POWER9 Functional Simulator

Command Reference

Understanding and using commands in the POWER9 Functional Simulator environment

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Revision Log

Each release of this document supersedes all previously released versions. The revision log lists all significant changes made to the document since its initial release. In the rest of the document, change bars in the margin indicate that the adjacent text was modified from the previous release of this document.

Revision Date	Pages	Description
13 October 2016	—	Version 1.0. Initial release.

About this Document

The IBM® POWER9® Functional Simulator was developed and refined in conjunction with several design projects built upon the IBM Power Architecture®. The POWER9 Functional Simulator enables hardware and software developers to simulate a POWER9 processor-based system to develop and enhance application support for this platform. The *POWER9 Functional Simulator Command Reference User's Manual* provides information about simulator commands that are available to configure and manage components in the simulation environment. These commands pertain to the command-line interface that is available after the simulator is installed and started.

Intended Audience

This document is intended for designers and programmers who are developing and testing applications that are designed to run on systems based on the POWER9 processor. Potential users include:

- System and software designers
- Hardware and software tool developers
- Application and product engineers

Using this Manual

This manual first presents preliminary topics that aid in understanding and using the POWER9 Functional Simulator commands and in managing the simulated machine. It then provides a command page for each available command.

Command Page Organization

Commands in this manual are arranged alphabetically. They typically contain the following information:

- Command Name: Provides a brief introduction to command functionality.
- Tcl Syntax: Specifies the full Tcl syntactic structure and grammar of the command statement. The syntax statements in this guide adhere to standard Tcl command notation, as described in *Conventions* on page 20. Some commands require one or more input parameters that must be passed to the command for it to execute successfully. In cases where multiple optional parameters are supported, the default is stated if applicable. For an explanation of how to read a synopsis statement, see *Section 1.4 Using the Command Pages* on page 27.
- Description: Describes the type of operation that is performed in the simulation by this command.
- Arguments: Describes each required or optional input argument.
- Example Code and Output: Provides sample code to demonstrate how the command is called, and displays corresponding output that is generated by the executed sample command sequence.

Conventions

The following typographical components are used to define special terms and command syntax:

Convention	Description
Bold typeface	Represents literal information, such as: • Information and controls displayed on screen, including menu options, application pages, windows, dialogs, and field names. • Commands, file names, and directories as used in general descriptions. • In-line programming elements, such as function names and XML elements when referenced in the main text.
Italics typeface	Emphasizes new concepts and terms and to stress important ideas. In the case of command names, this font is used to denote user-specified components when describing command usage and functionality.
`Bold monospaced` typeface	Used in Tcl command format and syntax statements to denote the command name (as provided in each command page); for example, **`define config`**.
`Bold italics monospaced` typeface	Used in Tcl command format and syntax statements to denote the user-specified component in a command name (if applicable.) For example, in the ***`configuration_object`*** **`config`** command, the ***`configuration_object`*** represents the name of a configuration object on which the command action is performed.
`Italic monospaced` typeface	Delimits required parameters in Tcl command format and syntax statements or in sample code for which a value must be specified, such as in *`cd /users/your_name`*, where *`your_name`* denotes a user-specified input.
?argument? (Question-mark delimited)	Encloses optional parameters in format and syntax descriptions. For example, in the statement ***`machine`*** **`bogus disk init`** *`devicenum imagepath accesstype ?cowpath? $hash_size?`*, the *`?cowpath?`* and *`?hash_size?`* parameters are optional.
Monospaced typeface	Used for example code, such as to represent Tcl or C/C++ code examples.
{ } (Braces)	Used in general descriptions to delimit a set of mutually exclusive user-specified parameter. **Note:** Braces are not used in Tcl command format and syntax statements, which follow the conventions defined previously.
| (Vertical rule)	Separates items in a list of choices enclosed in { } (braces) in format and syntax descriptions.
UPPERCASE	Indicates keys or key combinations that you can use. For example, press CTRL + ALT + DEL.
... (Horizontal or Vertical ellipsis) . . .	In format and syntax descriptions, as well as in code examples, an ellipsis indicates that some material has been omitted to simplify a discussion.
Hyperlink	Web-based URLs are displayed in blue text to denote a virtual link to an external document. For example: http://www.ibm.com
Note: This is note text.	The note block denotes information that emphasizes a concept or provides critical information.
This is an inline footnote reference.[1] 1. Descriptive footnote text.	A footnote annotates an explanatory note or reference inserted at the foot of the page that explains or expands upon a point within the text or indicates the source of a citation or peripheral information.

Related Documents

The following documents and links provide helpful information about Tcl/Tk used in the IBM® POWER9 Functional Simulator environment:

- *Practical Programming in Tcl and Tk* by Brent B. Welch. Prentice Hall, Inc.
- *Tcl/Tk in a Nutshell* by Paul Raines & Jeff Tranter, O'Reilly and Associates.
- The SourceForge.net Tcl Foundry located at http://sourceforge.net/projects/tcl/

Among the documents available in OpenPOWER Connect, an IBM online technical library, the following are particularly helpful in understanding the operation of the POWER9 Functional Simulator:

- *Power ISA User Instruction Set Architecture - Book I (Version 3.0)*
- *Power ISA Virtual Environment Architecture - Book II (Version 3.0)*
- *Power ISA Operating Environment Architecture (Server Environment) - Book III-S (Version 3.0)*

Help and Support

For questions or to request technical support:

1. Go to IBM Customer Connect (https://www-03.ibm.com/technologyconnect/tgcm/login.jsp).
2. Sign in with your IBM ID.
   (New users must register first. Click "Registration" in the right navigation panel.)
3. Click on "Help and support" in the left navigation panel.
4. Scroll down to the section for POWER9 Functional Simulator Support.
5. Select either "Open a new Customer Connect support request" or "Manage existing Customer Connect support requests."

Note: If the Customer Connect support channel for the POWER9 Functional Simulator isn't established, please use the POWER8 Functional Simulator channel.

To provide additional feedback, contact OpenPOWER@us.ibm.com.

1. Introduction

This chapter describes the POWER9 Functional Simulator command framework and introduces the structure, format, and usage of simulator commands. Topics in this chapter include:

- Understanding and Using Simulator Commands
- Managing a Simulated Machine
- Overview of Command Structure and Syntax
- Using the Command Pages
- Accessing Help for Commands
- Top-Level Simulator Commands

1.1 Understanding and Using Simulator Commands

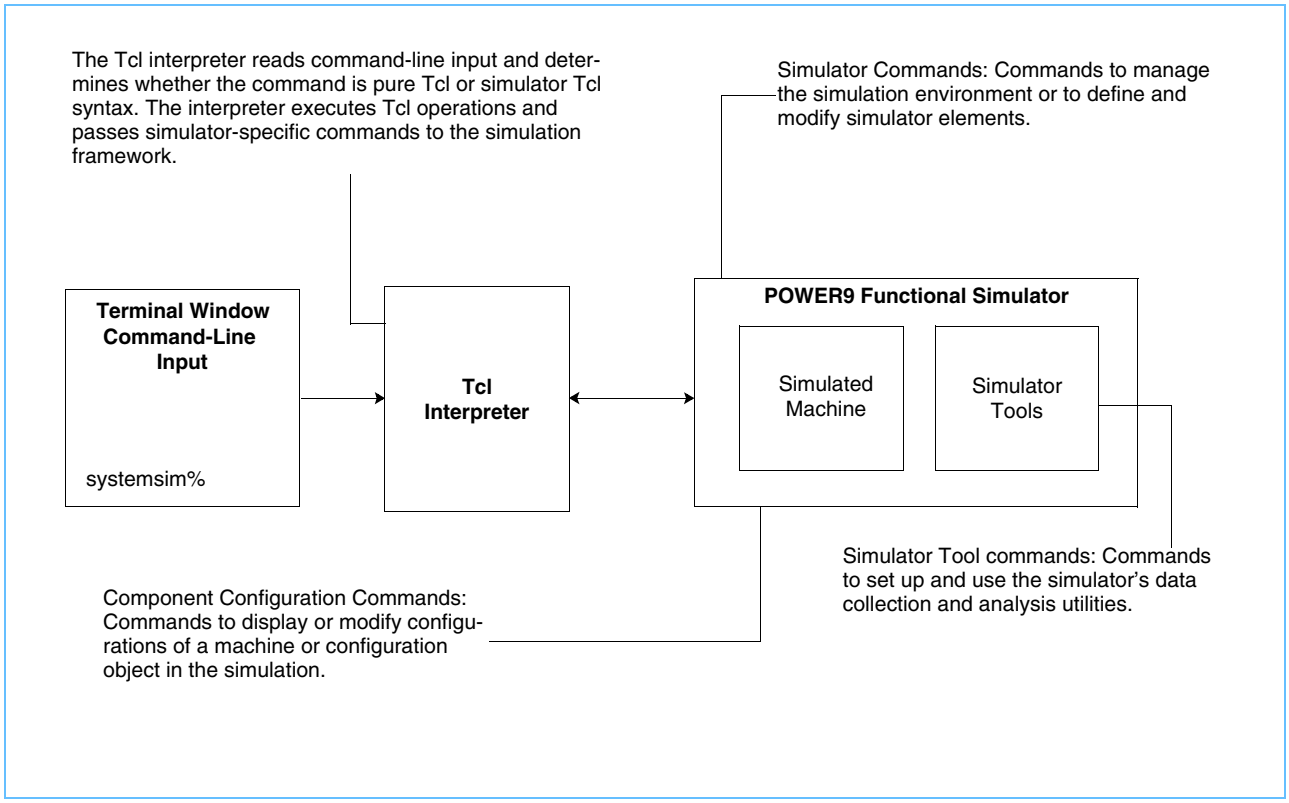
The POWER9 Functional Simulator uses Tcl/Tk to provide a simple and programmable command syntax that is easily extended and minimizes the need for proprietary programming grammar and usage. By extending Tcl with exported functions, data types, and numerous predefined interfaces for all inter-object communication, the simulator provides a rapid, cross-platform development environment that enables users to quickly start working in the simulation environment.

The POWER9 Functional Simulator command framework provides an extensive set of commands for modeling, simulating, and tuning microprocessor components in a system. Each component in a microprocessor system is configured through commands that not only define the component's run-time behavior and characteristics, but also govern its relationships and interactions with surrounding components in the system.

In addition to configuring system components, the simulator commands can be combined with programming logic and Tcl programming constructs to gather, analyze, and visualize simulation events, run workloads on the modeled microarchitecture, and generate performance metrics with new or revised configurations to forecast performance at future workloads. The command-line interface also can be used to perform a number of operations on the simulator itself, such as to control a simulation, start data collection, and define and load virtual devices and disk images.

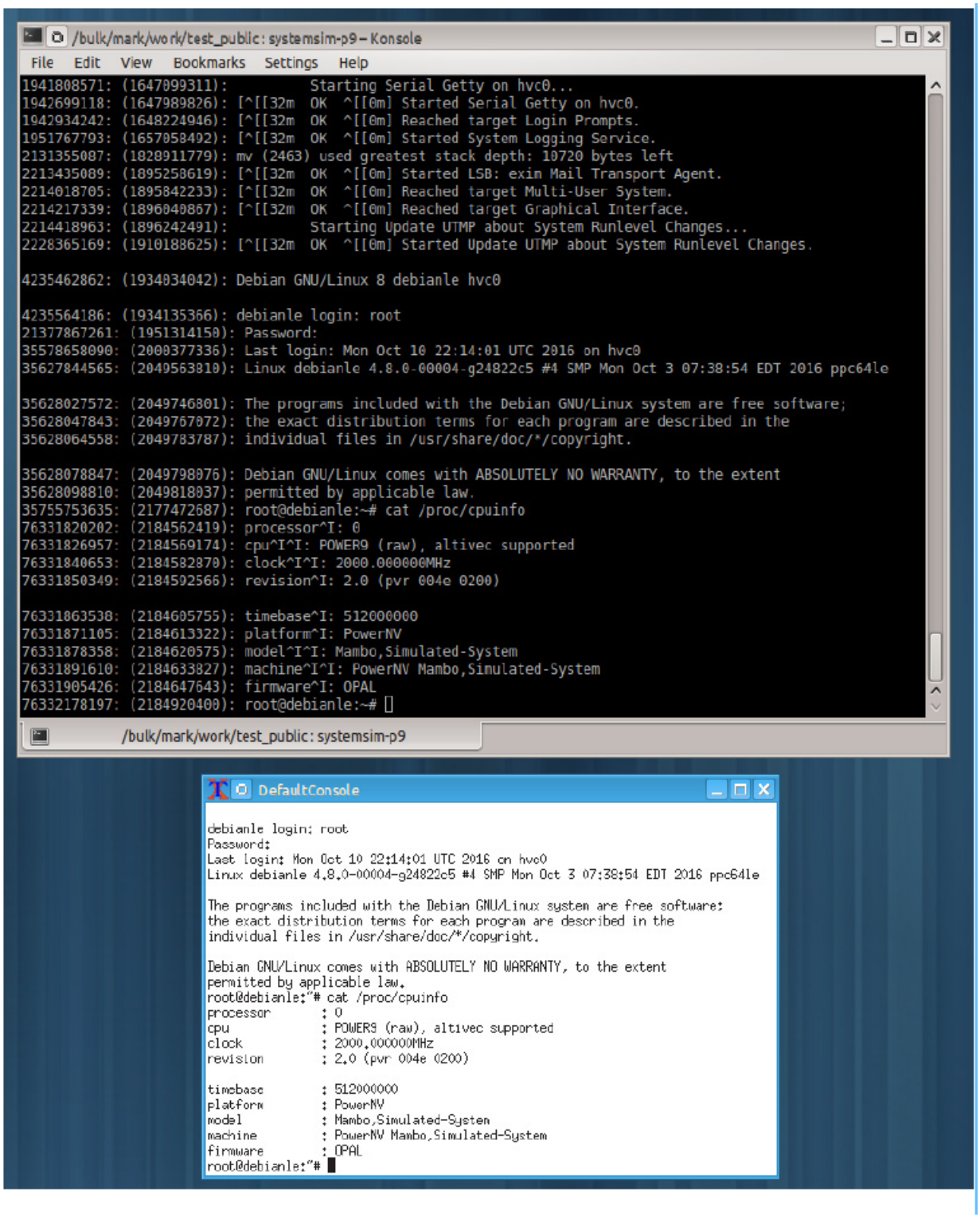
Figure 1-1 on page 24 illustrates how commands are processed in the simulation environment and describes the different categories of commands that are available.

