



## Imperas Peripheral Model Guide

### Model Specific Information for ovpworld.org / VirtioBlkMMIO

#### Imperas Software Limited

Imperas Buildings, North Weston  
Thame, Oxfordshire, OX9 2HA, U.K.  
docs@imperas.com.



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## Model Release Status

This model is released as part of OVP releases and is included in OVPworld packages. Please visit [OVPworld.org](http://OVPworld.org).

## Table Of Contents

<b>1.0 Model Specific Information</b>	4
1.1 Description	4
1.2 Limitations	4
1.3 Licensing	4
1.4 Reference	4
1.5 Location	4
<b>2.0 Peripheral Instance Parameters</b>	4
<b>3.0 Net Ports</b>	4
<b>4.0 Bus Master Ports</b>	5
4.1 Bus Master Port: dma	5
<b>5.0 Bus Slave Ports</b>	5
5.1 Bus Slave Port: bport1	5
<b>6.0 Platforms that use this peripheral component</b>	5
<b>7.0 Peripheral components in the library</b>	7
<b>8.0 General Information on Peripheral Models</b>	9
8.1 Background	9
<b>9.0 Building peripherals easily with Imperas iGen</b>	9
<b>10.0 Peripheral model internals</b>	9
<b>11.0 Parts of peripheral models</b>	10
11.1 Configuring the Peripheral Instance with Parameters	10
11.2 Net Ports	10
11.3 Bus master ports	10
11.4 Bus slave ports	10
11.5 Packetnets	10
<b>12.0 More information (documentation) on peripheral models and modeling</b>	10

## 1.0 Model Specific Information

This document provides usage information for an Imperas OVP peripheral behavioral model.

The document is split into sections providing specific information for this peripheral, including any ports for connecting into a platform, registers, other component parts, and configuration options and general information for peripheral modeling with Imperas OVP.

### 1.1 Description

VIRTIO version 1 mmio block device This model implements a VIRTIO MMIO block device as described in: <http://docs.oasis-open.org/virtio/virtio/v1.0/virtio-v1.0.pdf>. Use the VB\_DRIVE parameter to specify the disk image file to use. Set the VB\_DRIVE\_DELTA parameter to 1 to prevent writes to disk during simulation from changing the image file.

### 1.2 Limitations

Only supports the Legacy (Device Version 1) interface. Only little endian guests are supported.

### 1.3 Licensing

Open Source Apache 2.0

### 1.4 Reference

<http://docs.oasis-open.org/virtio/virtio/v1.0/virtio-v1.0.pdf>

### 1.5 Location

The VirtioBlkMMIO peripheral model is located in an Imperas/OVP installation at the VLNV: [ovworld.org / peripheral / VirtioBlkMMIO / 1.0](http://ovworld.org/peripheral/VirtioBlkMMIO/1.0).

## 2.0 Peripheral Instance Parameters

This model accepts the following parameters:

Table 1. Peripheral Parameters

Name	Type	Description
VB_DRIVE	string	Filename of image for Virtio Block device
VB_DRIVE_DELTA	bool	If true the Drive uses delta writes (image will not be updated)
record	string	Record external events into this file
replay	string	Replay external events from this file

## 3.0 Net Ports

This model has the following net ports:

Table 2. Net Ports

Name	Type	Must Be Connected	Description
------	------	-------------------	-------------

Interrupt	output	F (False)	
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## 4.0 Bus Master Ports

This model has the following bus master ports:

### 4.1 Bus Master Port: *dma*

Table 3. *dma*

Name	Address Width (bits)	Description
<i>dma</i>	40	

## 5.0 Bus Slave Ports

This model has the following bus slave ports:

### 5.1 Bus Slave Port: *bport1*

Table 4. Bus Slave Port: *bport1*

Name	Size (bytes)	Must Be Connected	Description
<i>bport1</i>	0x200	F (False)	

Table 5. Bus Slave Port: *bport1* Registers:

