AlertLog Package
User Guide

User Guide for Release 2017.05

By

Jim Lewis

SynthWorks VHDL Training

Jim@SynthWorks.com

http://www.SynthWorks.com

Table of Contents

1 AlertLogPkg Overview

VHDL assert statements are a limited form of an alert and log filtering utility. In the simulator GUI, you can set an assertion level that will stop a simulation. In the simulator GUI, you can turn off some assertions from printing. However, none of this capability can be configured in VHDL, and in addition, at the end of a test, there is no way to retrieve a count of the ERROR level assertions that have occurred.

The AlertLogPkg provides Alert and Log procedures that replace VHDL assert statements and gives VHDL direct access to enabling and disabling of features, retrieving alert counts, and set stop counts (limits). All of these features can be used in either a simple global mode or a hierarchy of alerts.

Alert simplifies signaling errors (when an error occurs) and reporting errors (passed or failed when a test finishes). Alerts have the levels FAILURE, ERROR, and WARNING. Each level is counted and tracked in an internal data structure. Within the data

structure, each of these can be enabled or disabled. A test can be stopped if an alert value has been signaled too many times. Stop values for each counter can be set. The default for FAILURE is 0 and ERROR and WARNING are integer'right. If all test errors are reported as an alert, at the end of the test, a report can be generated which provides pass/fail and a count of the different alert values.

Logs provide a mechanism to conditionally print information. This verbosity control allows messages (such as debug, DO254 final test reports, or info) that are too detailed for normal testing to be printed when specifically enabled. VIA the simulator GUI, assert has this capability to a limited degree.

AssertLogPkg uses TranscriptPkg to print to either std.textio.OUTPUT, a file, or both. When the TranscriptFile is opened, alert and log print to the TranscriptFile, otherwise, they print to std.textio.OUTPUT. For more details on TranscriptPkg see the TranscriptPkg User Guide (TranscriptPkg_user_guide.pdf).

Already using another package for alerts and verbosity control? The AlertLogPkg has an extensive API that will allow you to retrieve any error information reported by the OSVVM packages and allow you to print a summary of results via another package.

2   AlertLogPkg Use Models

Alerts and Logs may be used in either simple or hierarchy model.

In simple mode, there is single global alert counter that accumulates the number of FAILURE, ERROR, and WARNING level alerts for the entire testbench.   When a test completes, a summary of the total number of errors as well as the errors for each level can be produced.

In hierarchy mode, there is an alert counter for each error and/or reporting source alert counters. Each model and/or source of alerts has its own set of alert counters. Counts from lower levels propagate up to the top level counter. Each level in the hierarchy also supports separate verbosity control. When a test completes, an error report can be produced for both the top level and each level in the alert hierarchy.

3   Simple Mode Example: Global Alert Counter

By default, there is a single global alert counter.   All designs that use alert or log need to reference the package AlertLogPkg.

```
use osvvm.OsvvmContext ;
architecture Test1 of tb is
```

Use Alert to flag an error, AlertIf to flag an error when a condition is true, or AlertIfNot to flag an error when a condition is false (similar to assert). Alerts can be of severity FAILURE, ERROR, or WARNING.

```
--                    message,          level
When others =>  Alert("Illegal State", FAILURE) ;
. . .
--         condition,                 message,              level
AlertIf(ActualData /= ExpectedData, "Data Miscompare …", ERROR) ;
. . .
read(Buf, A, ReadValid) ;
--            condition, message,          level
AlertIfNot( ReadValid, "read of A failed", FAILURE) ;
```

The output for an alert is as follows. Alert adds the time at which the log occurred.

```
%% Alert ERROR   Data Miscompare … at 20160 ns
```

When a test completes, use ReportAlerts to provide a summary of errors.

```
ReportAlerts ;
```

When a test passes, the following message is generated:

```
%% DONE  PASSED  t1_basic  at 120180 ns
```

When a test fails, the following message is generated (on a single line):

```
%% DONE  FAILED  t1_basic  Total Error(s) = 2  Failures: 0  Errors: 1  Warnings: 1
at 120180  ns
```

Similar to assert, by default, when an alert FAILURE is signaled, a test failed message (see ReportAlerts) is produced and the simulation is stopped. This action is controlled by a stop count. The following call to SetAlertStopCount, causes a simulation to stop after 20 ERROR level alerts are received.

```
SetAlertStopCount(ERROR, 20) ;
```

Alerts can be enabled by a general enable, SetGlobalAlertEnable (disables all alert handling) or an enable for each alert level, SetAlertEnable. The following call to SetAlertEnable disables WARNING level alerts.

```
SetGlobalAlertEnable(TRUE) ; -- Default
SetAlertEnable(WARNING, FALSE) ;
```

Logs are used for verbosity control. Log level values are ALWAYS, DEBUG, FINAL, and INFO.

```
Log ("A message", DEBUG) ;
```

Log formats the output as follows.

```
%% Log   DEBUG  A Message  at 15110 ns
```