Figure 1-1. Categories of Simulator Commands



After the simulator is started, commands can be entered at the simulator command line or through simulation Tcl scripts. *Figure 1-2* on page 25 illustrates the simulator command line and the simulated Linux console that is launched from the simulator when one of the scripts found in the **run/p9/linux** directory is executed by the **run/p9/power9** script.

Figure 1-2. *Linux Boot of the POWER9 Functional Simulator with Console Display*



1.2 Managing a Simulated Machine

Commands to set up and start a simulated machine can be entered at the simulator command line or through a Tcl configuration and start-up file that is loaded when the simulator starts. Each installation provides a default **`lib/p9/systemsim.tcl`** file that specifies a general set of commands to initialize the base simulation configurations and environment settings, create a local version of the simulator, and load and initialize one or more disk images. At startup, the POWER9 Functional Simulator interprets instructions in **`lib/p9/systemsim.tcl`** to set up default simulation behavior. Alternatively, a custom Tcl file is commonly used to start up and configure the simulation environment.

1.3 Overview of Command Structure and Syntax

Commands are organized into a hierarchy of operations based on the command function. At the top level, commands perform general sets of operations in the simulation environment, such as:

- Defining and displaying machine properties and system configurations
- Modifying configurable parameters
- Managing the simulation environment.

The following command notation illustrates the general syntax structure of the simulator commands:

```
object [action] [{parameter1 . . parametern} [options]]
```

where:

- *object* is the entity on which the command action is performed. There are three types of objects to consider when specifying a command:
  - *Simulator*. Most commands are available to perform an action on the simulator itself. In this case, the simulator is the implied object of a command. It is not, therefore, explicitly stated in the command syntax. For example, the **quit** command simply exits the simulation environment and returns to the host command line. Likewise, the **version list** command determines and displays version and build information for the simulator.
  - *Machine or configuration objects.* After a machine configuration is created or a machine is instantiated, simulator commands can be used to manage these objects. For example, a system parameter can be reconfigured only after a configuration object, for example **myconf**, is created. Once the object is created, the **config** command is used to modify a setting in this configuration object. Configuration options might be limited for certain model builds.
  - *Utility objects*. The POWER9 Functional Simulator includes utilities for data collection and performance analysis that are called through commands, in which the utility is the object of the command. For example, the **simdebug** command allows you to list, set, and see status of which function-specific debug messages are enabled.
- *action* defines the type of operation that the command is performing on an object. Extending the **quit** command described earlier, **quit** stops the simulator and returns to the main shell. Likewise, the **display** command lists information about the simulation.
- *parameter1 . . parametern* specifies required input parameters. For example, the display command is a simulator command that can be used on a created machine configuration. To show the memory map of a created machine configuration named mysim, use the following command:

  ```
  mysim display memorymap
  ```

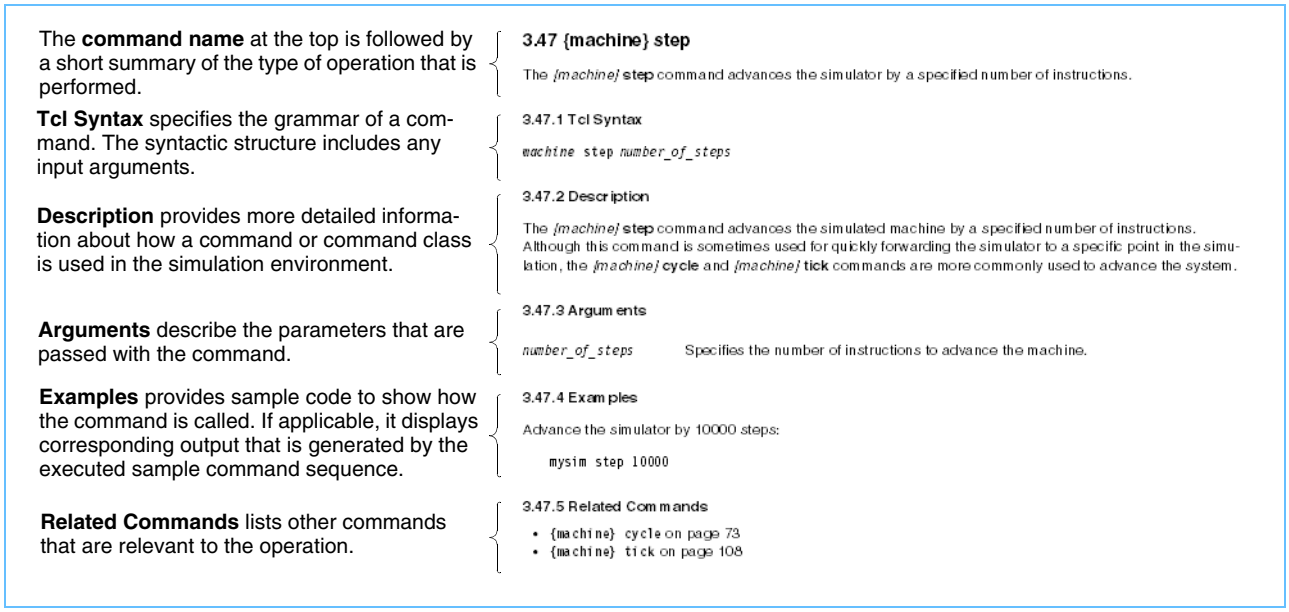
- *options* lists arguments that modify the action that is performed on the object. Extending the previous simdebug example, you can list what debug message options are available and determine if they are active (1) or not (0) by executing the following command:

  simdebug list

1.4 Using the Command Pages

Commands are arranged alphabetically. *Figure 1-3* on page 27 shows a sample syntax page that illustrates the format and general contents of command pages provided in this reference guide.

Figure 1-3. Sample Command Page Content and Format



1.5 Accessing Help for Commands

At any time, users can type the **help** command at the command line to retrieve a list of command choices that are available from that point in the syntax statement. In most cases, you can also just type a partial command sequence and press return. For example, at the top level, **help** displays a list of top-level commands. An arrow indicates that a subsequent level of command functionality is available for this command.

1.6 Top-Level Simulator Commands

Table 1-1 summarizes the functionality of selected top-level commands that are used to define, modify, and use the simulator. In the remainder of this chapter, command pages provide the complete command-line syntax and usage of each command or class of commands.

Table 1-1. POWER9 Functional Simulator Top-Level Commands

Command	Command Summary
alias	Assigns a user-specified personal shorthand for a command string. The **alias** command allows users to call a small, more familiar command or name to execute long or complex command strings.
define	Defines settings for a configuration object. The **define** command also provides that ability to duplicate configurations from a predefined machine type, instantiate a machine based on a configuration object, and enumerate a list of machines that are active in the simulation.
display	Displays system-wide information about configurations, machines, instruction settings, and warning levels. The **display** command is especially useful to determine properties that are configured for machines that are currently available in a simulation.
help or helprecursive	Displays a listing of simulator commands. The **helprecursive** command displays a comprehensive command tree that hierarchically lists syntax and input parameters for all available commands.
modify	Modifies configurable simulation settings or parameters. The **modify** command is useful for changing various run-time parameters, such as the interval at which instructions are executed, the checkpoint type, latency cycles, or the warning level that is set for the simulation environment.
quit	Ends the current simulation and exits to the operating system command line.
simdebug	Provides low-level tracing capabilities that are useful for debugging functionality or performance issues in the simulated system.
simstop	Stops the simulation and waits for an instruction at the simulator command line. The **simstop stop** command stops the simulation, and the “simulation stopped (USER)” message is displayed. The **simstop status** command can be used in a tcl script to determine if the simulation has been stopped.
version	Displays the version number of simulation system components, the date and timestamp of the installed simulator build, and compile-time flags that are enabled in the build.

1.7 alias

The **alias** command enables users to call a small, more familiar command or name to execute long or complex command strings

1.7.1 Tcl Syntax

alias create *alias_name cmdstring*
alias create_unique *cmdstring*
alias delete *alias_name*
alias list

1.7.2 Description

The **alias** command assigns a user-specified shorthand for a command string. The alias command enables users to call a small, more familiar command or name to execute long or complex command strings.

alias create	Associates user-specified shorthand with a command string.
alias create_unique	Enables you to create a unique alias for an existing command in the format AL_0, AL_1, AL_2, and so on.
alias delete	Deletes an alias that was previously associated with a command string.
alias list	Generates a list of all the aliases and the command string that is associated with each.

1.7.3 Arguments

alias_name	Specifies the name of the alias that you are creating.
command string	Specifies the command string that you want to associate with the alias name.

1.7.4 Examples

1. Create an alias to display the contents of gpr8, instead of typing the entire command:

   systemsim % mysim display gpr 8
   0x0000000000000000

   systemsim % alias create reg8 mysim display gpr 8
   reg8

   systemsim % reg8
   0x0000000000000000

2. Create a unique alias:

   systemsim % alias create_unique version
   AL_0
   systemsim % AL_0 list
   POWER9 Functional Simulator Version 1.0-0

```
Built: 15:10:21 Sep 19 2016
systemsim %
```

3. Generate a list of aliases:

```
systemsim % alias list
reg8 {mysim display gpr 8}
AL_0 {version}
```

1.8 define

The **define** command is used to define, configure, and instantiate a configuration object that is used to create a machine for the simulation environment. The various forms of this command are described in detail in *Section 2 Defining, Configuring, and Instantiating a Machine* on page 39.

For more information, see:

- *Section 2.1 define config* on page 40
- *Section 2.2 define cpu* on page 41
- *Section 2.3 define dup* on page 42
- *Section 2.4 define list* on page 43
- *Section 2.5 define machine* on page 44

1.9 display

The **display** command displays system-wide information about configurations, machines, instruction settings, and warning levels.

1.9.1 Tcl Syntax

```
display command_line_config_options
display command_line_user_options
display configures
display default_configure
display htm_status
display kips
display kips_dump_interval
display machines
display quiet_mode
display regress_mode
display standalone_mode
display warning
```

1.9.2 Description

The **display** commands show the current value of specific or selected options.

display command_line_config_options	Shows the command-line configuration options.
display command_line_user_options	Shows the command-line user options.
display configures	Shows the existing, defined configurations available for use.
display default_configure	Shows the default configuration that is used if no other is specified.
display htm_status	Shows the status of transactional memory (HTM).
display kips	Shows the default instructions per second, in thousands (kips) for this model.
display kips_dump_interval	Shows a parameter that is not applicable for this model; do not alter from the default value.
display machines	Shows the machines that are currently defined.
display quiet_mode	Shows the on or off status of quiet mode.
display regress_mode	Shows the on or off status of regress mode.
display standalone_mode	Shows the on or off status of standalone mode.
display warning	Shows the current warning level.

1.9.3 Examples

1. Display the current warning level:

   systemsim % display warning

The following output is displayed:

```
Warning level is 3
```

2. Display the status of quiet mode:

   ```
   systemsim % display quiet_mode
   ```

   The following output is displayed:

   ```
   off
   ```

1.10 help or helprecursive

The **help** and **helprecursive** commands provide a built-in help function.

1.10.1 Tcl Syntax

```
help
command line command help
helprecursive
```

1.10.2 Description

The **help** and **helprecursive** commands provide context-sensitive help.

help — When entered at the command-line prompt, **help** provides top-level help. That is, it displays a list of the next level of commands. Commands that are followed by an arrow (**->**) symbol are commands that **helprecursive** can expand further.