Name	Offset	Width (bits)	Description	R/W	is Volatile
<i>ab_MagicValue</i>	0x0	32	Magic value ('virt' string)		
<i>ab_Version</i>	0x4	32	Device Version number		
<i>ab_DeviceID</i>	0x8	32	Block Subsystem Device ID		
<i>ab_VendorID</i>	0xc	32	Subsystem Vendor ID ('OVP' string)		
<i>ab_HostFeatures</i>	0x10	32	Host features flags		
<i>ab_HostFSel</i>	0x14	32	Host features select		
<i>ab_GuestFeatures</i>	0x20	32	Guest features flags		
<i>ab_GuestFSel</i>	0x24	32	Guest features select		
<i>ab_GuestPageSz</i>	0x28	32	Guest page size		
<i>ab_QueueSel</i>	0x30	32	Virtual queue index		
<i>ab_QueueNumMax</i>	0x34	32	Maximum virtual queue size		
<i>ab_QueueNum</i>	0x38	32	Virtual queue size		
<i>ab_QueueAlign</i>	0x3c	32	Virtual queue align		
<i>ab_QueuePFN</i>	0x40	32	Virtual queue PFN		
<i>ab_QueueNotify</i>	0x50	32	Virtual queue notify		
<i>ab_IntStatus</i>	0x60	32	Interrupt status		
<i>ab_IntAck</i>	0x64	32	Interrupt acknowledge		
<i>ab_Status</i>	0x70	32	Device status		

## 6.0 Platforms that use this peripheral component

Peripheral components can be used in many different platforms, including those developed by Imperas or by other users of OVP. You can use this peripheral in your own platforms.

Table 6. Publicly available platforms using peripheral 'VirtioBlkMMIO'

Platform Name	Vendor
ARMv8-A-FMv1	arm.ovpworld.org
iMX6S	nxp.ovpworld.org
virtio	riscv.ovpworld.org
FU540	sifive.ovpworld.org

This peripheral is used in some internal Imperas virtual platforms. Please contact Imperas for more information.

## 7.0 Peripheral components in the library

Table 7. Publicly available Imperas/OVP peripheral models (224 models)