Each log level is independently enabled or disabled. This allows the testbench to support debug or final report messages and only enable them during the appropriate simulation run. The log ALWAYS is always enabled, all other logs are disabled by default. The following call to SetLogEnable enables DEBUG level logs.

```
SetLogEnable(DEBUG, TRUE) ;
```

4   Hierarchy Mode Example: Separate Alert Counters

In hierarchy mode, each model and/or source of alerts has its own set of alert counters. Counts from lower levels propagate up to the top level counter. The ultimate goal of using hierarchy mode is to get a summary of errors for each model and/or source of alerts in the testbench:

```
%% DONE  FAILED  Testbench  Total Error(s) = 21  Failures: 1  Errors: 20
Warnings: 0  at 10117000 ns
%%    Default          Failures: 0  Errors: 4  Warnings: 0
%%    OSVVM            Failures: 0  Errors: 0  Warnings: 0
%%    U_CpuModel       Failures: 0  Errors: 4  Warnings: 0
%%     Data Error      Failures: 0  Errors: 2  Warnings: 0
%%     Protocol Error  Failures: 1  Errors: 2  Warnings: 0
%%    U_UART_TX        Failures: 0  Errors: 6  Warnings: 0
%%    U_UART_RX        Failures: 0  Errors: 6  Warnings: 0
```

Using hierarchy mode requires a little more work. Inside AlertLogPkg there is a data structure inside shared variable.   Each level in a hierarchy is referenced with an AlertLogID - which is currently an integer index into the data structure. As a result, each model must get (allocate) an AlertLogID and then reference the AlertLogID when signaling alerts. Other than referencing the AlertLogID, the usage is identical.

A new AlertLogID is created by calling the function GetAlertLogID. GetAlertLogID has two parameters: Name and ParentID. Name is a string of the ALERT (that prints when the alert prints). ParentID is of type AlertLogIDType.

In the following example, CPU_ALERT_ID uses the instance name of the model as its name. Since it is a top level model, it uses ALERTLOG_BASE_ID (which is also the default) as its ParentID. DATA_ALERT_ID is an alert counter within the CPU. So it uses a string as its name and CPU_ALERT_ID as its ParentID.

```
constant CPU_ALERT_ID : AlertLogIDType :=
    --          Name (string value),        Parent AlertLogID
    GetAlertLogID(PathTail(CpuModel'PATH_NAME), ALERTLOG_ BASE_ID) ;
constant DATA_ALERT_ID : AlertLogIDType :=
    GetAlertLogID("Data Error", CPU_ALERT_ID) ;
constant PROTOCOL_ALERT_ID : AlertLogIDType :=
    GetAlertLogID("PROTOCOL Error", CPU_ALERT_ID) ;
```

The AlertLogID is specified first in calls to Alert, Log, SetAlertEnable, SetAlertStopCount, and SetLogEnable.

```
Alert(CPU_ALERT_ID, "CPU Error", ERROR) ;
```

```
    AlertIf(PROTOCOL_ALERT_ID, inRdy /= '0', "during CPU Read operation", FAILURE);
    AlertIfNotEqual(DATA_ALERT_ID, ReadData, ExpectedData, "Actual /= Expected Data");
    --           AlertLogID,    Level,    Enable
    SetAlertEnable(CPU_ALERT_ID,  WARNING,  FALSE) ;
    --             AlertLogID,    Level,   Count
    SetAlertStopCount(CPU_ALERT_ID, ERROR,     20) ;

    Log(UartID, DEBUG, "Uart Parity Received") ;

    --       AlertLogID,  Level,    Enable, DescendHierarchy
    SetLogEnable(UartID,  WARNING,  FALSE,  FALSE) ;
```

Printing of Alerts and Logs include the AlertLogID.

```
    %% Alert FAILURE in CPU_1, Expect data XA5A5 at 2100 ns
    %% Log   ALWAYS  in UART_1,  Parity Error  at 2100 ns
```

5 Package References

Using AlertLogPkg requires the following package references:

```
    library osvvm ;
    use osvvm.OsvvmGlobalPkg.all ;
    use osvvm.AlertLogPkg.all ;
```

Alternately use the OSVVM context clause:

```
    library osvvm ;
    context osvvm.OsvvmContext ;
```

6 Name and Mode Reference

Simple mode is the default.   Hierarchical mode is initiated by creating an AlertLogID with GetAlertLogID.   Once initiating hierarchical mode, it is not possible to go back to simple mode.

All AlertLogPkg alerts, logs, and affirmations support overloading for simple mode and hierarchical mode.   The only difference of a hierarchical mode subprogram is that the first parameter is the AlertLogID that was obtained with AlertLogID.

Note that a simple mode subprogram may be called when in hierarchy mode.   It will report using the AlertLogID, ALERTLOG_DEFAULT_ID.

