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BIRD ID#: {TBD}  
ISSUE TITLE: Crosstalk clarification w.r.t. AMI  
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STATEMENT OF THE ISSUE:

The description of how crosstalk is to be handled with respect to AMI models is unclear in the 5.0 version of the IBIS spec.

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STATEMENT OF THE RESOLVED SPECIFICATIONS:

Replace the following text in Section 3.1.2.1:

```
| 3.1.2.1 impulse_matrix  
| =====  
|  
| 'impulse_matrix' is the channel impulse response matrix. The impulse values  
| are in volts and are uniformly spaced in time. The sample spacing is given  
| by the parameter 'sample_interval'.  
|  
| The impulse_matrix is stored in a single dimensional array of floating point  
| numbers which is formed by concatenating the columns of the impulse response  
| matrix, starting with the first column and ending with the last column. The  
| matrix elements can be retrieved/identified using  
|  
|     impulse_matrix[idx] = element (row, col)  
|     idx = col * number_of_rows + row  
|     row - row index , ranges from 0 to row_size-1  
|     col - column index, ranges from 0 to aggressors  
|  
| The first column of the impulse_matrix is the impulse response for the  
| primary channel. The rest are the impulse responses from aggressor drivers  
| to the victim receiver.  
|  
| The AMI_Init function may return a modified impulse response by modifying  
| the first column of impulse_matrix. If the impulse response is modified,  
| the new impulse response is expected to represent the filtered response.  
| The number of items in the matrix should remain unchanged.  
|  
| The aggressor columns of the matrix should not be modified.
```

With the following text:

```
| 3.1.2.1 impulse_matrix  
| =====  
|  
|*****  
|* 'impulse_matrix' points to a memory location where the collection of  
|* channel impulse responses, called the "impulse response matrix", is stored
```

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|* in the form of a single dimensional array of floating point numbers. The
|* impulse values are in volts per second and are uniformly spaced in time.
|* The sample spacing is given by the parameter 'sample_interval'.
|*
|* The first column of the impulse response matrix is the impulse response
|* for a through channel, a channel that serves as a communication path
|* between a transmitter/receiver pair. The rest of the columns contain the
|* impulse responses of crosstalk channels. Crosstalk channels describe
|* the path between aggressor transmitters and victim receiver(s).
|* Transmitters which do not belong to a through channel are all considered
|* aggressor transmitters.
|*
|* The single dimensional array of 'impulse_matrix' is formed by concatenating
|* the columns of an impulse response matrix, starting with the first column
|* and ending with the last column. The matrix elements can be retrieved or
|* identified using the following relationships:
|
|   impulse_matrix[idx] = element (row, col)
|   idx = col * number_of_rows + row
|*   row: row index , ranges from 0 to row_size-1
|*   col: column index, ranges from 0 to aggressors
|*
|* Each column in the impulse response matrix must have the same sample
|* spacing and the same length.
|*
|* To include any crosstalk effects in the Reference Flows described in
|* this section of this specification, the crosstalk impulse responses
|* must be included in the 'impulse_matrix' and passed to the transmitter and
|* receiver AMI_Init functions. If present, any filtering in the transmitter
|* and/or receiver AMI_Init function(s) must also be applied to the crosstalk
|* impulse responses to properly account for the crosstalk effects. If the
|* 'impulse_matrix' is modified by the AMI_Init function(s), the modified
|* 'impulse_matrix' at the victim receiver is expected to represent the
|* filtered response of the through channel and the crosstalk channels.
|*
|* Note that when 'impulse_matrix' includes crosstalk impulse responses, the
|* transmitter's and receiver's 'impulse_matrix'-es will contain different
|* data sets, even for a transmitter/receiver pair of the same through
|* channel. A transmitter's AMI_Init function operates on all of those
|* impulse responses which originate from it (including the through and
|* all crosstalk channel impulse responses). A receiver's AMI_Init function,
|* however, operates on all of those impulse responses which are received by
|* it (including the through and all crosstalk channel impulse responses).
|*
|* As an illustration, consider a crosstalk analysis with five channels,
|* where channel 3 in the center is the through channel (victim) and channels
|* 1, 2 and 4, 5 are the aggressors. If the five 'impulse_matrix'-es of the
|* five transmitters' AMI_Init functions contain the following data:
|*
|*****
|*   impulse_matrix impulse_matrix
|*   column 1       column 2
|*
|*Tx1      IR1_1          IR1_3
|*Tx2      IR2_2          IR2_3
|*Tx3      IR3_3
|*Tx4      IR4_4          IR4_3
|*Tx5      IR5_5          IR5_3
|*****
|*
|* then the 'impulse_matrix' passed into the victim receiver's (Rx3) AMI_Init
|* function will contain the following data:
|*

```

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|*****
|*      impulse_matrix impulse_matrix impulse_matrix impulse_matrix impulse_matrix
|*      column 1         column 2         column 3         column 4         column 5
|*
|*Rx3  Tx3Init(IR3_3) Tx1Init(IR1_3) Tx2Init(IR2_3) Tx4Init(IR4_3) Tx5Init(IR5_3)
|*****
|*
|* where "IRi_j" represents the impulse response from the transmitter on
|* channel i to the receiver on channel j, Tx1Init() .. Tx5Init() represents
|* the output of a transmitter's AMI_Init function which modified the impulse
|* response denoted inside the parentheses. Note that while the
|* 'impulse_matrix' of each transmitter's AMI_Init function contains at most
|* one crosstalk impulse response, the victim receiver's 'impulse_matrix'
|* contains four crosstalk impulse responses. Also, using the above notation
|* note that the first index number of each impulse response passed to the
|* transmitter's AMI_Init function matches the transmitter's channel number,
|* and the second index number of each impulse response passed to the
|* receiver's AMI_Init function matches the receiver's channel number.
|*
|* It is the EDA tool's responsibility to rearrange the content of the
|* 'impulse_matrix' between the transmitter and receiver AMI_Init calls.
|*
|* The EDA tool is also responsible to limit the number of crosstalk channel
|* impulse responses in 'impulse_matrix' so that they shall not exceed
|* 'Max_Init_Aggressors' as specified in the corresponding .ami parameter
|* file of the algorithmic model. Consequently, the 'aggressors' parameter
|* of the AMI_Init function shall never contain a greater value than the
|* value provided in 'Max_Init_Aggressors' of the corresponding .ami parameter
|* file. While the allocated memory space for 'impulse_matrix' may be larger,
|* it is assumed that there is no meaningful data in that space beyond the
|* last column of the impulse response matrix that is stored in it.
|*
|* The AMI_Init function must not change the size or organization of
|* 'impulse_matrix' that it was given in any way.
|*

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ANALYSIS PATH/DATA THAT LED TO SPECIFICATION:

Discussion within the IBIS-ATM committee provided many important inputs to this BIRD. It was desirable to clarify that the impulse\_matrix columns populated by the aggressor channels should include any impulse response modification that is to be made by the respective aggressor transmitters.

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ANY OTHER BACKGROUND INFORMATION:

The following documents are provided as supporting material for this BIRD:

- "CrossTalk\_IRmatrix.pdf", provided by Arpad Muranyi of Mentor Graphics
- "CrossTalk\_Sparams.pdf", provided by Walter Katz of SiSoft

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