Peripheral	Peripheral	Peripheral
ovpworld.org/VirtioNetMMIO	philips.ovpworld.org/ISP1761	renesas.ovpworld.org/adc
renesas.ovpworld.org/bcu	renesas.ovpworld.org/brg	renesas.ovpworld.org/can
renesas.ovpworld.org/can	renesas.ovpworld.org/clkgen	renesas.ovpworld.org/crc
renesas.ovpworld.org/csib	renesas.ovpworld.org/csie	renesas.ovpworld.org/dma
renesas.ovpworld.org/intc	renesas.ovpworld.org/memc	renesas.ovpworld.org/rng
renesas.ovpworld.org/taa	renesas.ovpworld.org/tms	renesas.ovpworld.org/tmt
renesas.ovpworld.org/uartc	renesas.ovpworld.org/UPD70F3441Logic	riscv.ovpworld.org/CLINT
riscv.ovpworld.org/PLIC	riscv.ovpworld.org/SmartLoaderRV64Linux	safeppower.ovpworld.org/node
safeppower.ovpworld.org/NostrumNode	safeppower.ovpworld.org/ring_oscillator	safeppower.ovpworld.org/TTELNode
sifive.ovpworld.org/gpio	sifive.ovpworld.org/MSEL	sifive.ovpworld.org/PRCI
sifive.ovpworld.org/pwm	sifive.ovpworld.org/spi	sifive.ovpworld.org/teststatus
sifive.ovpworld.org/UART	smmc.ovpworld.org/LAN9118	smmc.ovpworld.org/LAN91C111
ti.ovpworld.org/tca6416a	ti.ovpworld.org/UartInterface	ti.ovpworld.org/ucd9012a
ti.ovpworld.org/ucd9248	vendor.com/fifo	xilinx.ovpworld.org/axi-gpio
xilinx.ovpworld.org/axi-intc	xilinx.ovpworld.org/axi-pcie	xilinx.ovpworld.org/axi-timer
xilinx.ovpworld.org/logicore-fit	xilinx.ovpworld.org/mdm	xilinx.ovpworld.org/mpmc
xilinx.ovpworld.org/xps-gpio	xilinx.ovpworld.org/xps-iic	xilinx.ovpworld.org/xps-intc
xilinx.ovpworld.org/xps-ll-temac	xilinx.ovpworld.org/xps-mch-emc	xilinx.ovpworld.org/xps-sysace
xilinx.ovpworld.org/xps-timer	xilinx.ovpworld.org/xps-uartlite	xilinx.ovpworld.org/zynq_7000-can
xilinx.ovpworld.org/zynq_7000-ddrc	xilinx.ovpworld.org/zynq_7000-devcfg	xilinx.ovpworld.org/zynq_7000-dmac
xilinx.ovpworld.org/zynq_7000-gpio	xilinx.ovpworld.org/zynq_7000-iic	xilinx.ovpworld.org/zynq_7000-ocm
xilinx.ovpworld.org/zynq_7000-qos301	xilinx.ovpworld.org/zynq_7000-qspi	xilinx.ovpworld.org/zynq_7000-sdio
xilinx.ovpworld.org/zynq_7000-slcr	xilinx.ovpworld.org/zynq_7000-spi	xilinx.ovpworld.org/zynq_7000-swdt
xilinx.ovpworld.org/zynq_7000-ttc	xilinx.ovpworld.org/zynq_7000-tz_GPVsecurity	xilinx.ovpworld.org/zynq_7000-tz_security
xilinx.ovpworld.org/zynq_7000-usb	altera.ovpworld.org/dw-apb-timer	altera.ovpworld.org/dw-apb-uart
altera.ovpworld.org/IntervalTimer32Core	altera.ovpworld.org/IntervalTimer64Core	altera.ovpworld.org/JtagUart
altera.ovpworld.org/PerformanceCounterCore	altera.ovpworld.org/RSTMGR	altera.ovpworld.org/SystemIDCore
altera.ovpworld.org/Uart	amd.ovpworld.org/79C970	andes.ovpworld.org/ATCUART100
andes.ovpworld.org/NCEPLIC100	andes.ovpworld.org/NCEPLMT100	arm.ovpworld.org/AaciPL041
arm.ovpworld.org/CompactFlashRegs	arm.ovpworld.org/CoreModule9x6	arm.ovpworld.org/DebugLedAndDipSwitch
arm.ovpworld.org/DMemCtrlPL341	arm.ovpworld.org/IcpControl	arm.ovpworld.org/IcpCounterTimer
arm.ovpworld.org/IntICP	arm.ovpworld.org/IntICP	arm.ovpworld.org/KbPL050
arm.ovpworld.org/L2CachePL310	arm.ovpworld.org/LcdPL110	arm.ovpworld.org/MmciPL181
arm.ovpworld.org/RtcPL031	arm.ovpworld.org/SerBusDviRegs	arm.ovpworld.org/SmartLoaderArm64Linux
arm.ovpworld.org/SmartLoaderArmLinux	arm.ovpworld.org/SMemCtrlPL354	arm.ovpworld.org/SysCtrlSP810
arm.ovpworld.org/TimerSP804	arm.ovpworld.org/TzpcBP147	arm.ovpworld.org/UartPL011
arm.ovpworld.org/VexpressSysRegs	arm.ovpworld.org/WdtSP805	atmel.ovpworld.org/AdvancedInterruptController
atmel.ovpworld.org/ParallelIOController	atmel.ovpworld.org/PowerSaving	atmel.ovpworld.org/SpecialFunction
atmel.ovpworld.org/TimerCounter	atmel.ovpworld.org/UsartInterface	atmel.ovpworld.org/WatchdogTimer
cadence.ovpworld.org/gem	cadence.ovpworld.org/uart	cirrus.ovpworld.org/GD5446
freescale.ovpworld.org/KinetisADC	freescale.ovpworld.org/KinetisAIPS	freescale.ovpworld.org/KinetisAXBS
freescale.ovpworld.org/KinetisCAN	freescale.ovpworld.org/KinetisCMP	freescale.ovpworld.org/KinetisCMT