6.1   SetAlertLogName: Setting the Test Name

SetAlertLogName sets the name of the current test that is printed by ReportAlerts. This is particularly recommended if a test can end due to a stop count, such as FAILURE as ReportAlerts is automatically called.

```
    procedure SetAlertLogName(Name : string ) ;
    . . .
    SetAlertLogName("Uart1") ;
```

6.2   GetAlertLogName

GetAlertLogName returns the string value of name associated with an AlertLogID.   If no AlertLogID is specified, it will return the name set bySetAlertLogName.

```
impure function GetAlertLogName(AlertLogID : AlertLogIDType:= ALERTLOG_BASE_ID)
return string ;
```

6.3   GetAlertLogID: Creating Hierarchy

Each level in a hierarchy is referenced with an AlertLogID. The function, GetAlertLogID, creates a new AlertLogID.   If an AlertLogID already exists for the specified name, GetAlertLogID will return its AlertLogID. It is recommended to use the instance label as the Name.   The interface for GetAlertLogID is as follows.

```
impure function GetAlertLogID(
  Name : string ;
  ParentID : AlertLogIDType := ALERTLOG_BASE_ID ;
  CreateHierarchy : Boolean := TRUE
) return AlertLogIDType ;
```

The CreateHierarchy parameter is intended to allow packages to use a unique AlertLogID for reporting Alerts without creating hierarchy in ReportAlerts. As a function, GetAlertLogID can be called while elaborating the design by using it to initialize a constant or signal:

```
Constant UartID : AlertLogIDType :=
  --                              Name,        Parent AlertLogID
      GetAlertLogID("UART_1", ALERTLOG_BASE_ID);
```

6.4   FindAlertLogID: Find an AlertLogID

The function, FindAlertLogID, finds an existing AlertLogID. If the AlertLogID is not found, ALERTLOG_ID_NOT_FOUND is returned. The interface for FindAlertLogID is as follows.

```
impure function FindAlertLogID(Name : string ; ParentID : AlertLogIDType)
    return AlertLogIDType ;
impure function FindAlertLogID(Name : string ) return AlertLogIDType ;
```

Note the single parameter FindAlertLogID is only useful when there is only one AlertLogID with a particular name (such as for top-level instance names). As a function, FindAlertLogID can be called while elaborating the design by using it to initialize a constant or signal.

```
constant UartID : AlertLogIDType := FindAlertLogID(Name => "UART_1") ;
```

Caution: only use FindAlertLogID when it is known that the ID has already been created - such as in a testbench where the testbench components have already been elaborated, as otherwise, it is appropriate to use GetAlertLogID.

6.5   PathTail - Used to Discover Instance Name of a Component

When used in conjunction with attribute PATH_NAME applied to an entity name, PathTail returns the instance name of component.

```
constant CPU_ALERT_ID : AlertLogIDType :=
    --         Name (string value),        Parent AlertLogID
    GetAlertLogID(PathTail(CpuModel'PATH_NAME), ALERTLOG_ BASE_ID) ;
```

6.6   GetAlertLogParentID

Get the AlertLogID of the parent of a specified AlertLogID.

```
impure function GetAlertLogParentID(AlertLogID : AlertLogIDType) return
AlertLogIDType ;
```

7   Alert Method Reference

Alert is intended for parameter error checking.   For self-checking see affirmations.

7.1   AlertType

Alert levels can be FAILURE, ERROR, or WARNING.

```
type AlertType is (FAILURE, ERROR, WARNING) ;
```

7.2   Alert

Alert generates an alert.   The following overloading is supported.

```
procedure alert(
  AlertLogID  : AlertLogIDType ;
  Message   : string ;
  Level     : AlertType := ERROR
) ;

procedure Alert( Message : string ; Level : AlertType := ERROR ) ;
```

Usage of alert:

```
. . .
Alert(UartID, "Uart Parity", ERROR) ;

Alert("Uart Parity") ;  -- ERROR by default
```

7.3   AlertIf and AlertIfNot

Alert has two conditional forms, AlertIf and AlertIfNot.   The following is their overloading.

```
-- with an AlertLogID
procedure AlertIf( AlertLogID : AlertLogIDType ; condition : boolean ;
    Message : string ; Level : AlertType := ERROR ) ;
impure function  AlertIf( AlertLogID : AlertLogIDType ; condition : boolean ;
    Message : string ; Level : AlertType := ERROR ) return boolean ;
procedure AlertIfNot( AlertLogID : AlertLogIDType ; condition : boolean ;
```

```
        Message : string ; Level : AlertType := ERROR )  ;
    impure function  AlertIfNot( AlertLogID : AlertLogIDType ; condition : boolean ;
        Message : string ; Level : AlertType := ERROR ) return boolean ;

    -- without an AlertLogID
    procedure AlertIf( condition : boolean ;
        Message : string ; Level : AlertType := ERROR ) ;
    impure function  AlertIf( condition : boolean ;
        Message : string ; Level : AlertType := ERROR ) return boolean ;
    procedure AlertIfNot( condition : boolean ;
        Message : string ; Level : AlertType := ERROR ) ;
    impure function  AlertIfNot( condition : boolean ;
        Message : string ; Level : AlertType := ERROR ) return boolean ;
```

Usage of conditional alerts:

```
    -- with an AlertLogID
    AlertIf(UartID, Break='1', "Uart Break", ERROR) ;
    AlertIfNot(UartID, ReadValid, "Read", FAILURE);

    -- without an AlertLogID
    AlertIf(Break='1', "Uart Break", ERROR) ;
    AlertIfNot(ReadValid, "Read Failed", FAILURE) ;
```