When entered after a simulator command, **help** provides hints about how to correctly form that command. That is, it indicates that correct syntax for the command.

helprecursive — When entered after a simulator command, **helprecursive** provides a list of all the commands and subcommands available for a particular command. To see all commands and subcommands available for **mysim**, type

```
mysim helprecursive
```

1.10.3 Examples

```
mysim thread help:: Available Commands
          config_on
          dtranslate
          itranslate
          setargs [args list]
          stall
          start_thread {PC_address}
          step {number of instructions}
          stop_thread
          cpu {cpu-number} ->
          display ->
          interrupt ->
          load ->
          mcm {mcm-number} ->
          memory ->
          osinfo ->
          set ->
          thread {thread-number} ->
          util ->
```

1.11 quit

The **quit** command ends the current simulation and exits to the operating-system command line.

1.11.1 Tcl Syntax

```
quit
```

1.11.2 Description

The **quit** command exits the simulator.

1.11.3 Examples

```
quit
```

1.12 simdebug

The **simdebug** command provides low-level tracing capabilities that are useful for debugging functionality or performance issues in the simulated system.

1.12.1 Tcl Syntax

```
simdebug  list
simdebug  set name value
simdebug  status name
```

1.12.2 Description

The **simdebug** command controls the debug output generated by the simulator or lists the various debug types and their output configuration. A one indicates on or enabled; a zero indicates off or disabled.

1.12.3 Arguments

name	Name of the output control parameter you are modifying.
value	Either 1 (enabled/on) or 0 (disabled/off).

1.12.4 Examples

Display the status of the simdebug named “helpful:”

```
systemsim % simdebug status helpful
```

The following output is displayed:

```
1
```

1.13 simstop

The **simstop** command stops the simulation and waits for an instruction at the simulator command line. The **simstop** command performs the same operation as typing **CTRL+C** to interrupt the simulation.

1.13.1 Tcl Syntax

```
simstop status
simstop stop
```

1.13.2 Description

The **simstop** command can be executed from a Tcl script to cause the simulation to stop. The simulation can then be restarted from the simulator command line. This allows users to run a script to a certain point, then do manual command execution.

1.13.3 Examples

```
puts "console line: $triginfo(linenum): string trim $triginfo(line) "\r\n"]"
puts "Stopping"
simstop
```

1.14 version

The **version** command displays the version number and timestamp details of simulation system components and build.

1.14.1 Tcl Syntax

```
version list
```

1.14.2 Description

Displays the version number of simulation system components and the date and timestamp of the installed simulator build.

1.14.3 Examples

Display the version number of the simulation system components and the date and timestamps:

```
systemsim % version list
```

The following output is displayed:

```
POWER9 Functional Simulator Version 1.0-0
Built: 15:08:04 Sep 19 2016
```

2. Defining, Configuring, and Instantiating a Machine

This chapter describes commands that are used to define and configure a configuration object that is used to create a machine for the simulation environment. *Section 1 Introduction* on page 23 presents concepts that are helpful in understanding how to configure and use a simulated machine in the simulator environment. *Section 1.2 Managing a Simulated Machine* on page 26 illustrates the process by which a configuration object is defined, configured, and used to instantiate the simulated machine.

2.1 define config

The **define config** command defines a new configuration object.

2.1.1 Tcl Syntax

`define config` *`new_configuration_object`*

2.1.2 Description

The **define config** command creates a new configuration object. A configuration object is a named collection, such as **myconf**, of machine properties that are used to instantiate a machine that is run in the simulator. The **define config** command creates and populates a new configuration object with default properties that have been defined for a machine type. Once an object is defined, the default properties can be reconfigured with the *{configuration_object}* **config** command before the **define machine** command is used to instantiate a machine object from this configuration.

2.1.3 Arguments

`new_configuration_object`	Specifies the name of the new configuration object.

2.1.4 Examples

```
define config myconf
```

where **myconf** is a configuration object that defines baseline settings for a machine that can be run in a simulation.

2.1.5 Related Commands

- define cpu on page 41
- define dup on page 42
- define machine on page 44
- **`display configures`** on page 46

2.2 define cpu

The **define cpu** command defines a new CPU.

2.2.1 Tcl Syntax

define cpu *config-name cpu-name*

2.2.2 Description

The **define cpu** command defines a new CPU.

2.2.3 Arguments

config-name	Specifies the name of the configuration object.
cpu-name	The CPU name (cpu 0, cpu 1, and so on) you choose to associate with your configuration.

2.2.4 Examples

```
define config myconf
```

where **myconf** is a configuration object that defines baseline settings for a machine that can be run in a simulation.

2.2.5 Related Commands

- define config on page 40
- define dup on page 42
- define machine on page 44
- **display configures** on page 46

2.3 define dup

The **define dup** command defines a duplicate configuration object based on an existing machine type.

2.3.1 Tcl Syntax

define dup *existing_configuration_object new_configuration_object*

2.3.2 Description

The **define dup** command duplicates a *configuration object* from an existing configuration. A configuration object is a named collection, such as **myconf**, of machine properties that are used to instantiate a machine that is run in the simulator. Although the **define dup** command provides similar functionality as the **define config** command, unlike **define config** it requires an existing configuration object and cannot be used to create a configuration object with different machine properties.

2.3.3 Arguments

existing_configuration_object	Specifies the name of an existing configuration object that will be duplicated.
new_configuration_object	Specifies the name of the duplicate configuration object to be created.

2.3.4 Examples

1. Define a **myconf** configuration object into which all properties and values of the pre-defined **P9** configuration object for the POWER9 processor are duplicated. This **myconf** object can then be used to modify one or more configurations and instantiate a custom POWER9 machine based on the revised settings:

   ```
   define dup P9 myconf
   ```

2. Define an **anotherconf** configuration object to duplicate the **myconf** configuration object created in step 1:

   ```
   define dup myconf anotherconf
   ```

2.3.5 Related Commands

- **define config** on page 40
- **define cpu** on page 41
- **define machine** on page 44
- **display configures** on page 46

2.4 define list

The **define list** command lists all machines that are active in a simulation.

2.4.1 Tcl Syntax

```
define list
```

2.4.2 Description

The **define list** command provides a list of machines that are active in the simulation environment.

2.4.3 Examples

Output the name of all existing machines that have been created from configurations. In the case where the **mysim** and **anothersim** machines are defined, typing the **define list** command at the simulator prompt displays the following output:

```
anothersim mysim
```

2.4.4 Related Commands

- define config on page 40
- define cpu on page 41
- define dup on page 42
- define machine on page 44

2.5 define machine

The **define machine** command instantiates a machine from a configuration object.

2.5.1 Tcl Syntax

`define machine` *`configuration_object_name machine_name`*

2.5.2 Description

The **define machine** command instantiates a machine that is used in a simulation. Multiple machines can be created in the simulator based on a single configuration object.

2.5.3 Arguments

`configuration_object_name`	Specifies the name of an existing configuration object that will be duplicated.
`machine_name`	Specifies the name of the duplicate configuration object to be created.

2.5.4 Examples

Instantiate a **mysim** machine from the **myconf** configuration object:

```
define machine myconf mysim
```

Once created, the **mysim** machine can be run in a simulation to capture details about the functionality and performance of this machine configuration.

2.5.5 Related Commands

- define config on page 40
- define cpu on page 41
- define dup on page 42
- define list on page 43

2.6 {configuration_object} config

The *{configuration_object}* **config** command assigns a value to a configuration property.

2.6.1 Tcl Syntax

configuration_object **config** *property_name property_value*

2.6.2 Description

The *{configuration_object}* **config** command assigns a new value to an existing property in a configuration object.

2.6.3 Arguments

property_name	Specifies the name of an existing configuration property whose current value is replaced with the specified value. See {configuration_object} display on page 46, which can be used to display a complete list of properties.
property_value	Specifies the value that is assigned to the configuration property.

2.6.4 Examples

1. Reconfigure the default *memory_size* property in the **myconf** configuration object to be 128 MB:

   ```
   myconf config memory_size 128M
   ```

   Note: For properties that specify a size parameter, such as *memory_size*, the actual size of the value must be provided. For example, the sample code above sets the machine memory size to 128M, which the simulator interprets as a scaled integer and sets the memory size to 128 *megabytes*. If the value 128 is specified, the memory size is set to 128 *bytes*.

2. Verify that the *memory_size* parameter for **myconf** has been modified:

   ```
   myconf display memory_size
   ```

   The following output is displayed:

   ```
   myconf:
       memory_size = 128M (number of bytes of memory)
   ```

2.6.5 Related Commands

- {configuration_object} display on page 46
- define config on page 40

2.7 {configuration_object} display

The {*configuration_object*} **display** command displays a list of configuration properties.

2.7.1 Tcl Syntax

configuration_object **display** *$property_name$*

2.7.2 Description

The *{configuration_object}* **display** command outputs the name and value of all properties that correspond to the specified search string for the given configuration object. If a property name is not specified, the entire list of properties for the configuration object is displayed. A valid search string can include any sequence of characters, based on which the simulator returns information about all properties that contain the given string.

2.7.3 Arguments

property_name	(Optional) Specifies the name of an existing configuration property that is displayed to standard output. If *property_name* is not specified, the entire list of properties for the configuration object is displayed.

2.7.4 Examples

1. View all configuration properties containing the string, memory:

   ```
   myconf display memory
   ```

   The following output is displayed:

   ```
   myconf:
       memory_size = 64M (number of bytes of memory)
       memory_start = 0 (address of first byte of memory)
   ```

2. View all configuration properties containing the string, M:

   ```
   myconf display M
   ```

   The following output is displayed:

   ```
   myconf:
       htm/htm_os_supports_tm = FALSE  (does the OS support TM operations)
               machine_type = p9 (type of machine: WALNUT, SPRUCE, ...)
               memory_size = 64M  (number of bytes of memory)
               memory_start = 0  (address of first byte of memory)
   ```

2.7.5 Related Commands

- {configuration_object} config on page 45

2.8 {configuration_object} exit

The *{configuration_object}* **exit** command deletes a configuration object.

2.8.1 Tcl Syntax

configuration_object **exit**

2.8.2 Description

The *{configuration_object}* **exit** command removes the specified configuration object from the simulation environment. The *{configuration_object}* **exit** command performs the same operation as the *{configuration_object}* **quit** command.

2.8.3 Examples

1. Delete the **tmpconf** configuration object from the simulation environment:

   ```
   tmpconf exit
   ```

   Note: The *{configuration_object}* **exit** command permanently removes the object from the system. Before removing a configuration object, ensure that you do not need the configurations specified in this object.

2. Verify that the **tmpconf** object has been removed by listing all active configuration objects and machines in the system:

   ```
   display configures
   ```

2.8.4 Related Commands

- {configuration_object} display on page 46
- {configuration_object} quit on page 49
- **display configures** on page 46

2.9 {configuration_object} query

The *{configuration_object}* **query** command displays the value of a configuration object property.

2.9.1 Tcl Syntax

configuration_object **query** *full_property_name*

2.9.2 Description

The *{configuration_object}* **query** command returns the value of the specified property for the given configuration object. Although the *{configuration_object}* **display** command provides similar functionality as *{configuration_object}* **query**, the return value from *{configuration_object}* **query** is formatted such that it can be conveniently used as input in a Tcl procedure.

2.9.3 Arguments

full_ property_name	Specifies the complete name of an existing configuration property.

2.9.4 Examples

View the value assigned to the **memory_size** configuration property:

```
myconf query memory_size
```

The following output is displayed:

```
64M
```

Alternatively, using the *{configuration_object}* **display** command to view memory size results in the following output:

```
myconf:
    memory_size = 64M (number of bytes of memory)
```

2.9.5 Related Commands

- {configuration_object} display on page 46

2.10 {configuration_object} quit

The *{configuration_object}* **quit** command deletes a configuration object.

2.10.1 Tcl Syntax

configuration_object **quit**

2.10.2 Description

The *{configuration_object} quit* command removes the specified configuration object from the simulation environment. The *{configuration_object}* **quit** command performs the same operation as the *{configuration_object}* **exit** command.

2.10.3 Examples

1. Delete the **tmpconf** configuration object from the simulation environment:

   ```
   tmpconf quit
   ```

   Note: The *{configuration_object}* **quit** command permanently removes the object from the system. Before removing a configuration object, ensure that you do not need the configurations specified in this object.

2. Verify that the **tmpconf** object has been removed by listing all active configuration objects and machines in the system:

   ```
   display configures
   ```

2.10.4 Related Commands

- {configuration_object} display on page 46
- {configuration_object} exit on page 47
- **`display configures`** on page 46

3. Configuring and Modifying Machine Properties

This chapter describes commands that are used to configure and modify machine properties in the simulation environment.

3.1 {machine} bogus disk cleanup

The {machine} **bogus disk cleanup** command removes a bogus disk from the system.

3.1.1 Tcl Syntax

```
machine bogus disk cleanup
```

3.1.2 Description

Bogus disk support provides a high-performance call-through interface to block devices, disk images, or both that reside on the host system The *{machine}* **bogus disk cleanup** command extends functionality provided by the *{machine}* **bogus disk commands** by synchronizing all data and cleaning up all references to virtual disk device images that have been loaded in the simulation. Although the **bogus disk** commands integrate this functionality into their exit routines, issuing the *{machine}* **bogus disk cleanup** command before exiting a simulation ensures that files are properly synchronized.

