**BUFFER ISSUE RESOLUTION DOCUMENT (BIRD)**

**BIRD ID#: 155.1**

**ISSUE TITLE:** *New AMI API to Resolve Dependent Model Parameter*

**REQUESTER:** *Fangyi Rao and Radek Biernacki, Agilent Technologies, Inc.*

*Adge Hawes, IBM*

**DATE SUBMITTED:** December 13, 2012

**DATE REVISED:**  *July 2, 2013*

**DATE ACCEPTED BY IBIS OPEN FORUM:**

**ANALYSIS PATH/DATA THAT LED TO SPECIFICATION:**

AMI model parameters that are used by EDA tools can depend on other model parameters and simulation parameters including data rate, IBIS corner and IBIS model name. The form of such dependency relation varies from IC vendor to IC vendor and from device to device. The number of possible variations among vendors and devices is infinite. Model vendors need a flexible mechanism to implement parameter dependency according to their proprietary formula and pass the dependent parameter values to EDA tools. It’s foreseeable that certain vendors need to conceal the dependency formula.

The proposed approach does not require any ad hoc syntax or rule to be added for new dependency forms. Bit\_time, corner and model\_name are formal arguments of AMI\_Resolve, therefore there is no need to introduce “simulation reserved parameters”. The same DLL can resolve dependent parameters for different IBIS models according to the model\_name input argument. The API is a sensible partition between EDA tool and model, allowing model vendors to have full control on dependency definition as well as implementation.

A new API is added to AMI and a new reserved parameter is introduced.

In Section 10.1, replace

“The executable model file of a Serializer-Deserializer (SERDES) transmitter or receiver contains up to three functions: “AMI\_Init”, “AMI\_GetWave” and “AMI\_Close”.”

with

“The executable model file of a Serializer-Deserializer (SERDES) transmitter or receiver contains up to five functions: “AMI\_Resolve”, “AMI\_Resolve\_Close”, “AMI\_Init”, “AMI\_GetWave” and “AMI\_Close”.”

In Section 10.3 add:

*Function:* **AMI\_Resolve**

*Required:* No

*Declaration:* AMI\_Resolve (double bit\_time,

char \* corner,

char \* model\_name,

char \* AMI\_parameters\_in,

char \*\* AMI\_paramters\_out);

*Arguments:*

**bit\_time**

Input argument, in second, equals 1/data rate.

**Corner**

Input argument, ibis model corner, allowed values are “typ”, “min” and “max”.

**model\_name**

Input argument, ibis model name.

**AMI\_parameters\_in**

Input argument, a string that contains name-value pairs of all parameters of Usage Type In. The format of this string is the same as that of the AMI\_parameters\_in argument in AMI\_Init.

**AMI\_parameters\_out**

Output argument, pointer to a string that contains name-value pairs of dependent parameters. The format of this string is the same as that of the AMI\_parameters\_out argument in AMI\_Init.

*Function:* **AMI\_Resolve\_Close**

*Required:* Yes if AMI\_Resolve exists

*Declaration:* AMI\_Resolve\_Close (char \* AMI\_paramters\_out);

*Arguments:*

**AMI\_parameters\_out**

The AMI\_parameters\_out pointer returned by AMI\_Resolve.

In Section 10A, add:

Add under “Usage”

“**Dep**

Parameter value is to be assigned by the AMI\_Resolve function”

Also in Section 10A, replace

“**Out**

Parameter value is coming from the AMI model

**InOut**

Parameter value is a required input to the AMI model. The AMI model may return a different value.”

with

“**Out**

Parameter value is coming from the AMI\_Init and/or AMI\_GetWave functions

**InOut**

Parameter value is a required input to the AMI model. The AMI\_Init and/or AMI\_GetWave functions may return a different value.”

Add to “**RESERVED PARAMETERS REFERENCE”**

*Parameter:*      **Resolve\_Exists**

*Required:*        No

*Descriptors*:

Usage:                   Info

Type:                     Boolean

Format:                  Value

Default:<Boolean\_literal*>*

Description:<string>

*Definition:*       Tells EDA tool whether the model implements the AMI\_Resolve/AMI\_Resolve\_Close function pair

*Usage Rules:*   If omitted, the default if False.