The function form is convenient for use for conditional exit of a loop.

```
    exit AlertIfNot(UartID, ReadValid, "in ReadCovDb while reading …", FAILURE) ;
```

7.4   AlertIfEqual and AlertIfNotEqual

Alert form AlertIfEqual and AlertIfNotEqual to check two values. In the following, AType can be std_logic, std_logic_vector, unsigned, signed, integer, real, character, string, or time.

```
    -- with an AlertLogID
    procedure AlertIfEqual( AlertLogID : AlertLogIDType ;  L, R : AType ;
        Message : string ; Level : AlertType := ERROR )  ;
    procedure AlertIfNotEqual( AlertLogID : AlertLogIDType ;  L, R : AType ;
        Message : string ; Level : AlertType := ERROR )  ;

    -- without an AlertLogID
    procedure AlertIfEqual( L, R : AType ; Message : string ;
        Level : AlertType := ERROR )  ;  Message : string ;
    procedure AlertIfNotEqual( L, R : AType ;
        Level : AlertType := ERROR )  ;
```

7.5   AlertIfDiff

Alert form AlertIfDiff is for comparing two files.

```
    -- with an AlertLogID
    procedure AlertIfDiff (AlertLogID : AlertLogIDType ; Name1, Name2 : string;
        Message : string := "" ; Level : AlertType := ERROR ) ;
    procedure AlertIfDiff (AlertLogID : AlertLogIDType ; file File1, File2 : text;
        Message : string := "" ; Level : AlertType := ERROR ) ;
    -- without an AlertLogID
    procedure AlertIfDiff (Name1, Name2 : string; Message : string := "" ;
```

```
        Level : AlertType := ERROR ) ;
    procedure AlertIfDiff (file File1, File2 : text; Message : string := "" ;
        Level : AlertType := ERROR ) ;
```

7.6   IncrementAlertCount

Intended as a silent alert. Used by CoveragePkg.

```
-- Hierarchy
procedure IncAlertCount(   -- A silent form of alert
  AlertLogID  : AlertLogIDType ;
  Level       : AlertType := ERROR
) ;
-- Global Alert Counters
procedure IncAlertCount( Level : AlertType := ERROR ) ;
```

7.7   SetAlertEnable: Alert Enable / Disable

Alerts are enabled by default.   SetAlertEnable allows alert levels to be individually enabled or disabled. When used without AlertLogID, SetAlertEnable sets a value for all AlertLogIDs.

```
procedure SetAlertEnable(Level : AlertType ;  Enable : boolean) ;
. . .
--                       Level,      Enable
SetAlertEnable(WARNING, FALSE) ;
```

When an AlertLogID is used, SetAlertEnable sets a value for that AlertLogID, and if DescendHierarchy is TRUE, it's the AlertLogID's of its children.

```
procedure SetAlertEnable(AlertLogID : AlertLogIDType ;  Level : AlertType ;
Enable : boolean ; DescendHierarchy : boolean := TRUE) ;
```

7.8   GetAlertEnable

Get the value of the current alert enable for either a specific AlertLogId or for the global alert counter.

```
-- Hierarchy
impure function GetAlertEnable(AlertLogID : AlertLogIDType ;  Level : AlertType)
return boolean ;
-- Global Alert Counter
impure function GetAlertEnable(Level : AlertType) return boolean ;
```

7.9   SetAlertStopCount: Alert Stop Counts

When an alert stop count is reached, the simulation stops.   When used without AlertLogID, SetAlertStopCount sets the alert stop count for the top level to the specified value if the current count is integer'right, otherwise, it sets it to the specified value plus the current count.

```
procedure SetAlertStopCount(Level : AlertType ;  Count : integer) ;
. . .
--                    Level,      Count
```

```
SetAlertStopCount(ERROR,      20) ;  -- Stop if 20 errors occur
```

When used with an AlertLogID, SetAlertStopCount sets the value for the specified AlertLogID and all of its parents. At each level, the current alert stop count is set to the specified value when the current count is integer'right, otherwise, the value is set to the specified value plus the current count.

```
procedure SetAlertStopCount(AlertLogID : AlertLogIDType ;
   Level : AlertType ;  Count : integer) ;
. . .
--               AlertLogID,  Level,     Count
SetAlertStopCount(UartID,      ERROR,     20) ;
```

By default, the AlertStopCount for WARNING and ERROR are integer'right, and FAILURE is 0.