3.1.3 Examples

Issue the *{machine}* **bogus disk cleanup** command to synchronize disk images in the system:

```
mysim bogus disk cleanup
```

The simulator prints a confirmation message:

```
ok
```

3.1.4 Related Commands

- {machine} bogus disk init on page 54
- {machine} bogus disk sync on page 57

3.2 {machine} bogus disk display

The {machine} **bogus disk display** command shows the minor number assigned to the bogus device by the simulated system, the path to the device on the host system, the block and device sizes configured for the bogus disk, and the access type (read, write, or copy on write).

3.2.1 Tcl Syntax

```
machine bogus disk display
```

3.2.2 Description

The {machine} **bogus disk display** command is only useful when there is an active bogus disk that has already been initialized and mounted. Then it can be used to display information about the active bogus disk.

3.2.3 Examples

Issue the *{machine}* **bogus disk display** command to display information about the active bogus disk:

```
systemsim % mysim bogus disk display
```

The simulator displays the statistics:

```
{ minor 0 path /home/mambo_kernels/debian-ppc64le-rootfs-v2.0.img blksz 4096 devsz 10485760
cow_flags rw cow_path (null) }
```

3.2.4 Related Commands

- {machine} bogus disk init on page 54
- {machine} bogus disk sync on page 57

3.3 {machine} bogus disk init

The *{machine}* **bogus disk init** command loads and initializes a virtual disk device into simulation.

3.3.1 Tcl Syntax

machine bogus disk init *devicenum imagepath accesstype ?cowpath? $hash_size?*

3.3.2 Description

Bogus disk support provides a high-performance call-through interface to block devices, disk images, or both that reside on the host system The *{machine}* **bogus disk init** command loads a disk image residing on the host machine into the simulation environment. This command interface serves as the BIOS of a regular machine that links a specific hard drive/rootdisk to an internal device number.

Before the newly instantiated machine can run in simulation, a rootdisk image must be loaded in the system, which contains the root environment for the system. This image provides a snapshot of a functioning Linux system that is available inside the simulator, including all tools, libraries, and debuggers that are required to run an actual Linux system. This enables the simulator to provide the appropriate run-time support to run applications as they are executed in an actual Linux environment. The simulator is designed to optimize the execution of the Linux kernel by reading contents of the rootdisk image as the simulator traverses the root file system in the simulator environment.

3.3.3 Arguments

devicenum	Specifies a device number (starting at 0) that correlates to a device in Linux.
imagepath	Specifies the full path name to the disk image.
accesstype	Specifies the access type to the disk file. Supported access types include read (***r***), write only (**w**), read-write (**rw**), copy-on-write (**cow**), or an alternate copy-on-write (**newcow**) method. The **cow** access type is an optimization strategy that specifies that all write operations are performed on a snapshot of the original disk image so that the state of the original image is maintained. If the simulation fails or is stopped, it can be resumed from either the point at which it stopped, or it can revert to the original disk image. The **newcow** access type provides another type of the copy-on-write functionality in which a new version of the disk image is created each time the simulation starts.
cowpath	Specifies the file path of the snapshot disk image.[1]
hashsize	Specifies the size of the hash table that is storing the snapshot images. The hash table size is a performance-to-memory trade-off.

1. A **cowpath.table** is an internal hash table that is used to map sectors in the original disk image to sectors in the snapshot image file. When a disk image is loaded for the first time with the **cow** access method, the snapshot disk file and **cowpath.table** file are automatically created. If these files already exist, however, the mapping in the **cowpath.table** is used to load the current state of the disk image file. In essence, all changes from the previous session are loaded and the POWER9 Functional Simulator can continue from that point.

3.3.4 Examples

The following sample lines of code are added in the **boot-linux-le-rtas.tcl** configuration and startup file to mount the Linux kernel and rootdisk images. As illustrated in this code, the simulator provides distinct commands for loading the Linux kernel (line 53) versus loading the rootdisk image (line 42).

```
41 #bogus disk
42 mysim bogus disk init 0 disk.img rw
.
.
.
52 # Load vmllinux
53 mysim load vmlinux vmlinux 0
```

The following *{machine}* **bogus disk** command creates a copy-on-write disk image located in **/tmp/hdisk0cow** and a copy-on-write table at **/tmp/hdisk0cow.table**. The internal hash table size is set to 1024. The hash-table size is a performance-to-memory trade-off. Increasing the hash-table size improves performance in an environment where many changes are made.

```
mysim bogus disk init 0 /tmp/hdisk0 cow /tmp/hdisk0cow 1024
```

3.3.5 Related Commands

- {machine} bogus disk sync on page 57
- {machine} load vmlinux on page 94

3.4 {machine} bogus disk stat

The {machine} **bogus disk stat** command shows the minor number assigned to the bogus device by the simulated system, the path to the device on the host system, and the read/write event statistics.

3.4.1 Tcl Syntax

machine `bogus disk stat`

3.4.2 Description

The {machine} **bogus disk stat** command is only useful when there is an active bogus disk that has already been initialized and mounted. Then it can be used to show statistics.

3.4.3 Examples

Issue the *{machine}* **bogus disk stat** command to display statistics:

```
systemsim % mysim bogus disk stat
```

The simulator displays the statistics:

```
{ minor 0 path /home/mambo_kernels/debian-ppc64le-rootfs-v2.0.img reads 24574976 writes
1622016 }
```

3.4.4 Related Commands

- {machine} bogus disk init on page 54
- {machine} bogus disk sync on page 57

3.5 {machine} bogus disk sync

The *{machine}* **bogus disk sync** command synchronizes a copy-on-write file for subsequent usage.

3.5.1 Tcl Syntax

machine `bogus disk sync` *`devicenum`*

3.5.2 Description

The *{machine}* **bogus disk sync** command maintains the integrity of an existing copy-on-write image file so that it is usable in subsequent sessions. Although the **bogus disk** commands integrate this functionality into their exit routines, issuing this command before exiting a simulation ensures that the copy-on-write file is properly synchronized.

3.5.3 Arguments

`devicenum`	Specifies a device number used when the disk was initialized.

3.5.4 Examples

The following *{machine}* **bogus disk sync** command synchronizes the **mambobd0** disk image and writes the copy-on-write image and table files:

```
mysim bogus disk sync 0
```

3.5.5 Related Commands

- {machine} bogus disk init on page 54

3.6 {machine} bogus net cleanup

The {machine} **bogus net cleanup** command removes a bogus network device connection from the system.

3.6.1 Tcl Syntax

```
machine bogus net cleanup
```

3.6.2 Description

Bogus net support provides a high-performance call-through interface to simulate Ethernet connectivity between a simulated Ethernet adapter and the Ethernet adapters that reside on the host system. The *{machine}* **bogus net cleanup** command extends functionality provided by *{machine}* **bogus net** by cleaning up all references to virtual net devices that have been initialized and are in use in the simulation. Although the **bogus net init** command integrates this functionality into its exit routines, issuing the *{machine}* **bogus net cleanup** command before exiting a simulation ensures that simulated network device closure is done correctly.

3.6.3 Examples

Issue the *{machine}* **bogus net cleanup** command to correctly close the network devices configured in the system:

```
mysim bogus net cleanup
```

The simulator prints a confirmation message:

```
ok
```

3.6.4 Related Commands

- {machine} bogus net init on page 59

3.7 {machine} bogus net init

The *{machine}* **bogus net init** command loads and initializes a virtual Ethernet device.

3.7.1 Tcl Syntax

```
machine bogus net init devicenum MACaddr socket_file IRQ IRQ_offset
```

3.7.2 Description

The *{machine}* **bogus net init** command supports a call-through interface to an Ethernet network. This interface is provided through an emulated Ethernet device (**mambonet0**) and a separate utility that interfaces with a network device on the host system.

3.7.2.1 Extended Description of Bogus Network Support

There are three key components to bogus network communications:

1. A facility on the host system that provides systemsim-p9 with a path to the network. The TUN/TAP support available for Linux is a good choice for this component. TUN/TAP is assumed in the remainder of this description.
2. The systemsim-p9 support for the bogus network. This support is not enabled by default. Simulator commands are used to enable the bogus network support.
3. An operating system (OS) kernel with a bogus network driver.

3.7.2.2 Setting up TUN/TAP on the Host System

You must have root privileges on your system to set up bogus network operation. Execute the following commands:

```
sudo tunctl -u $USER -t tap0
sudo ifconfig tap0 172.19.98.108 netmask 255.255.255.254
```

3.7.2.3 Configuring systemsim-p9 Support for the Bogus Network

To enable bogus network support, issue simulator commands that configure and initialize the bogus network. These commands must be issued before booting the Linux kernel on the simulator so that Linux recognizes the bogus network device during its boot process. The general form of the command to initialize the bogus network is:

```
mysim bogus net init 0 <mac address> <interface name> <irq>
```

The <mac address> parameter is the media access control (MAC) hardware address that you want the emulated Ethernet to use. It must be unique on your network (that is, not used by any other emulated hosts or by any host network adapter). The <interface name> parameter is the name of the interface to be used, typically “tap0.” The <irq> parameter specifies the interrupt request queue ID to be used by the bogus network device; use 0 0 for the POWER9 Functional Simulator.

3.7.3 Arguments

devicenum	Specifies a device number (starting at 0) that correlates to a device in Linux.
MACaddr	Specifies the MAC hardware address that the emulated Ethernet will use. This must be a unique address on the network (that is, one that is not used by any other emulated hosts or by any host network adapter).
interface name	The *interface name* parameter is the name of the interface to be used, typically "tap0."
IRQ and *IRQ_offset*	The *IRQ* and *IRQ_offset* parameters specify the interrupt request queue ID to be used by the bogus network device; use *0 0* for the POWER9 Functional Simulator.

3.7.4 Examples

The following {machine} **bogus net init** command initializes the simulated **eth0** network device using the **d0:d0:d0:da:da:da** MAC address and the **tap0** interface:

```
mysim bogus net init 0 d0:d0:d0:da:da:da tap0 0 0
```

3.7.5 Related Commands

- {machine} bogus disk init on page 54
- {machine} bogus net cleanup on page 58

3.8 {machine} bogushalt

TThe {machine} **bogushalt** command is used to configure the simulator's behavior when it encounters the special bogushalt instruction.

3.8.1 Tcl Syntax

```
machine bogushalt delay delay_in_ticks
machine bogushalt disable
machine bogushalt display
machine bogushalt enable
```

3.8.2 Description

The *{machine}* **bogushalt** command can be used to configure the simulator's behavior when it executes a **bogushalt** instruction. **bogushalt** can be used to simulate a simple halt Power instruction. With POWER9's support of the stop instruction this is mostly of historical significance. The following subcommands are available in the *{machine}* **bogushalt** set of commands

{machine} delay **{integer}**	Specifies the number of ticks the simulator will delay.
{machine} **disable**	Disables *{machine*} **bogushalt** support..
{machine} **display**	Print the current status of *{machine*} **bogushalt** support..
{machine} **enable**	Enables *machine*} **bogushalt** support.

3.8.3 Arguments

delay_in_ticks	Specifies an integer amount for the number of ticks that the simulator will delay processing instructions.

3.8.4 Examples

Set the bogushalt delay to be 2,000 ticks:

```
mysim bogushalt delay 2000
```

The following output is displayed:

```
Bogus halt delay is set to 2000 ticks
```

3.8.5 Related Commands

- {machine} bogus disk init on page 54

3.9 {machine} config_on

The *{machine}* **config_on** command starts the processor component.

3.9.1 Tcl Syntax

```
machine config_on
```

3.9.2 Description

The *{machine}* **config_on** command performs the same operation as the *{machine}* **cpu 0 config_on** command (see *Section 3.17 {machine} cpu* on page 71) to control the state of the default processor (CPU 0). In hardware, this operation is generally implemented by moving a mode bit in the processor's Machine State Register (MSR).

When a machine is created in the simulator, the processor is set to off by default. In a typical environment, the processor is turned on as a side effect of loading the machine, which initializes the machine state. The *{machine}* **config_on** command is necessary only when the machine state is not defined by any initial processing.

3.9.3 Examples

In a machine with a single processor, start the processor:

```
mysim config_on
```

The following message is displayed to confirm that the processor is started:

```
CPU 0 set running
```

3.9.4 Related Commands

- {machine} cpu on page 71
- {machine} stall on page 105

3.10 {machine} console create

The *{machine}* **console create** command defines the source (or sink) of characters for the simulation console.

3.10.1 Tcl Syntax

```
machine console create console_id in|inout|out file file_name
machine console create console_id in|inout|out listen port
machine console create console_id in|inout|out program program_name
machine console create console_id in|inout|out socket host:port
machine console create console_id in|inout|out string input_string
```

3.10.2 Description

The *{machine}* **console create** command feeds characters from the specified source into the simulation and vice versa. The simulated machine is designed to accept input from the user, which normally is typed directly into the simulator console window. However, in the case of predefined scripts, the input can be obtained from additional sources, such as text files or programs. The input characters are copied to the simulation as if they are typed into the console interface. The simulation environment provides different *{machine}* **console create** commands, each of which defines the source (or sink) of the characters for the console. These command options are listed in the Arguments section.