freescale.ovpworld.org/KinetisCRC	freescale.ovpworld.org/KinetisDAC	freescale.ovpworld.org/KinetisDDR
freescale.ovpworld.org/KinetisDMA	freescale.ovpworld.org/KinetisDMAC	freescale.ovpworld.org/KinetisDMAMUX
freescale.ovpworld.org/KinetisENET	freescale.ovpworld.org/KinetisEWM	freescale.ovpworld.org/KinetisFB
freescale.ovpworld.org/KinetisFMC	freescale.ovpworld.org/KinetisFTFE	freescale.ovpworld.org/KinetisFTM
freescale.ovpworld.org/KinetisGPIO	freescale.ovpworld.org/KinetisI2C	freescale.ovpworld.org/KinetisI2S
freescale.ovpworld.org/KinetisLLWU	freescale.ovpworld.org/KinetisLPTMR	freescale.ovpworld.org/KinetisMCG
freescale.ovpworld.org/KinetisMPU	freescale.ovpworld.org/KinetisNFC	freescale.ovpworld.org/KinetisOSC
freescale.ovpworld.org/KinetisPDB	freescale.ovpworld.org/KinetisPIT	freescale.ovpworld.org/KinetisPMC
freescale.ovpworld.org/KinetisPORT	freescale.ovpworld.org/KinetisRCM	freescale.ovpworld.org/KinetisRFSYS
freescale.ovpworld.org/KinetisRFVBAT	freescale.ovpworld.org/KinetisRNG	freescale.ovpworld.org/KinetisRTC
freescale.ovpworld.org/KinetisSDHC	freescale.ovpworld.org/KinetisSIM	freescale.ovpworld.org/KinetisSMC
freescale.ovpworld.org/KinetisSPI	freescale.ovpworld.org/KinetisTSI	freescale.ovpworld.org/KinetisUART
freescale.ovpworld.org/KinetisUSB	freescale.ovpworld.org/KinetisUSBDCD	freescale.ovpworld.org/KinetisUSBHS
freescale.ovpworld.org/KinetisVREF	freescale.ovpworld.org/KinetisWDOG	freescale.ovpworld.org/Uart
freescale.ovpworld.org/VybridADC	freescale.ovpworld.org/VybridANADIG	freescale.ovpworld.org/VybridCCM
freescale.ovpworld.org/VybridDMA	freescale.ovpworld.org/VybridGPIO	freescale.ovpworld.org/VybridI2C
freescale.ovpworld.org/VybridLCD	freescale.ovpworld.org/VybridQUADSPI	freescale.ovpworld.org/VybridSDHC
freescale.ovpworld.org/VybridSPI	freescale.ovpworld.org/VybridUART	freescale.ovpworld.org/VybridUSB
imperas.ovpworld.org/frameBuffer	imperas.ovpworld.org/uart	imperas.ovpworld.org/usecCounter
intel.ovpworld.org/82077AA	intel.ovpworld.org/82371EB	intel.ovpworld.org/8253
intel.ovpworld.org/8259A	intel.ovpworld.org/NorFlash48F4400	intel.ovpworld.org/PciIDE
intel.ovpworld.org/PciPM	intel.ovpworld.org/PciUSB	intel.ovpworld.org/Ps2Control
marvell.ovpworld.org/GT6412x	maxim.ovpworld.org/max673x	microsemi.ovpworld.org/CoreUARTapb
mips.ovpworld.org/16450C	mips.ovpworld.org/MaltaFPGA	mips.ovpworld.org/SmartLoaderLinux
motorola.ovpworld.org/MC146818	national.ovpworld.org/16450	national.ovpworld.org/16550
national.ovpworld.org/16550_4bytes	nxp.ovpworld.org/iMX6_Analog	nxp.ovpworld.org/iMX6_CCM
nxp.ovpworld.org/iMX6_GPC	nxp.ovpworld.org/iMX6_GPIO	nxp.ovpworld.org/iMX6_GPT
nxp.ovpworld.org/iMX6_MMDC	nxp.ovpworld.org/iMX6_SDHC	nxp.ovpworld.org/iMX6_SRC
nxp.ovpworld.org/iMX6_UART	nxp.ovpworld.org/iMX6_WDOG	ovpworld.org/Alpha2x16Display
ovpworld.org/DynamicBridge	ovpworld.org/FlashDevice	ovpworld.org/ledRegister
ovpworld.org/SerInt	ovpworld.org/SimpleDma	ovpworld.org/switchRegister
ovpworld.org/temperatureSensor	ovpworld.org/trap	ovpworld.org/trap4K
ovpworld.org/vEthernet_Bridge	ovpworld.org/VirtioBlkMMIO	



## 8.0 General Information on Peripheral Models

This document provides usage information for an Imperas OVP peripheral behavioral model.