*Other Notes:* Independent parameters must be of Usage type In. Because their values are used to determine dependent parameters, they must not be updated by AMI\_Init and therefore must not be of type Out or InOut. Independent parameters must not be of type Info either as they are used by DLL.

Dependent parameters must be of Usage TypeDep. The following parameters cannot have usage “Dep”.Any parameters with Format Table

GetWave\_Exists

Resolve\_Exists

Init\_Returns\_Impulse

Max\_Init\_Aggressors

AMI\_Version

Supporting\_Files

DLL\_Path

DLL\_id

Usage type Dep distinguishes parameters returned by AMI\_Resolve, which are of of type Dep, from those by AMI\_Init and/or AMI\_GetWave, which are of type Out or InOut, preventing a parameter from being returned by both AMI\_Resolve and AMI\_Init/AMI\_GetWave.

The usage of the new API is described below.

1. User selects ibis model and specifies corner and data rate.
2. EDA tool initializes AMI\_parameters\_out to NULL.
3. If Resolve\_Exists is False, go to step 9.
4. If Resolve\_Exists is True, EDA tool allocates memory for the AMI\_parameters\_in string and writes to it name-value pairs of all parameters of Usage type In.
5. EDA tool calls AMI\_Resolve before analog channel impulse characterization.
6. DLL computes dependent parameter values according to independent parameter values in AMI\_parameters\_in, bit\_time, corner and model\_name.
7. DLL allocates memory for the AMI\_parameters\_out string and writes to it name-value pairs of dependent parameters.
8. EDA tool sets/adjusts analog model parameters if their values are returned by DLL in AMI\_parameters\_out. EDA tool calls AMI\_Resolve\_Close to release the memory allocated by the DLL in AMI\_Resolve.
9. EDA tool characterizes analog channel impulse responses and finishes the rest of the simulation.

The new API provides model vendors infinite scalability, extensibility and flexibility to implement dependency relations. It also conceals the dependency formula. It allows any complex dependency relation. A few examples are listed below.

Example 1: multi-dimensional functions such as y = f(x1, x2, x3)

Example 2: various interpolation methods

Example 3: various extrapolation methods

Example 4: expression in condition statement such as



Example 5: advanced functions such as

y(tap1, tap2, tap3) = FIR(tap1, tap2, tap3) spectrum at data rate

*Examples:*

(Rx\_model

(Reserved\_Parameters

(Resolve\_Exists (Usage Info) (Type Boolean) (Value True)

(Description “Indicates whether DLL implements AMI\_Resolve.”))

(Rx\_Receiver\_Sensitivity (Usage Out) (Type Float) (Range 0.0 0.0 0.01)

(Description “Value depends on OP\_mode and data rate”))

…

)

(Model\_Specific

(Tstonefile (Usage Dep) (Type String) (Value “ignore\_me.s4p”)

(Description “Rx analog model. Value depends on OP\_mode”))

(OP\_mode (Usage In) (Type Integer) (List 0 1 2 3)

(Description “Operation mode”))

…

)

)

In this example, the Rx analog model is represented with a 4-port touchstone file specified by parameter Tstonefile, Both Rx\_Receiver\_Sensitivity and Tstonefile depend on parameter OP\_mode, which specifies the device operation mode. Rx\_Receiver\_Sensitivity also depends on bit\_time. Parameter OP\_mode, having a usage type In, is included in both input parameter strings to AMI\_Resolve and AMI\_Init. Tstonefile is of usage type Dep, and its dependency on OP\_mode is resolved in AMI\_Resolve, which returns the value of Tstonefile. Rx\_Receiver\_Sensitivity is of usage type Out, and its dependency on OP\_mode and bit\_time is resolved in AMI\_Init, which returns the value of Rx\_Receiver\_Sensitivity.

Tables 17-19 will be modified to add Resolve\_Exists and to include Dep in allowed usage types of jitter parameters