3.10.3 Arguments

console_id	Specifies a user-defined console name. This identifier is a unique name associated with a console. The *console_id* enables the console that is being created to be identified in a list and is used with other console-related commands, such as enabling, disabling, or deleting a console.
in|*inout*|*out*	Specifies whether the console will be used for input (**in**), output (**out**), or input and output (**inout**). Input consoles provide characters that are given to the machine, and output consoles display any characters that the computer generates.
file *filename*	Indicates that the specified file is used to read input or record output results, or both.
listen *port*	Indicates that the simulator will create the specified port and then listen for another program to attach to this port.
program *prog_name*	Indicates that characters will be sent to or from a specified program. For example, an Xterm window is an instance of the program option, since it is normally the display for the machine console. When the **program** option is used, communication occurs over pseudo-terminals. The pseudo-TTYS provide interfaces to receive nonblocking input as well as to send terminal control characters.
socket *host:port*	Indicates that the simulator will attempt to connect to the named host and port.
string *input_string*	Indicates that the source input is given in the **string** command. Strings cannot be used for output consoles.

3.10.4 Examples

The following sample lines of code are added in the **systemsim.tcl** configuration and startup file to manage the simulation from the console window. The console **callthru exit** command (line 17) exits the POWER9 Functional Simulator console. A simple GCC compile operation on source that is called from the host to the simulated system (lines 22 – 25) is executed. The simulation is then started.

```
.
.
.
16: # exit console to start simulation
17: mysim console create input in string "callthru exit"
.
.
.
21: # invoke call-thrus to start instructions to compile C program
22: mysim console create input in string "callthru source hello.c >
hello.c"
23: mysim console create input in string "gcc -o hello hello.c"
24: mysim console create input in string "./hello"
25: mysim console create input in string "callthru exit"
```

3.10.5 Related Commands

- {machine} console create on page 63
- {machine} console destroy on page 65

3.11 {machine} console destroy

The *{machine}* **console destroy** command removes the specified console.

3.11.1 Tcl Syntax

machine `console destroy` *`console_id`*

3.11.2 Description

The *{machine}* **console destroy** command removes the specified console from its use in input and output, and deletes all its supporting data structures. An EOF is generated for any output file or socket.

3.11.3 Arguments

`console_id`	Specifies the name of the console to be removed.

3.11.4 Examples

The following sample command line removes the c0 console from the simulation:

```
mysim console destroy c0
```

3.11.5 Related Commands

- {machine} console create on page 63
- {machine} console disable on page 66
- {machine} console enable on page 68
- {machine} console list on page 69

3.12 {machine} console disable

The *{machine}* **console disable** command disables a simulation console.

3.12.1 Tcl Syntax

machine `console disable` *`console_id`*

3.12.2 Description

Once created, an input console can be disabled so that it cannot read input characters; likewise, a disabled output console does not generate output characters from the machine. The *{machine}* **console disable** command suspends the specified console from its use in input and output.

3.12.3 Arguments

`console_id`	Specifies the name of the console to be disabled.

3.12.4 Examples

The following sample command line disables the c0 console from the simulation:

```
mysim console disable c0
```

3.12.5 Related Commands

- {machine} console create on page 63
- {machine} console enable on page 68

3.13 {machine} console display buffered

The *{machine}* **console display buffered** command displays the status of console line buffering.

3.13.1 Tcl Syntax

```
machine console display buffered
```

3.13.2 Description

The *{machine}* **console display buffered** command displays whether or not line buffering is currently enabled in the system. The simulator is able to buffer output until an end-of-line character (**\n**) is generated. If two or more multichip modules (MCMs) are outputting to the same console, buffering allows the console lines from the different MCMs to be separated. In contrast, if buffering is disabled, the characters output by the various MCMs are interleaved by time.

3.13.3 Examples

The following command line displays whether buffering is enabled in the simulation environment:

```
mysim console display buffered
```

Displays the following output:

```
on
```

3.13.4 Related Commands

- {machine} console create on page 63
- {machine} console set display buffered on page 70

3.14 {machine} console enable

The *{machine}* **console enable** command enables a simulation console.

3.14.1 Tcl Syntax

machine `console enable` *`console_id`*

3.14.2 Description

An enabled input console provides input characters to the simulation; likewise, an enabled output console accepts output characters from the machine. The *{machine}* **console enable** command renders the specified console functional for input and output.

3.14.3 Arguments

`console_id`	Specifies a name of the console to be enabled.

3.14.4 Examples

The following sample command line enables the c0 console in the simulation:

```
mysim console enable c0
```

3.14.5 Related Commands

- {machine} console create on page 63
- {machine} console disable on page 66

3.15 {machine} console list

The *{machine}* **console list** command lists information about currently defined consoles.

3.15.1 Tcl Syntax

```
machine console list
```

3.15.2 Description

The *{machine}* **console list** command lists all currently defined consoles by their respective console identifiers. For each console, the command output indicates:

- Whether the console is enabled or disabled
- Whether it is used for inputting characters, outputting characters, or both
- The console type (**file**, **listen**, **program**, **socket**, or **string**)
- The parameters for the listed console

3.15.3 Examples

The following sample lines of code demonstrate command output that is generated when the following *{machine}* **console create** commands are issued in a simulation:

```
mysim console create c0 in program xterm
mysim console create c1 in string "ls\nexit"
mysim console create outfile out file /tmp/saved_output
mysim console create input in string "callthru exit"
```

Once these consoles are created, enabled, and disabled, the *{machine}* **console list** command will display the following output:

```
c0 :: DISABLE input program : xterm
c1 :: ENABLE input string : ls\nexit
outfile :: DISABLE output file :
/tmp/saved_output input :: ENABLE input string :
callthru exit
```

3.15.4 Related Commands

- {machine} console create on page 63
- {machine} console destroy on page 65
- {machine} console disable on page 66
- {machine} console enable on page 68

3.16 {machine} console set display buffered

The *{machine}* **console set display buffered** command turns the buffered display on or off.

3.16.1 Tcl Syntax

machine `console set display buffered` *on* | *off*

3.16.2 Description

The *{machine}* **console set display buffered** command turns on or off a display that indicates whether or not line buffering is currently enabled in the system. The simulator is able to buffer output until an end-of-line character (**\n**) is generated. If two or more multichip modules (MCMs) are outputting to the same console, buffering allows the console lines from the different MCMs to be separated. In contrast, if buffering is disabled, the characters output by the various MCMs are interleaved by time.

3.16.3 Arguments

on	Turns the buffered display on.
off	Turns the buffered display off.

3.16.4 Examples

1. The following command line turns the buffered display on:

   ```
   mysim console set display buffered on
   ```

   This command displays the following output:

   ```
   on
   ```

2. The following command line turns the buffered display off:

   ```
   mysim console set display buffered off
   ```

   This command displays the following output:

   ```
   off
   ```

3.16.5 Related Commands

- {machine} console create on page 63
- {machine} console display buffered on page 67

3.17 {machine} cpu

The *{machine}* **cpu** command enables simulator commands to be called on the specified CPU.

3.17.1 Tcl Syntax

machine cpu *cpu_number simulator_command*

3.17.2 Description

The POWER9 Functional Simulator is designed to simulate a system in which multiple, separate processors are running on an MCM. The *{machine}* **cpu** command is a wrapper command that runs a subset of simulator commands on the processor that is specified by *cpu_number*. To view a complete list of processor-related commands, type *{machine}* **cpu** at the simulator command line.

For example, the *{machine}* **cpu** *cpu_number* **memory fread** command enables users to copy the specified number of bytes from the specified input source into the given memory address.

3.17.3 Arguments

cpu_number	Specifies the name of the processor on which the command operation (defined by the *simulator_command* input) is performed.
simulator_command	Specifies the command input that is run on the specified processor.

3.17.4 Examples

On CPU 0, read a specified number of bytes from a specified file to the specified location in memory:

```
mysim cpu 0 memory fread 0x100 1024 bootfile
```

3.17.5 Related Commands

- {machine} mcm on page 96
- {machine} thread on page 109

3.18 {machine} cycle

The *{machine}* **cycle** command advances the simulator by a specified number of cycles.

3.18.1 Tcl Syntax

machine cycle *number_of_cycles*

3.18.2 Description

The *{machine}* **cycle** command advances the simulated machine by a specified number of cycles. This command is useful for quickly forwarding a simulation to a specific point at which relevant metrics can be gathered for performance analysis and correlation.

3.18.3 Arguments

number_of_cycles Specifies the number of cycles to advance the machine.

3.18.4 Examples

The following sample code illustrates example Tcl steps used to advance a simulation in fast mode to the point at which the boot process is complete. At this time, the fast mode is turned off, the simulator is advanced by a specified number of cycles, and a trace generator procedure is started to verify the flow of logic or identify bottlenecks within an application:

```
...
# run through boot instructions in turbo mode
mysim mode turbo

# advance to specific point in the boot process
mysim cycle 160000000

# now turn on simple mode and enable some simdebugs
mysim mode simple
simdebug set mem_refs 1
...
```

3.18.5 Related Commands

- {machine} step on page 107
- {machine} tick on page 110

3.19 {machine} display cycles

The *{machine}* **display cycles** command displays the current cycle count.

3.19.1 Tcl Syntax

```
machine display cycles
```

3.19.2 Description

The *{machine}* **display cycles** command displays the current cycle count. Output from this command is easily captured and directly passed as input in Tcl scripts to track the number of cycles that an application or process has run.

3.19.3 Examples

Display the cycle count after advancing the simulator 10 cycles with the *{machine}* **cycle** command:

```
mysim cycle 10
```

The simulator advances by the specified number of cycles, after which the *{machine}* **display cycles** command can be used to view how many cycles have elapsed:

```
mysim display cycles
```

The simulator summarizes the count as follows:

```
10
```

3.19.4 Related Commands

- {machine} cycle on page 72

3.20 {machine} display features

The *{machine}* **display features** command displays common features enabled in the simulation system.

3.20.1 Tcl Syntax

```
machine display features
```

3.20.2 Description

The *{machine}* **display features** command displays a summary of features that are enabled in the simulation system. The following features are available:

FLOATING_POINT	Indicates that floating-point instructions are enabled.
VMX	Indicates that the VMX instruction set is supported.
VSX	Indicates that the VSX instruction set is supported.
HTM	Indicates that hardware transactional memory is supported.
RADIX_MMU	Indicates that Radix address translation is supported.

3.20.3 Examples

Check which features are enabled for the **mysim** simulation machine:

```
mysim display features
```

The following features are displayed for this machine:

```
FLOATING_POINT VMX VSX HTM RADIX_MMU
```

3.21 {machine} display fpr, fpr_as_fp, fprs

The *{machine}* **display fpr**, **display fpr_as_fp**, and **display fprs** commands display either the contents of a specified floating-point register or the contents of all floating-point registers

3.21.1 Tcl Syntax

```
machine display fpr number
machine display fpr_as_fp number
machine display fprs
```

3.21.2 Description

The *{machine}* **display fpr** command displays the contents of the specified floating-point register in hexadecimal format. The **display fprs** command displays the contents of all the floating-point registers in hexadecimal format. The **display fpr_as_fp** command displays the contents of the specified floating-pint register in scientific floating-point format. That is:

```
systemsim % mysim cpu 0:0 set fpr 0 0x44400000200
0x0000044400000200
systemsim % mysim cpu 0:0 display fpr 0
0x0000044400000200
systemsim % mysim cpu 0:0 display fpr_as_fp 0
2.3172194E-311
```

3.21.3 Arguments

number	Identifies the floating-point register whose contents are to be displayed.

3.21.4 Examples

1. Display the contents of FPR 1 as a hexadecimal number:

   ```
   systemsim % mysim display fpr 1
   ```

   The following content is displayed:

   ```
   0x3FD8C076BB3180ED
   ```

2. Display the contents of FPR 1 in scientific floating-point format:

   ```
   systemsim % mysim display fpr_as_fp 1
   ```

   The following content is displayed:

   ```
   0.38674706
   ```

3. Display the contents of all floating-point registers as hexadecimal numbers:

   ```
   systemsim % mysim display fprs
   ```

   The following content is displayed:
   ```
   0 3fd0000000000000
   ```

```
 1 3fd8c076bb3180ed
 2 3fdf3326c8be664e
 3 0000000000000000
 4 0000000000000000
 5 0000000000000000
 6 00000000100aa470
 7 00000000100aa490
 8 0000000000000000
 9 0000000000000000
10 3fdf3326c8be664e
11 bf899b26e8333640
12 3f8a9698c2914998
13 0000000000000000
14 0000000000000000
15 0000000000000000
16 0000000000000000
17 0000000000000000
18 0000000000000000
19 0000000000000000
20 0000000000000000
21 0000000000000000
22 0000000000000000
23 0000000000000000
24 0000000000000000
25 0000000000000000
26 0000000000000000
27 0000000000000000
28 0000000000000000
29 0000000000000000
30 0000000000000000
31 0000000000000000
```

3.22 {machine} display gpr, gprs

The *{machine}* **display gpr** and **display gprs** commands display either the contents of a specified general-purpose register (GPR) or the contents of all general-purpose registers. If you assigned an alias to a GPR, you can use that alias in this command instead of the number of the register.