7.10   GetAlertStopCount

Get the value of the current alert stop count for either a specific AlertLogId or for the global alert counter.

```
-- Hierarchy
impure function GetAlertStopCount(
  AlertLogID : AlertLogIDType ;
  Level : AlertType
) return integer ;
-- Global Alert Stop Count
impure function GetAlertStopCount(Level : AlertType) return integer ;
```

7.11   ClearAlerts: Reset Alert and Stop Counts

ClearAlerts resets all alert counts to 0 and stop counts back to their default.

```
procedure ClearAlerts ;
```

7.12   SetGlobalAlertEnable: Alert Global Enable / Disable

SetGlobalAlertEnable allows Alerts to be globally enabled and disabled. The intent is to be able to disable all alerts until the system goes into reset. Alerts are enabled by default.

```
procedure SetGlobalAlertEnable (A : EnableType := TRUE) ;
impure function SetGlobalAlertEnable (A : EnableType := TRUE) return EnableType ;
```

Suppress all alerts before reset by turning alerts off during elaboration with a constant declaration and then turning them back on later.

```
InitAlerts : Process
  constant DisableAlerts : boolean := SetGlobalAlertEnable(FALSE);
begin
  wait until nReset = '1' ; --  Deassertion of reset
  SetGlobalAlertEnable(TRUE)  ;  -- enable alerts
```

For an alternate methodology, see ClearAlerts.

7.13   GetGlobalAlertEnable

Get the current value of the global alert enable

```
impure function GetGlobalAlertEnable return boolean ;
```

8   Reporting Alerts

8.1   AlertCountType

Alerts are stored as a value of AlertCountType.

```
subtype AlertIndexType is AlertType range FAILURE to WARNING ;
type    AlertCountType is array (AlertIndexType) of integer ;
```

CAUTION: When working with values of AlertCountType, be sure to use named association as the type ordering may change in the future.

```
variable ExternalErrors : AlertCountType ;
. . .
ExternalErrors := (FAILURE => 0, ERROR => 6, WARNING => 0) ;
```

8.2   ReportAlerts: Reporting Alerts

At test completion alerts are reported with ReportAlerts.

```
procedure ReportAlerts (
    Name            : string := "" ;
    AlertLogID      : AlertLogIDType := ALERTLOG_BASE_ID ;
    ExternalErrors  : AlertCountType := (others => 0)
) ;
. . .
ReportAlerts ;
```

ReportAlerts has 3 optional parameters: Name, AlertLogID, and ExternalErrors. Name overrides the name specified by SetAlertLogName. AlertLogID allows reporting alerts for a specific AlertLogID and its children (if any). ExternalErrors allows separately detected errors to be reported. ExternalErrors is type AlertCountType and the value (FAILURE => 0, ERROR => 5, WARNING => 1) indicates detection logic separate from AlertLogPkg saw 0 Failures, 5 Errors, and 1 Warning.   See notes under AlertCountType.

```
    --           Name,   AlertLogID,  ExternalErrors
    ReportAlerts("Uart1", UartID,      (FAILURE => 0, ERROR => 5, WARNING => 1) ) ;
```

ReportAlerts can also be used to print a passed/failed message for an AlertCount that is passed into the procedure call.

```
procedure ReportAlerts ( Name : String ; AlertCount : AlertCountType) ;
```

This is useful to accumulate values returned by different phases of a test that need to be reported separately.

```
ReportAlerts("Test1: Final", Phase1AlertCount + Phase2AlertCount) ;
```

Also see SetAlertLogOptions.

8.3   ReportNonZeroAlerts

Within the hierarchy, if a level has no alerts set, then that level will not be printed.

```
procedure ReportNonZeroAlerts (
    Name            : string := OSVVM_STRING_INIT_PARM_DETECT ;
    AlertLogID      : AlertLogIDType := ALERTLOG_BASE_ID ;
    ExternalErrors  : AlertCountType := (others => 0)
) ;
```

8.4   GetAlertCount

GetAlertCount returns the AlertCount value at AlertLogID. GetAlertCount is overloaded to return either AlertCountType or integer.

```
impure function GetAlertCount(AlertLogID : AlertLogIDType := ALERTLOG_BASE_ID)
    return AlertCountType ;
impure function GetAlertCount(AlertLogID : AlertLogIDType := ALERTLOG_BASE_ID)
    return integer ;
. . .
TopTotalErrors  := GetAlertCount ;           -- AlertCount for Top of hierarchy
UartTotalErrors := GetAlertCount(UartID) ;  -- AlertCount for UartID
```

8.5   GetEnabledAlertCount

GetEnabledAlertCount is similar to GetAlertCount except it returns 0 for disabled alert levels. GetEnabledAlertCount is overloaded to return either AlertCountType or integer.

```
impure function GetEnabledAlertCount(AlertLogID : AlertLogIDType :=
    ALERTLOG_BASE_ID) return AlertCountType ;
impure function GetEnabledAlertCount (AlertLogID : AlertLogIDType :=
    ALERTLOG_BASE_ID) return integer ;
. . .
TopTotalErrors  := GetEnabledAlertCount ;          -- Top of hierarchy
UartTotalErrors := GetEnabledAlertCount(UartID) ;  -- UartID
```

8.6   GetDisabledAlertCount

GetDisabledAlertCount returns the count of disabled errors for either the entire design hierarchy or a particular AlertLogID. GetDisabledAlertCount is relevant since a "clean" passing design will not have any disabled alert counts.

```
impure function GetDisabledAlertCount return AlertCountType ;
impure function GetDisabledAlertCount return integer ;
impure function GetDisabledAlertCount(AlertLogID: AlertLogIDType)
    return AlertCountType ;
impure function GetDisabledAlertCount(AlertLogID: AlertLogIDType) return integer ;
```

Note that disabled errors are not added to higher levels in the hierarchy. Hence, often GetAlertCount /= GetEnabledAlertCount + GetDisabledAlertCount.