The document is split into sections providing specific information for this peripheral, including any ports for connecting into a platform, registers etc. and configuration options and general information for peripheral modeling with Imperas OVP.

### 8.1 Background

Imperas OVP simulation technology enables very high performance simulation, debug and analysis of platforms containing multiple processors and peripheral models. The technology is designed to be extensible: you can create new models of processors, peripherals and other platform components using interfaces and libraries defined by OVP.

The peripheral models created using the OVP APIs run on the Peripheral Simulation Engine (PSE).

The model is typically written in C and compiled into an executable for the PSE processor architecture. The model is compiled for speed of execution and to protect IP. It is dynamically loaded by the simulator at run time.

## 9.0 Building peripherals easily with Imperas iGen

To aid with model creation, Imperas products include iGen, a model generation tool. iGen takes the laborious and error-prone task of constructing the various hardware model and software element files required for a typical model, and automates this process. iGen creates the needed C files. iGen also creates the C++ SystemC TLM2 interface files needed to run peripheral models in SystemC simulations.

iGen takes as input a simple script specification that includes device internals such as registers and memories, port information, component descriptors, and other elements. iGen then builds the C code model files and user editable templates. These include model frameworks with registers, function calls, memory map, and other items. It ensures that all component parts of the model are well-structured using best practices, and are consistent throughout the files, thus eliminating a common source of errors.

More information on iGen can be found: [imperas.com/products](http://imperas.com/products).

## 10.0 Peripheral model internals

Each instance of a peripheral model runs on its own virtual machine with an address space large enough for the model. This processor (the PSE) and its memory are separate from any processors, memories and buses in the platform being simulated; they exist only to execute the code of the peripheral model.

Interception of functions defined in the peripheral model allows the use of features of the host system in the

implementation of the behavior of a peripheral. As an example, a real platform might contain a video display device. When simulating this system, it is generally more convenient not to simulate the complete video display device but to use a video package available on the host machine, such as SDL, and to use this to render to the host display. Also models of uarts, ethernet devices and USB components can make use of the host PC resources during simulation, to allow, for example, a simulation to browse the real internet, or the simulation to connect to a real USB device.

## **11.0 Parts of peripheral models**

### ***11.1 Configuring the Peripheral Instance with Parameters***

A peripheral can include the behaviour of several configurations. These are controlled when the peripheral is instanced in the platform by setting parameters defined on the peripheral.

### ***11.2 Net Ports***

Peripherals may be connected to other peripherals or processors with signal wires (nets). These can be used to act as interrupt signals or used to control behavior between peripherals.

The wires are created in the platform as nets and this net is connected into the peripheral using a net port.

### ***11.3 Bus master ports***

A bus master port initiates (and controls the address of) a bus cycle. Bus cycles are generated by behavioral code within the peripheral model.

### ***11.4 Bus slave ports***

A peripheral can be defined as having several bus slave ports. The bus slave ports can be split into several address blocks. Each address block be either local memory or memory mapped registers. Both of these can have associated callback functions. A memory mapped register can also be defined as specific read/write access, whether it is volatile, and also whether it is associated with a reset pin and mask. A memory mapped register can also have specific bit fields defined.

### ***11.5 Packetnets***

A peripheral can be defined as being connected to packetnet ports. A packetnet is used to model packet based communication such as Ethernet, CAN bus or GSM. A packetnet is created in a platform, then connected to packetnet ports on model instances. A packetnet can have many connections, each able to send or receive packets. A packetnet is used as an efficient method of communication within OVP models.

For more information on modeling with packetnets, please see the peripheral modeling documentation: [OVP\\_Peripheral\\_Modeling\\_Guide.pdf](#), [OVPSim\\_and\\_CpuManager\\_User\\_Guide.pdf](#) and the example: [\\$IMPERAS\\_HOME/Examples/Models/Peripherals/packetnet](#).

## **12.0 More information (documentation) on peripheral models and modeling**

More information on modeling and APIs can be found at: [OVPworld.org/technology\\_apis](http://OVPworld.org/technology_apis).

Specifics on modeling peripherals can be found: [OVP Peripheral Modeling Guide.pdf](#).

A full list of the currently available OVP documentation is available: [OVPworld.org/documentation](#).

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