3.22.1 Tcl Syntax

machine **display gpr** *number* | *value*
machine **display gprs**

3.22.2 Description

The *{machine}* **display gpr** and **display gprs** commands display the contents of the specified general-purpose register or the contents of all the general-purpose registers.

3.22.3 Arguments

number	Identifies the general-purpose register whose contents are to be displayed.
value	A previously assigned alias that identifies the general-purpose register whose contents are to be displayed.

3.22.4 Examples

1. Display the contents of GPR 5:

   ```
   systemsim % mysim display gpr 5
   ```

   The following content is displayed:

   0x0000000000005000

2. If you previously assigned the alias “count_reg” to GPR 5, you can also use the following command to display the contents of GPR5:

   ```
   systemsim % mysim display gpr count_reg
   ```

   The following content is displayed:

   ```
   0x0000000000005000
   ```

3. Display the contents of all general-purpose registers:

   ```
   systemsim % mysim display gprs
   ```

   The following content is displayed:

   ```
   0 0000000000009ff8
   1 0000000000021d80
   2 00000000000280c8
   3 000000000000002c
   4 0000000000021df8
   5 000000000000002c
   ```

```
 6 0000000000031000
 7 0000000000031000
 8 0000000000030000
 9 000000000000002c
10 0000000000000000
11 0000000000000000
12 0000000000000000
13 0000000000055100
14 0000000000000000
15 0000000000000000
16 0000000000000000
17 0000000000000000
18 0000000000000000
19 0000000000000000
20 0000000000004540
21 0000000000000000
22 b000000130003002
23 0000000000004380
24 0000000000000200
25 0000000000000000
26 0000000000000000
27 0000000000000000
28 0000000000000000
29 0000000000000000
30 0000000000000000
31 0000000000021cf0
```

3.23 {machine} display instruction_count

The *{machine}* **display instruction_count** command displays the current instruction count.

3.23.1 Tcl Syntax

```
machine display instruction_count
```

3.23.2 Description

The *{machine}* **display instruction_count** displays the current instruction count. Output from this command is easily captured and directly passed as input in Tcl scripts to track the number of instructions that an application or process has run.

3.23.3 Examples

Display the instruction count after advancing the simulator 1000 cycles with the *{machine}* **cycle** command:

```
mysim cycle 1000
```

The simulator advances by the specified number of cycles, after which the *{machine}* **display instruction_count** command can be used to view how many instructions have elapsed:

```
mysim display instruction_count
```

The simulator displays the count as follows:

```
1001
```

3.23.4 Related Commands

- {machine} cycle on page 72
- {machine} display cycles on page 73

3.24 {machine} display memory_size

The *{machine}* **display memory_size** command returns the memory size used for the current configuration.

3.24.1 Tcl Syntax

```
machine display memory_size
```

3.24.2 Description

The *{machine}* **display memory_size** command returns the memory size used for the current configuration. The default size is 0x0000000040000000.

3.24.3 Examples

Display the memory size:

```
mysim display memory_size
```

The simulator returns the size as follows:

```
0x0000000040000000 #This equates to 1 GB of memory
```

3.24.4 Related Commands

- {machine} display cycles on page 73

3.25 {machine} display memorymap

The *{machine}* **display memorymap** command displays information about the memory map configuration.

3.25.1 Tcl Syntax

machine `display memorymap` *?format_type?*

3.25.2 Description

The *{machine}* **display memorymap** command displays a memory map that contains information about the start and end addresses for the memory, ROM, and PIC components.

3.25.3 Arguments

format_type (Optional) Specifies the format type for listing memory map information. The following *format_type* options are available:

- *active:* Generates command output in tabular format where information about the start and end addresses for memory, ROM, and PIC resources is listed. If a *format_type* is not specified with the command, the *active* option is the default display type.
- *listformat:* Presents the command output in a format that can be easily captured and directly passed as input in Tcl scripts.

3.25.4 Examples

1. View a memory map for the simulation in the default format:

   ```
   mysim display memorymap
   ```

   The simulator displays the mapping, as follows:

   ```
   NAME:      MEMORY START: 0x0000000000000000 END:0x0000000003FFFFFF
   NAME:      ROM START: 0x00000000F0000000 END:0x00000000F000007F
   NAME:      PIC START: 0x00000000FFC00000 END:0x00000000FFC3FFFF
   ```

2. View a memory map for the simulation in list format:

   ```
   mysim display memorymap listformat
   ```

   The simulator displays the mapping, as follows:

   ```
   {NAME {MEMORY} START 0x0000000000000000 END 0x0000000003FFFFFF} { {ROM} START
   0x00000000F0000000 END 0x00000000F000007F} { {PIC} START 0x00000000FFC00000 END
   0x00000000FFC3FFFF}
   ```

3.25.5 Related Commands

- {machine} memory display on page 97

3.26 {machine} display nfpr, ngpr, mode, name

The *{machine}* **display nfpr**, **display ngpr**, **display mode**, and **display name** commands are useful for tcl control scripts. The information returned contains the number of floating-point (nfpr) or general-purpose (ngpr) registers in the model, what mode (simple or turbo), and what name is in use for the configured machine.

3.26.1 Tcl Syntax

***machine* display nfpr**
***machine* display ngpr**
***machine* display mode**
***machine* display name**

3.26.2 Description

The *{machine}* **display nfpr** command displays the number of floating-point registers. The **display ngpr command** displays the number of general-purpose registers. The **display mode** command indicates wheter the configured machine is operating in the simple or turbo mode. The **display name** command indicates what name is used for the configured machine.

3.26.3 Examples

1. Display the number of floating-point registers:

   ```
   systemsim % mysim display nfpr
   ```

   The following content is displayed:

   ```
   32
   ```

2. Display the number of general-purpose registers:

   ```
   systemsim % mysim display ngpr
   ```

   The following content is displayed:

   ```
   32
   ```

3. Display the mode of the configured machine:

   ```
   systemsim % mysim display mode
   ```

   The following content is displayed:

   ```
   Simulator is in mode SIMPLE
   ```

4. Display the name of the configured machine:

   ```
   systemsim % mysim display name
   ```

   The following content is displayed:

   ```
   machine name is mysim
   ```

3.27 {machine} display number_of_MCMs

The *{machine}* **display number_of_MCMs** command displays the number of MCMs in the system.

3.27.1 Tcl Syntax

```
machine display number_of_MCMs
```

3.27.2 Description

The *{machine}* **display number_of_MCMs** command displays an integer that represents the number of MCMs that are currently configured in the simulation. The output of this command can be easily captured and directly passed as input in Tcl scripts.

3.27.3 Examples

Display the number of MCMs in the simulation system:

```
mysim display number_of_MCMs
```

The following output is displayed:

```
1
```

3.28 {machine} display slb, spr, tm, vmx, vmxr, vsxr

The **display slb**, **display spr**, **display vmx**, **display vmxr**, and **display vsxr** commands can be used to display segment-lookaside buffer (slb) translations, special purpose register (spr) values, and vector registers. For vector registers, you can display the information in vector format; you must specify the register number and the number of bytes per vector. You can also display vector registers in the full 128-bit register format.

3.28.1 Tcl Syntax

machine **display slb** *number | valid | all*
machine **display spr** *name | list | values*
machine **display vmx** r*eg-num size*
machine **display vmxr** *reg-num*
machine **display vsxr** *reg-num*

3.28.2 Description

The *{machine}* **display slb**, **display spr**, **display vmx**, **display vmxr**, and **display vsxr** commands display the contents of the specified slb, spr, vector registers, and vector scaler registers.

3.28.3 Arguments

number	Identifies the SLB register whose contents are to be displayed.
valid	Indicates that only SLB entires that contain valid virtual-to-effective address mappings are to be displayed. An SLB entry is valid if the V bit is set.
all	Indicates that all the SLB registers are to be displayed.
name	Specifies the name of the SPR whose contents are to be displayed.
list	Requests a list of the names of all the SPRs supported in the model. Note that there are over 1,000 SPRs for the POWER9 model.
values	Requests a list of every SPR supported in the model and the current contents of each SPR.
reg-num	Specifies the register number of the vector register.
size	Specifies the number of bytes per vector.

3.28.4 Examples

1. Display the contents of every valid SLB register.

   ```
   systemsim % mysim display slb valid
   ```

   The following content is displayed:

   ```
   #        VSID                ESID       Ks Kp N  L  C  V  LP B
    0 0x0000408F92C94000 0xC000000000000000 0  1  0  1  0  1  0  0
   ```

```
 1 0x0000F09B89AF5000 0xD000000000000000 0  1  0  0  0  1  0  0
 9 0x000050B3777B9000 0xF000000000000000 0  1  0  0  0  1  0  0
19 0x0000B986C02FD000 0x0000000000000000 1  1  0  0  1  1  0  0
20 0x0000C4BE37E92000 0x00000000F0000000 1  1  0  0  1  1  0  0
21 0x0000BC8479B69000 0x0000000040000000 1  1  0  0  1  1  0  0
22 0x0000BA462E918000 0x0000000010000000 1  1  0  0  1  1  0  0
23 0x0000272901DA2000 0x00000FFFF0000000 1  1  0  0  1  1  0  0
```

2. Display the SPR named “pc.”

   ```
   systemsim % mysim display spr pc
   ```

   The following content is displayed:

   ```
   0x0000000000000100
   ```

3. Display VMX vector register 0 in vector format. There are 8 bytes per register.

   ```
   systemsim % mysim display vmx 0 8
   ```

   The following content is displayed:

   ```
   0x0000000000004500, 0x0000000000987600
   ```

4. Display VMX vector register 0 in the full 128-bit format.

   ```
   systemsim % mysim display vmxr 0
   ```

   The following content is displayed:

   ```
   0x00000000000045000000000000987600
   ```

5. Display VSX vector register 2.

   ```
   systemsim % mysim display vsxr 2
   ```

   The following content is displayed:

   ```
   0x00000000000000000345600001000000
   ```

3.29 {machine} dtranslate

The *{machine}* **dtranslate** command translates addresses for data loads and stores.

3.29.1 Tcl Syntax

machine `dtranslate` *address*

3.29.2 Description

The *{machine}* **dtranslate** command translates an effective address to a real address for data loads and stores. This command is only useful if address translation is active. In addition, the value used as the *address* argument must be a valid EA.

3.29.3 Arguments

address	Specifies the address to be translated.

3.29.4 Examples

The following *{machine}* **dtranslate** command translates the 0x00003FFFC2D476E0 effective address to the corresponding real address:

```
mysim dtranslate 0x00003FFFC2D476E0
```

The simulator displays the following result for this translation:

```
0x000000006EFE76E0
```

3.29.5 Related Commands

{machine} itranslate on page 91

3.30 {machine} exit

The *{machine}* **exit** command removes a machine from the simulation environment.

3.30.1 Tcl Syntax

```
machine exit
```

3.30.2 Description

The *{machine}* **exit** command permanently removes the specified simulation machine from the simulation environment and returns to the **systemsim %** command-line prompt. The *{machine}* **exit** command performs the same operation as the *{machine}* **quit** command. The **define machine** command can be used to create a new simulation machine.

3.30.3 Examples

Remove the **mysim** machine from the simulation environment:

```
mysim exit
```

3.30.4 Related Commands

- define machine on page 44
- {machine} quit on page 103

3.31 {machine} go

The *{machine}* **go** command starts running a machine in simulation.

3.31.1 Tcl Syntax

machine go

3.31.2 Description

The *{machine}* **go** command causes the simulated machine to advance its state indefinitely. The simulation continues until a stop condition is reached, which can include any of the following:

- Typing **CTRL+C** to interrupt a running simulation. The POWER9 Functional Simulator halts the simulation and returns to the **systemsim %** command-line prompt.
- An error condition that is encountered during simulation
- No processor activity occurs for three seconds after advancing the machine.

3.31.3 Examples

The following command starts the **mysim** machine:

```
mysim go
```

3.32 {machine} interrupt

The *{machine}* **interrupt** command schedules an interrupt of a given interrupt type.

3.32.1 Tcl Syntax

machine interrupt *interrupt_type*

3.32.2 Description

The *{machine}* **interrupt** command forces an exception (typically, a synchronous interrupts) of the given type to be raised. When the simulator subsequently is run, it performs actions defined by the core architecture to service the specified exception (that is, save machine state in appropriate registers, vector to the associated exception handler code location, and so on). This command is intended as a convenient mechanism to raise exceptions artificially, for the purposes of debugging exception handlers.

3.32.3 Arguments

interrupt_type Specifies the type of interrupt to be performed during a simulation. Many types of exceptions can be scheduled, including:

AlignmentException

DataStoragePageFault

DataStorageProtection

DataStorageReservationWithWriteThrough

DataStorageSegmentFault dar_value

Decrementer

External (msi|raise|lower)

FPUnavailable

HMI

HV_Decrementer

HV_Virtualization

HvSystemCall

IllegalInstruction

InstStorageG1

IPI

MachineCheck

MER

PerfMonitor

PreciseMachineCheck

PrivilegedInstruction

SystemCall

SystemError

SystemReset

TrapInstruction

VMX_Assist

VMXUnavailable

If the **interrupt** command is issued without the *interrupt_type* argument, it lists all available exception types.