8.7   Math on AlertCountType

```
function "+" (L, R : AlertCountType) return AlertCountType ;
function "-" (L, R : AlertCountType) return AlertCountType ;
```

```
function "-" (R : AlertCountType) return AlertCountType ;
. . .
TotalAlertCount := Phase1Count + Phase2Count ;
TotalErrors := GetAlertCount - ExpectedErrors ;
NegateErrors := -ExpectedErrors ;
```

8.8   SumAlertCount: AlertCountType to Integer Error Count

SumAlertCount sums up the FAILURE, ERROR, and WARNING values into a single integer value.

```
impure function SumAlertCount(AlertCount: AlertCountType) return integer ;
. . .
ErrorCountInt := SumAlertCount(AlertCount) ;
```

9   Log Method Reference

9.1   LogType

Log levels can be ALWAYS, DEBUG, FINAL, or INFO.

```
type LogType is (ALWAYS, DEBUG, FINAL, INFO) ;
```

9.2   Log

If the log level is enabled, then the log message will print. The Enable parameter is an override of the internal settings and if true, the log message will print.

```
-- with an AlertLogID
procedure log(
  AlertLogID  : AlertLogIDType ;
  Message     : string ;
  Level       : LogType := ALWAYS ; -- Log if LogType is enabled
  Enable      : boolean := FALSE    -- also log if Enable is TRUE
) ;

-- without an AlertLogID
procedure log(
  Message   : string ;
  Level     : LogType := ALWAYS ; -- Log if LogType is enabled
  Enable    : boolean := FALSE    -- also log if Enable is TRUE
) ;
```

Usage:

```
Log(UartID, "Uart Parity Received", DEBUG) ;
. . .
Log("Received UART word", DEBUG) ;
```

9.3   SetLogEnable: Enable / Disable Logging

Excepting ALWAYS, log enables are disabled by default. SetLogEnable allows alert levels to be individually enabled. When used without AlertLogID, SetLogEnable sets a value for all AlertLogIDs.

```
procedure SetLogEnable(Level : LogType ;  Enable : boolean) ;
. . .
Log(UartID, "Uart Parity Received", DEBUG) ;
```

When an AlertLogID is used, SetLogEnable sets a value for that AlertLogID, and if Hierarchy is true, the AlertLogIDs of its children.

```
procedure SetLogEnable(AlertLogID : AlertLogIDType ;
    Level : LogType ;  Enable : boolean ; DescendHierarchy : boolean := TRUE) ;
. . .
--       AlertLogID,  Level,   Enable,  DescendHierarchy
SetLogEnable(UartID,  WARNING, FALSE,   FALSE) ;
```

9.4   Reading Log Enables from a FILE

ReadLogEnables read enables from a file.

```
procedure ReadLogEnables (FileName : string) ;
procedure ReadLogEnables (file AlertLogInitFile : text) ;
```

The preferred file format is:

```
U_CpuModel DEBUG
U_UART_TX DEBUG INFO
U_UART_RX FINAL INFO DEBUG
```

ReadLogEnables will also read a file of the format:

```
U_CpuModel
DEBUG
U_UART_TX
DEBUG
U_UART_TX
INFO
. . .
```

9.5   IsLogEnabled /GetLogEnable

IsLoggingEnabled returns true when logging is enabled for a particular AlertLogID.

```
impure function IsLogEnabled(Level : LogType) return boolean ;
impure function IsLogEnabled(AlertLogID : AlertLogIDType ; Level : LogType)
    return boolean ;
. . .
If IsLogEnabled(UartID, DEBUG) then
. . .
```

GetLogEnable is a synonym for IsLogEnabled.

```
impure function GetLogEnable(AlertLogID : AlertLogIDType ;  Level : LogType)
return boolean ;
impure function GetLogEnable(Level : LogType) return boolean ;
```

10 Affirmation Reference

Affirmations are a combination of Alerts and Logs. If the Affirmation is true, then a log is generated. If an Affirmation is false, then an alert is generated.

Affirmations are intended to be used for self-checking of a test. Each call to AffirmIf is counted and reported during ReportAlerts.   This provides feedback on the amount of self-checking added by a test and is used as a quality metric.

