 Trace Integration

These functions implement integration with trace:

```
opPrintfTrace
opProcessorTraceBufferDisable
opProcessorTraceBufferDump
opProcessorTraceBufferEnable
opProcessorTraceHighPCSet
opProcessorTraceLowPCSet
opProcessorTraceOffAfter            vmirtTraceOffAfter
opProcessorTraceOnAfter             vmirtTraceOnAfter
```

For related VMI functions, see section 2.20.

3.19 Documentation

These functions implement documentation generation:

```
opDocChildNext
opDocFieldOffset
opDocFieldWidth
opDocIsTitle
opDocNodeType
opDocSectionAdd                     vmidocAddSection
opDocText
opDocTextAdd                        vmidocAddText
opModuleDocSectionAdd
opObjectDocNodeNext
```

For related VMI functions, see section 2.21.

3.20 Messages

These functions implement messaging and output:

opLastMessage	
opMessage	vmiMessage
opMessageDisable	
opMessageEnable	
opMessageQuiet	
opMessageSetNoWarn	
opMessageSetQuiet	
opMessageVerbose	
opModuleDiagnosticLevelSet	
opPeripheralDiagnosticLevelSet	
opPrintf	vmiPrintf
opResetErrors	
opSprintf	
opVAbort	
opVMessage	vmiVMessage
opVPrintf	vmiVPrintf
opVSprintf	

For related VMI functions, see section 2.22.

3.21 HTTP Interface

This function implements the HTTP interface:

opModuleHTTPOpen	vmihttpOpen

For related VMI functions, see section 2.23.