3.32.4 Examples

Force a load address alignment exception. The simulator is run afterwards, in order for the exception handling to take place:

```
mysim interrupt AlignmentException Load
```

3.33 {machine} itranslate

The *{machine}* **itranslate** command translates instruction addresses from an effective address to a real address.

3.33.1 Tcl Syntax

machine `itranslate` *address*

3.33.2 Description

The *{machine}* **itranslate** command translates an effective address to a real address for instructions. This command is only useful if address translation is active. In addition, the value used as the *address* argument must be a valid EA.

3.33.3 Arguments

address	Specifies the address to be translated.

3.33.4 Examples

The following *{machine}* **itranslate** command translates the 0x00000000101ECAB4 effective address to the corresponding real address:

```
mysim itranslate 0x00000000101ECAB4
```

The simulator displays the following result for this translation:

```
0x000000006D00CAB4
```

3.33.5 Related Commands

- {machine} dtranslate on page 86

3.34 {machine} load elf

The *{machine}* **load elf** command loads an ELF file into simulation memory.

3.34.1 Tcl Syntax

machine `load elf` *`filename`*

3.34.2 Description

The *{machine}* **load elf** command loads a properly formatted Executable and Linking Format (ELF) file into the memory of the simulated machine. Executing this command sets the initial PC and stack pointer for the program, and turns on **cpu 0**.

3.34.3 Arguments

`filename`	Specifies the name of the ELF file to load.

3.34.4 Examples

Load the **myprog.elf** executable into memory:

```
mysim load elf /tmp/myprog.elf
```

3.34.5 Related Commands

- {machine} load linux on page 93
- {machine} load vmlinux on page 94
- {machine} load xcoff on page 95

3.35 {machine} load linux

The *{machine}* **load linux** command loads a Linux image into simulation memory.

3.35.1 Tcl Syntax

machine `load linux` *`filename`*

3.35.2 Description

The *{machine}* **load linux** command loads a properly created Linux boot image into the memory of the simulated machine. Executing this command sets the initial PC and stack pointer for the program, and turns on **cpu 0**.

3.35.3 Arguments

`filename`	Specifies the name of the Linux image to load.

3.35.4 Examples

Load the **zImage.initrd.treeboot Linux** image into memory:

```
mysim load linux zImage.initrd.treeboot
```

3.35.5 Related Commands

- {machine} load elf on page 92
- {machine} load vmlinux on page 94
- {machine} load xcoff on page 95

3.36 {machine} load vmlinux

The *{machine}* **load vmlinux** command loads a vmlinux image into simulation memory.

3.36.1 Tcl Syntax

```
machine load vmlinux filename address
```

3.36.2 Description

The *{machine}* **load vmlinux** command loads a Linux kernel image into the memory of the machine. The vmlinux kernel is a modified Linux kernel that has been developed to simulate the process of loading and transferring control to the operating system kernel software. The vmlinux kernel essentially acts as a boot loader (**lilo/grub**) in a regular system. The *{machine}* **load vmlinux** command loads the modified kernel image into the memory of the simulated machine. Executing this command sets the initial PC and stack pointer for the program, and turns on **cpu 0.**

3.36.3 Arguments

filename	Specifies the name of the **vmlinux** file to load.
address	Specifies the physical address in memory where the image should be loaded.

3.36.4 Examples

Load the **vmlinux_2.6.7** kernel image file into memory address **0**:

```
mysim load vmlinux $IMAGE_PATH/vmlinux_2.6.7 0
```

3.36.5 Related Commands

- {machine} load elf on page 92
- {machine} load linux on page 93
- {machine} load xcoff on page 95

3.37 {machine} load xcoff

The *{machine}* **load xcoff** command loads the contents of an XCOFF file into simulation memory.

3.37.1 Tcl Syntax

machine `load xcoff` *`filename`*

3.37.2 Description

The *{machine}* **load xcoff** command loads a properly formatted XCOFF file into the memory of the simulated machine. Executing this command sets the initial PC and stack pointer for the program, and turns on **cpu 0**.

3.37.3 Arguments

`filename`	Specifies the name of the **xcoff** file to load.

3.37.4 Examples

Load the **XCOFF** file into memory:

```
mysim load xcoff /tmp/myobject.x
```

3.37.5 Related Commands

- {machine} load elf on page 92
- {machine} load linux on page 93
- {machine} load vmlinux on page 94

3.38 {machine} mcm

The *{machine}* **mcm** command enables simulator commands to be called on the specified MCM.

3.38.1 Tcl Syntax

machine mcm *mcm_number simulator_command*

3.38.2 Description

The POWER9 Functional Simulator is designed to simulate a system in which more than one multichip module (MCM) can run its multiple, separate processors. The *{machine}* **mcm** command is a wrapper command that runs a subset of simulator commands on the MCM that is specified by *mcm_number*. To view a complete list of MCM-related commands, type *{machine}* **mcm** at the simulator command line.

For example, the *{machine}* **mcm** *mcm_number* **memory fread** command enables users to copy the specified number of bytes from the specified input source into the given memory address.

3.38.3 Arguments

mcm_number	Specifies the name of the MCM on which the command operation (defined by the *simulator_command* input) is performed.
simulator_command	Specifies the command input that is run on the specified MCM.

3.38.4 Examples

On mcm 0, read a specified number of bytes from a specified file to the specified location in memory.

```
mysim mcm 0 memory fread 0x100 1024 bootfile
```

3.38.5 Related Commands

- {machine} cpu on page 71
- {machine} thread on page 109

3.39 {machine} memory display

The *{machine}* **memory display** command displays memory addresses.

3.39.1 Tcl Syntax

```
machine memory display address unit_size ?repeat_count?
machine memory display address STRING
```

3.39.2 Description

The *{machine}* **memory display** command provides two display options for viewing memory resources. The first command displays a sequence of memory addresses starting at a given address based on a specified unit size. The unit size can be represented in bytes, halfwords (two bytes), words (four bytes), or doublewords (eight bytes).

The second *{machine}* **memory display** command returns the character that corresponds to a memory address. This command is useful for verifying whether the character that occurs at a given address matches the expected output: for example, when developing applications.

3.39.3 Arguments

address	Specifies the physical address where the display will begin.
unit_size	Specifies the size of each unit, where: 1 Displays the address as a byte. 2 Displays the address as a halfword. 4 Displays the address as a word. 8 Displays the address as a doubleword.
repeat_count	(Optional) Specifies the number of units to display. If a count is not specified, the repeat count is 1 by default.
STRING	Specifies that the command will display the character that corresponds to a memory address. The literal STRING option (all capital letters) must be passed.

3.39.4 Examples

1. Assume that your program previously wrote data to memory location 0x00B60C - 0x00B660. Display the sequence of memory addresses starting at 0x00B60C repeated 20 times in word format:

   ```
   mysim memory display 0x00B60C 4 20
   ```

   The output of this command results in the following:

   ```
   0x28250000      0x40820038      0x7C7F1B78      0x7C9E238
   0x4800070D      0x4801B3B5      0x3B000000      0x3C80000
   0x60840000      0x788407C6      0x64840000      0x6084B60
   0x7C84F214      0x4BFFFFA9      0x4800005C      0x7C7F1B8
   0x7C9E2378      0x7CBD2B78      0x7CDC3378      0x7CFB3B78
   ```

2. Display the characters that corresponds to the memory address. Assume that the memory location starting at 0x100 contains the hex digits 0x32333425.

   ```
   mysim memory display 100 STRING
   ```

   The output of this command results in the following:

   ```
   234%
   ```

3. Using the same example data set that was used in example 1, display the memory address occurring after 0x00B60C in doubleword format:

   ```
   mysim memory display 0x00B60C 8
   ```

   The output of this command results in the following:

   ```
   0x2825000040820038
   ```

4. Using the same example data set that was used in example 1 again, display the sequence of memory addresses starting at 0x00B60C repeated 18 times in byte format:

   ```
   mysim memory display 0x00B60C 1 18
   ```

   The output of this command results in the following:

   ```
   0x28 0x25 0x00 0x00 0x40 0x82 0x00 0x38 0x7C 0x7F 0x1B 0x78 0x7C 0x9E 0x23 0x78 0x48 0x00
   ```

3.39.5 Related Commands

- {machine} memory fread, freadcmp, freadgz on page 99
- {machine} memory fwrite, fwritecmp, fwritegz on page 100
- {machine} memory set on page 101

3.40 {machine} memory fread, freadcmp, freadgz

The *{machine}* **memory fread, memory freadcmp,** and **memory freadgz** commands read directly from a file into memory.

3.40.1 Tcl Syntax

```
machine memory fread address number_of_bytes filename
machine memory freadcmp address number_of_bytes_to_read compressed-filename
machine memory freadgz address number_of_bytes_to_read compressed-filename
```

3.40.2 Description

The *{machine}* **memory fread** command implements the **Unix fread()** function. This command reads the specified number of bytes from the specified input source into the given memory address. See the “man” page on your Linux system for general information about **fread** command functionality.

The **freadcmp** and **freadgz** commands allow for use of compressed files.

3.40.3 Arguments

address	Specifies the physical address into which data from the input is read.
number_of_bytes	Specifies the number of bytes to read.
filename	Specifies the name of the input file that contains the data to read into memory.

3.40.4 Examples

Read data from the **saved_memory** input source into the 0x0 memory address:

```
mysim memory fread 0x0 0x4000 saved_memory
```

3.40.5 Related Commands

- {machine} memory display on page 97
- {machine} memory fwrite, fwritecmp, fwritegz on page 100
- {machine} memory set on page 101

3.41 {machine} memory fwrite, fwritecmp, fwritegz

The *{machine}* **memory fwrite, fwritecmp**, and **fwritegz** commands write directly from memory into an output file.

3.41.1 Tcl Syntax

```
machine memory fwrite address number_of_bytes filename append
machine memory fwritecmp address number_of_bytes_to_read compressed-filename
machine memory fwritegz address number_of_bytes_to_read compressed-filename
```

3.41.2 Description

The *{machine}* **memory fwrite** command implements the Unix **fwrite()** function. This command writes the specified number of bytes from the specified memory address into the output file. See the “man” page on your Linux system for general information about **fwrite** command functionality.

The **fwritecmp** and **fwritegz** commands allow for use of compressed files.

3.41.3 Arguments

address	Specifies the physical address from which data is read.
number_of_bytes	Specifies the number of bytes to read.
filename	Specifies the name of the output file into which data from memory is written.
append	Specifies that this write should be appended to the existing file.

3.41.4 Examples

Write data from the 0x0 memory address into the **saved_memory** output file:

```
mysim memory fwrite 0x0 0x4000 saved_memory
```

3.41.5 Related Commands

- {machine} memory display on page 97
- {machine} memory fread, freadcmp, freadgz on page 99
- {machine} memory set on page 101

3.42 {machine} memory set

The *{machine}* **memory set** command sets the memory address to a specified value.

3.42.1 Tcl Syntax

machine memory set *address unit_size 64-bit_value*

3.42.2 Description

The *{machine}* **memory set** command sets a small section of memory to the given value based on a specified size of memory (the unit size). The unit size can be represented in bytes, halfwords (two bytes), words (four bytes), or doublewords (eight bytes).

3.42.3 Arguments

address	Specifies the physical memory address to be written.
unit_size	Specifies the number of bytes to be written, where: 1 Represents a byte of memory. 2 Represents a halfword of memory. 4 Represents a word of memory. 8 Represents a doubleword of memory.
64-bit_value	Specifies the value to be written into the memory address.

3.42.4 Examples

Set the memory address at 0x40562 to the 0x0003C00 64-bit value:

```
mysim memory set 0x40562 4 0x00003C00
```

Set the memory address at 0x40562 to the 0x00503D6020C43D40 64-bit value:

```
mysim memory set 0x40562 8 0x00503D6020C43D40
```

3.42.5 Related Commands

- {machine} memory display on page 97
- {machine} memory fread, freadcmp, freadgz on page 99
- {machine} memory fwrite, fwritecmp, fwritegz on page 100

3.43 {machine} mode

The *{machine}* **mode** command sets the simulator execution mode.

3.43.1 Tcl Syntax

machine mode *mode_selection*

3.43.2 Description

The *{machine}* **mode** command is used to switch from simple mode to turbo mode. In simple mode, one instruction is decoded or executed at a time. Simple mode maintains architectural correctness at the register level, which can be useful for debugging complex problems. In turbo mode, multiple instructions are decoded and dynamically converted to host system instructions. Then, the instructions are executed in a large block. Turbo mode is faster. It is typically used for booting an operating system and running application code or for fast forwarding a simulation run for millions of cycles to quickly get to the area of interest.

3.43.3 Arguments

mode_selection	Specifies simple or turbo mode.

3.43.4 Examples

1. Set the simulator execution mode to simple:

   ```
   mysim mode simple
   ```

2. Set the simulator execution mode to turbo:

   ```
   mysim mode turbo
   ```

3.44 {machine} quit

The *{machine}* **quit** command removes a machine from the simulation environment.