10.1   AffirmIf / AffirmIfNot

AffirmIF has two forms of overloading. The first has a separate ReceivedMessage and ExpectedMessage.   When the affirmation passes, log is called with just the Received Message.   When an affirmation fails, alert is called with the ExpectedMessage concatenated to the end of the ReceivedMessage.

```
-- with an AlertLogID
procedure AffirmIf(
  AlertLogID       : AlertLogIDType ;
  condition        : boolean ;
  ReceivedMessage  : string ;
  ExpectedMessage  : string ;
  Enable           : boolean := FALSE
) ;

-- without an AlertLogID
procedure AffirmIf(
  condition        : boolean ;
  ReceivedMessage  : string ;
  ExpectedMessage  : string ;
  Enable           : boolean := FALSE
) ;
```

The second overloading of AffirmIF has a single Message parameter.   Hence, both alert and log print the same message.

```
-- with an AlertLogID
procedure AffirmIf(
  AlertLogID       : AlertLogIDType ;
  condition        : boolean ;
  Message          : string ;
  Enable           : boolean := FALSE
) ;

-- without an AlertLogID
procedure AffirmIf(
  condition        : boolean ;
  Message          : string ;
  Enable           : boolean := FALSE
```

17

```
) ;
```

There is also an AffirmIfNot for both of the forms above.

10.2   AffirmIfEqual

Affirmation form AffirmIfEqual checks if two values are equal.   It greatly simplifies the message printing since it differentiates between the Received and Expected values. In the following, AType can be std_logic, std_logic_vector, unsigned, signed, integer, real, character, string or time.

```
-- with an AlertLogID
procedure AffirmIfEqual(
  AlertLogID          : AlertLogIDType ;
  Received, Expected  : AType ;
  Message             : string := "";
  Enable              : boolean := FALSE
) ;

-- without an AlertLogID
procedure AffirmIfEqual(
  Received, Expected  : AType ;
  Message             : string := "";
  Enable              : boolean := FALSE
) ;
```

10.3   AffirmIfDiff

Affirmation form AffirmIfDiff is for comparing two files.

```
-- with an AlertLogID
procedure AffirmIfDiff (
  AlertLogID     : AlertLogIDType ;
  Name1, Name2   : string;
  Message        : string := "" ;
  Level          : AlertType := ERROR
) ;
procedure AffirmIfDiff (
  AlertLogID          : AlertLogIDType ;
  file File1, File2   : text;
  Message             : string := "" ;
  Level               : AlertType := ERROR
) ;

-- without an AlertLogID
procedure AffirmIfDiff (
  Name1, Name2   : string;
  Message        : string := "" ;
  Level          : AlertType := ERROR
) ;
procedure AffirmIfDiff (
  file File1, File2   : text;
  Message             : string := "" ;
  Level               : AlertType := ERROR
```

```
    ) ;
```

10.4   GetAffirmCount

Returns the current affirmation check count.

```
        impure function GetAffirmCount return natural ;
```

10.5   IncAffirmCount

Increments the affirmation check count. Intended to be used only in special situations, such as packages that have additional considerations when using affirmations.

```
        procedure IncAffirmCount ;
```

11 Alert and Log Output Control Options

11.1   SetAlertLogJustify

SetAlertLogJustify justifies name fields of Alerts and Logs. Call after setting up the entire hierarchy if you want Alerts and Logs justified (hence optional).

```
      SetAlertLogJustify ;
```

11.2   OsvvmOptionsType

OsvvmOptionsType defines the values for options. User values are: OPT_DEFAULT, DISABLED, FALSE, ENABLED, TRUE. The values DISABLED and FALSE are handled the same.   The values ENABLED and TRUE are treated the same.   The value OPT_USE_DEFAULT causes the variable to use its default value. OsvvmOptionsType is defined in OsvvmGlobalPkg.

```
      type OsvvmOptionsType is (OPT_INIT_PARM_DETECT, OPT_USE_DEFAULT, DISABLED, FALSE,
      ENABLED, TRUE) ;
```

11.3   SetAlertLogOptions: Configuring Report Options

The output from Alert, Log, and ReportAlerts is configurable using SetAlertLogOptions.

```
      procedure SetAlertLogOptions (
        FailOnWarning         : OsvvmOptionsType := OPT_INIT_PARM_DETECT;
        FailOnDisabledErrors  : OsvvmOptionsType := OPT_INIT_PARM_DETECT;
        ReportHierarchy       : OsvvmOptionsType := OPT_INIT_PARM_DETECT;
        WriteAlertLevel       : OsvvmOptionsType := OPT_INIT_PARM_DETECT;
        WriteAlertName        : OsvvmOptionsType := OPT_INIT_PARM_DETECT;
        WriteAlertTime        : OsvvmOptionsType := OPT_INIT_PARM_DETECT;
        WriteLogLevel         : OsvvmOptionsType := OPT_INIT_PARM_DETECT;
        WriteLogName          : OsvvmOptionsType := OPT_INIT_PARM_DETECT;
        WriteLogTime          : OsvvmOptionsType := OPT_INIT_PARM_DETECT;
        AlertPrefix           : string := OSVVM_STRING_INIT_PARM_DETECT;
        LogPrefix             : string := OSVVM_STRING_INIT_PARM_DETECT;
        ReportPrefix          : string := OSVVM_STRING_INIT_PARM_DETECT;
        DoneName              : string := OSVVM_STRING_INIT_PARM_DETECT;
        PassName              : string := OSVVM_STRING_INIT_PARM_DETECT;
        FailName              : string := OSVVM_STRING_INIT_PARM_DETECT
```

```
    ) ;
```

The following options are for ReportAlerts.

FailOnWarning	Count warnings as test errors.	Enabled
FailOnDisabledErrors	Disabled errors are test errors.	Enabled
ReportHierarchy	When multiple AlertLogIDs exist, print an error summary for each level.	Enabled
ReportPrefix	Prefix for each line of ReportAlerts.	"%% "
DoneName	Value printed after ReportPrefix on first line of ReportAlerts.	"DONE"
PassName	Value printed when a test passes.	"PASSED".
FailName	Value printed when a test fails.	"FAILED"

The following options are for alert:

WriteAlertLevel	Print level.	Enabled
WriteAlertName	Print AlertLogID name.	Enabled
WriteAlertTime	Alerts print time.	Enabled
AlertPrefix	Value printed at beginning of alert.	"%% Alert"

The following options are for Log:

WriteLogLevel	Print level.	Enabled
WriteLogName	Print AlertLogID name.	Enabled
WriteLogTime	Logs print time.	Enabled
LogPrefix	Value printed at beginning of log.	"%% Alert"

SetAlertOptions will change as AlertLogPkg evolves. Use of named association is required to ensure future compatibility.

```
    SetAlertLogOptions (
        FailOnWarning           => FALSE,
        FailOnDisabledErrors    => FALSE
    ) ;
```

After setting a value, a string value can be reset using OSVVM_STRING_USE_DEFAULT and an OsvvmOptionsType value can be reset using OPT_USE_DEFAULT.

11.4   ReportAlertLogOptions: Print Report Options

Prints out AlertLogPkg Report Options.

11.5   Getting AlertLog Report Options

Report options can be retrieved with one of the Get functions below.

```
    function GetAlertLogFailOnWarning       return AlertLogOptionsType ;
    function GetAlertLogFailOnDisabledErrors return AlertLogOptionsType ;
    function GetAlertLogReportHierarchy     return AlertLogOptionsType ;
    function GetAlertLogHierarchyInUse      return AlertLogOptionsType ;
    function GetAlertLogWriteAlertLevel     return AlertLogOptionsType ;
    function GetAlertLogWriteAlertName      return AlertLogOptionsType ;
```

```
function GetAlertLogWriteAlertTime      return AlertLogOptionsType ;
function GetAlertLogWriteLogLevel       return AlertLogOptionsType ;
function GetAlertLogWriteLogName        return AlertLogOptionsType ;
function GetAlertLogWriteLogTime        return AlertLogOptionsType ;
function GetAlertLogAlertPrefix         return string ;
function GetAlertLogLogPrefix           return string ;
function GetAlertLogReportPrefix        return string ;
function GetAlertLogDoneName            return string ;
function GetAlertLogPassName            return string ;
function GetAlertLogFailName            return string ;
```

12 Deallocating and Re-initializing the Data structure

12.1 DeallocateAlertLogStruct

DeallocateAlertLogStruct deallocates all temporary storage allocated by AlertLogPkg. Also see ClearAlerts.

12.2 InitializeAlertLogStruct

InitializeAlertLogStruct is used after DeallocateAlertLogStruct to create and initialize internal storage.

13 Compiling AlertLogPkg and Friends

See OSVVM_release_notes.pdf for the current compilation directions. Rather than referencing individual packages, we recommend using the context declaration:

```
library OSVVM ;
  context osvvm.OsvvmContext ;
```

14 About AlertLogPkg

AlertLogPkg was developed and is maintained by Jim Lewis of SynthWorks VHDL Training. It originated as an interface layer to the BitVis Utility Library (BVUL). However, it required a default implementation and that default implementation grew into its own project.

Please support our effort in supporting AlertLogPkg and OSVVM by purchasing your VHDL training from SynthWorks.

AlertLogPkg is released under the Perl Artistic open source license. It is free (both to download and use - there are no license fees). You can download it from http://www.synthworks.com/downloads. It will be updated from time to time. Currently there are numerous planned revisions.

If you add features to the package, please donate them back under the same license as candidates to be added to the standard version of the package. If you need features, be sure to contact us. I blog about the packages at http://www.synthworks.com/blog. We also support the OSVVM user community and blogs through http://www.osvvm.org.

Find any innovative usage for the package? Let us know, you can blog about it at osvvm.org.

15 Future Work

AlertLogPkg.vhd is a work in progress and will be updated from time to time.

Caution, undocumented items are experimental and may be removed in a future version.

16 About the Author - Jim Lewis

Jim Lewis, the founder of SynthWorks, has thirty plus years of design, teaching, and problem solving experience.   In addition to working as a Principal Trainer for SynthWorks, Mr Lewis has done ASIC and FPGA design, custom model development, and consulting.

Mr. Lewis is chair of the IEEE 1076 VHDL Working Group (VASG) and is the primary developer of the Open Source VHDL Verification Methodology (OSVVM.org) packages. Neither of these activities generate revenue. Please support our volunteer efforts by buying your VHDL training from SynthWorks.

If you find bugs these packages or would like to request enhancements, you can reach me at jim@synthworks.com.