3.44.1 Tcl Syntax

```
machine quit
```

3.44.2 Description

The *{machine}* **quit** command permanently removes the specified simulation machine from the simulation environment and returns to the **systemsim %** command-line prompt. The *{machine}* **quit** command performs the same operation as the *{machine}* **exit** command. The **define machine** command can be used to create a new simulation machine.

3.44.3 Examples

Remove the **mysim** machine from the simulation environment:

```
mysim quit
```

3.44.4 Related Commands

- define machine on page 44
- {machine} exit on page 87

3.45 {machine} setargs

The *{machine}* **setargs** command passes command-line arguments to standalone applications.

3.45.1 Tcl Syntax

machine setargs *arguments_list*

3.45.2 Description

The *{machine}* **setargs** command passes command-line arguments to standalone applications. The command determines the number of arguments that are being passed and the amount of address space that is needed to store the arguments. It allocates this amount of space in the data segment before the first text segment, and places the values or references in the newly allotted space. The contents of GPR[3] and GPR[4] are modified accordingly.

3.45.3 Arguments

arguments_list	Enumerates the list of arguments that are passed to the application.

3.45.4 Examples

The following sample lines of code added in a Tcl setup file pass an argument to a standalone ELF image. The CPU number is specified with the *{machine}* **setargs** command:

```
.
.
.
# load the application image and pass arguments
mysim load elf $IMAGES/my_machine/standalone/elf_program.img
mysim cpu 0 setargs 32769
.
.
.
 mysim go
```

3.45.5 Related Commands

- {machine} cpu on page 71
- {machine} load elf on page 92
- {machine} load linux on page 93
- {machine} load vmlinux on page 94
- {machine} load xcoff on page 95

3.46 {machine} stall

The *{machine}* **stall** command stops the processor component.

3.46.1 Tcl Syntax

```
machine stall
```

3.46.2 Description

The *{machine}* **stall** command controls the state of the default processor (CPU 0) by putting the processor in the stall state. This command is the opposite of the *{machine}* **config_on** command operation. In hardware, this operation is generally implemented by executing a halt instruction or by moving a mode bit in the processor's Machine State Register (MSR). The *{machine}* **stall** command is useful for dynamically switching off a processor. For example, it can be used when a standalone application, which has been running in a multiprocessor environment, needs to validate functionality on a single-processor system. In this case, the **stall** command can be issued for the CPU that must be stopped (that is, **mysim cpu 1 stall** to stop CPU 1).

3.46.3 Examples

In a machine with a single processor, stall the processor:

```
mysim stall
```

The following message is displayed to confirm that the processor has stopped:

```
Thread 0:0:0 stalled
CPU 0:0 stalled
```

3.46.4 Related Commands

- {machine} config_on on page 62
- {machine} cpu on page 71

3.47 {machine} start_thread

The *{machine}* **start_thread** command starts a thread.

3.47.1 Tcl Syntax

machine `start_thread` *PC_address*

3.47.2 Description

The *{machine}* **start_thread** command has a single parameter that enables the user to specify the starting address for thread execution.

3.47.3 Arguments

PC_address	Specifies the starting address for thread execution.

3.47.4 Related Commands

- {machine} stop_thread on page 108

3.48 {machine} step

The *{machine}* **step** command advances the simulator by a specified number of instructions.

3.48.1 Tcl Syntax

machine step *number_of_steps*

3.48.2 Description

The *{machine}* **step** command advances the simulated machine by a specified number of instructions. Although this command is sometimes used for quickly forwarding the simulator to a specific point in the simulation, the *{machine}* **cycle** and *{machine}* **tick** commands are more commonly used to advance the system.

3.48.3 Arguments

number_of_steps Specifies the number of instructions to advance the machine.

3.48.4 Examples

Advance the simulator by 10000 steps:

```
mysim step 10000
```

3.48.5 Related Commands

- {machine} cycle on page 72
- {machine} tick on page 110

3.49 {machine} stop_thread

The *{machine}* **stop_thread** command stops a thread.

3.49.1 Tcl Syntax

```
machine stop_thread
```

3.49.2 Description

The *{machine}* **stop_thread** command enables the user to stop thread execution.

3.49.3 Related Commands

- {machine} start_thread on page 106

3.50 {machine} thread

The *{machine}* **thread** command enables simulator commands to be called on the specified thread.

3.50.1 Tcl Syntax

machine thread *thread_number simulator_command*

3.50.2 Description

The POWER9 Functional Simulator is designed to simulate a system in which one or more processors can run multiple threads on a multichip module (MCM). The *{machine}* **thread** command is a wrapper command that runs a subset of simulator commands on the thread that is specified by *thread_number*. To view a complete list of thread-related commands, type *{machine}* **thread** at the simulator command line.

For example, the *{machine}* **mcm** *mcm_number* **cpu** *cpu_number* **thread** *thread_number* **stall** command stalls the selected thread on the selected core and MCM.

3.50.3 Arguments

thread_number	Specifies the name of the thread on which the command operation (defined by the *simulator_command* input) is performed.
simulator_command	Specifies the command input that is run on the specified thread.

3.50.4 Examples

Change the state of thread 0 running on CPU 0, located on MCM 0 to the stall state.

```
mysim mcm 0 cpu 0 thread 0 stall
```

The simulator prints out the following message:

```
Thread 0:0:0 stalled

CPU 0:0 stalled
```

3.50.5 Related Commands

- {machine} cpu on page 71
- {machine} mcm on page 96

3.51 {machine} tick

The *{machine}* **tick** command advances the simulator by a specified number of ticks.

3.51.1 Tcl Syntax

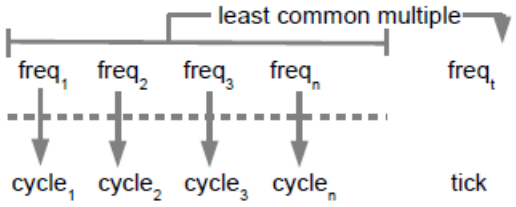
```
machine tick number_of_ticks
```

3.51.2 Description

The *{machine}* **tick** command advances the simulated machine by a specified number of ticks. In the simulation environment, a tick is a unifying representation of time as a function of the collective frequencies in the simulation system. In real systems, individual components probably have different perceptions of time based on their individual time domains. A time domain defines a frequency that sets the duration of a cycle. Events in a time domain are expressed in terms of its frequency cycles. In a simulation, time domains are encapsulated and declared as rational values relative to a base frequency. In this approach, each component can declare its own time domain to define its perception of time.

Figure 3-1 illustrates the relationship between the computation of a tick value and frequency cycles in the system.

Figure 3-1. Calculating Ticks in the System



To calculate the value of a tick, the simulator computes the least common multiple of the frequencies in the system. Then, for example, if a system contains n number of components whose frequencies are defined as: *freq1* = 2 GHz, *freq2* = 4 GHz, *freq3* = 6 GHz, and *freqn* = 12 GHz, then one tick in this simulated system represents 1/12,000,000 of a second.

3.51.3 Arguments

number_of_ticks	Specifies the number of ticks to advance the machine.

3.51.4 Examples

Advance the simulator by 10000 ticks:

```
mysim tick 10000
```

3.51.5 Related Commands

- {machine} cycle on page 72
- {machine} step on page 107

3.52 {machine} to_cycle

The *{machine}* **to_cycle** command advances the simulator to a specified point in the simulation.

3.52.1 Tcl Syntax

machine to_cycle *number*

3.52.2 Description

The *{machine}* **to_cycle** command advances the simulated machine to the specified point in the simulation. This command is useful for forwarding a simulation to a specific point, such as for debugging an application issue.

3.52.3 Arguments

number	Specifies the point in the simulation to advance the machine.

3.52.4 Examples

The following sample code illustrates example Tcl steps used to advance a simulation in fast mode to a given point in the simulation:

```
...
# advance to specific point in boot process
 mysim to_cycle 160000000

# now enable some simdebugs
simdebug set mem_refs 1
...
```

3.52.5 Related Commands

- {machine} cycle on page 72
- {machine} step on page 107
- {machine} tick on page 110

3.53 {machine} util dtranslate

The *{machine}* **util dtranslate** command translates the effective address given to a real address as a data reference.

3.53.1 Tcl Syntax

machine `util dtranslate` *address*

3.53.2 Description

The *{machine}* **util dtranslate** command translates the effective address given to a real address as a data reference. The translation uses the DERAT (if there is one) and DTLBs (if there are both instruction and data TLBs).

3.53.3 Arguments

address	Specifies a 32-bit or 64-bit effective address to be translated.

3.53.4 Examples

Translate the 0x145772 effective address to a real address:

```
mysim util dtranslate 0x145772

0x00000000c04567f0
```

3.53.5 Related Commands

- {machine} util itranslate on page 114

3.54 {machine} util dtranslate_wimg

The *{machine}* **util dtranslate_wimg** command translates the effective address given to a real address as a data reference. It also shows the WIMG bits associated with the address provided for translation, where:

W Write through

I Caching inhibited

M Memory coherency required

G Guarded

3.54.1 Tcl Syntax

machine `util dtranslate_`**wimg** *address*

3.54.2 Description

The *{machine}* **util dtranslate_wimg** command translates the effective address given to a real address as a data reference. The translation uses the DERAT (if there is one) and DTLBs (if there are both instruction and data TLBs). The command also shows the WIMG bits associated with the address provided for translation.

3.54.3 Arguments

address	Specifies a 32-bit or 64-bit effective address to be translated.

3.54.4 Examples

Translate the 0x4328 effective address to a real address and show the WIMG bits:

```
mysim util dtranslate_wimg 0x4328

0x00

systemsim % mysim util dtranslate 0x4038

0x0000000000004038
```

3.54.5 Related Commands

- {machine} util itranslate on page 114

3.55 {machine} util itranslate

The *{machine}* **util itranslate** command translates the effective address given to a real address as an instruction fetch.

3.55.1 Tcl Syntax

```
machine util itranslate address
```

3.55.2 Description

The *{machine}* **util itranslate** command translates the effective address given to a real address as an instruction fetch. The translation uses the IERAT (if there is one) and ITLBs (if there are both instruction and data TLBs).

3.55.3 Arguments

address	Specifies a 32-bit or 64-bit effective address to be translated.

3.55.4 Examples

Translate the 0x145772 effective address to a real address:

```
mysim util itranslate 0x145772

0x00000000028190926
```

3.55.5 Related Commands

- {machine} util dtranslate on page 112

3.56 {machine} util itranslate_wimg

The *{machine}* **util itranslate_wimg** command translates the effective address given to a real address as an instruction fetch. It also shows the WIMG bits associated with the address provided for translation, where:

W Write through

I Caching inhibited

M Memory coherency required

G Guarded

3.56.1 Tcl Syntax

machine `util itranslate_wimg` *address*

3.56.2 Description

The *{machine}* **util itranslate_wimg** command translates the effective address given to a real address as an instruction fetch. The translation uses the IERAT (if there is one) and ITLBs (if there are both instruction and data TLBs). The command also shows the WIMG bits associated with the address provided for translation.

3.56.3 Arguments

address	Specifies a 32-bit or 64-bit effective address to be translated.

3.56.4 Examples

Translate the 0x4328 effective address to a real address and show the WIMG bits:

```
mysim util itranslate_wimg 0x4328

0x00

systemsim % mysim util itranslate 0x4038

0x0000000000004038
```

3.56.5 Related Commands

- {machine} util dtranslate on page 112

3.57 {machine} util ppc_disasm

The *{machine}* **util ppc_disasm** command interprets an instruction as a POWER instruction executed at a given address.

3.57.1 Tcl Syntax

machine util ppc_disasm *instruction address*

3.57.2 Description

The *{machine}* **util ppc_disasm** command interprets the specified instruction as a POWER instruction that can be executed at the given address, and prints the assembly language interpretation of this instruction. The *address* input is required for all instructions, but used only for the interpretation of relative addresses, such as in branches.

3.57.3 Arguments

instruction	Specifies a 32-bit number to be interpreted as an instruction.
address	Specifies the address where the instruction is to be stored.

3.57.4 Examples

Interpret 0x74003100 as an instruction that is stored to the 0x4328 address:

```
mysim util ppc_disasm 0x74003100 0x4328
```

The simulator displays following output for this command:

```
andis. r0,r0,0x3100
```

3.58 {machine} util stuff

The *{machine}* **util stuff** command is used to stuff an instruction (a 32-bit hexadecimal value) directly into the execution stream of an active thread.

3.58.1 Tcl Syntax

```
machine util stuff instruction
```

3.58.2 Description

The *{machine}* **util stuff** command, which inserts an instruction into an execution stream, is designed to be used by a test execution script.

3.58.3 Arguments

instruction	Specifies a 32-bit number to be interpreted as an instruction.

3.58.4 Examples

Insert the instruction 0x74003100 into an active thread:

```
mysim util stuff 0x74003100
```

3.58.5 Related Commands

- {machine} util dtranslate on page 112
- {machine} util dtranslate_wimg on page 113
- {machine} util itranslate on page 114
- {machine} util itranslate_wimg on page 115
- {machine} util ppc_disasm on page 116