AMI Redriver Flow

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Problem Statement

- Under the assumption that all models have Init with Init_Returns_Impulse=True and GetWave, the only problem in the current redriver flow is that redriver Rx/Tx and terminal Rx Init don’t have the upstream cumulative impulse response for Init optimization and for statistical simulations

Convention

h_{AC} = Impulse response of analog channel

h_{TxAC} = Impulse response of Tx + analog channel

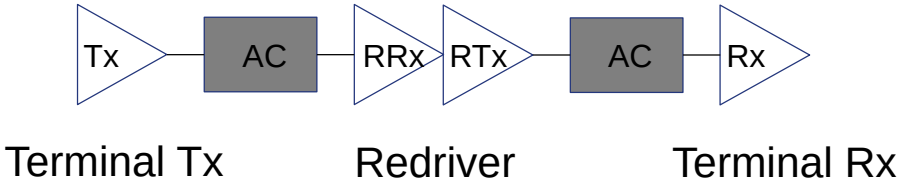
h_{TxACRx} = Impulse response of Tx + analog channel + Rx

Tx: Terminal Tx

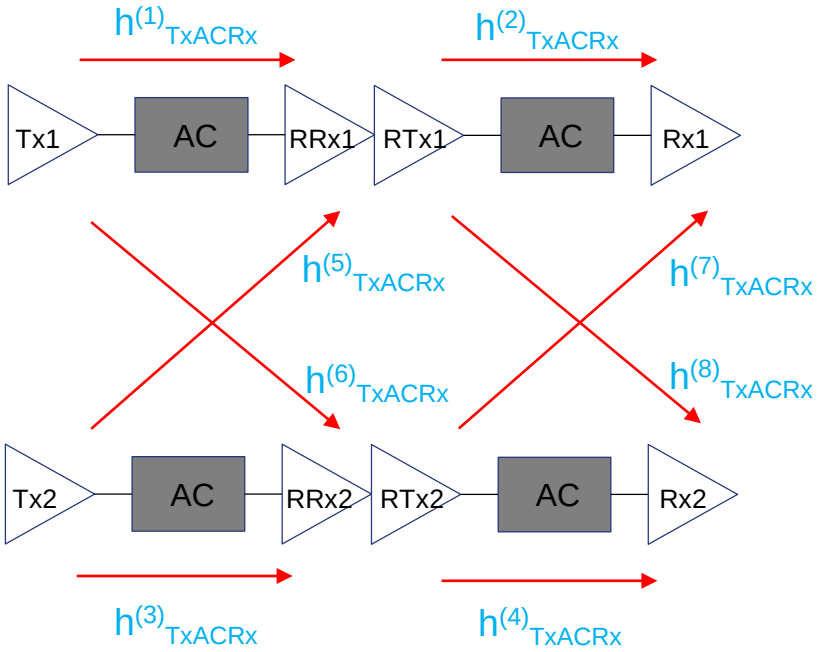
Rx: Terminal Rx

RRx: Redriver Rx

RTx: Redriver Tx



Statistical Simulation with Crosstalk



Tx1 -> Rx1 paths: $h^{(1)}_{TxACRx} * h^{(2)}_{TxACRx}$

$h^{(6)}_{TxACRx} * h^{(7)}_{TxACRx}$

Tx2 -> Rx1 paths: $h^{(3)}_{TxACRx} * h^{(7)}_{TxACRx}$

$h^{(5)}_{TxACRx} * h^{(2)}_{TxACRx}$

- It will be more efficient for EDA tool to construct all possible paths if h_{TxACRx} of each section is available
- This requires passing downstream channel impulse responses to Tx (terminal and redriver)

Proposal

- Solution: attach the upstream cumulative impulse response to the end of the impulse matrix
- Downstream impulses are still passed to Tx (terminal and redriver) Init as in current Spec
- Simulation flow is the same as in current Spec
- Note: if Tx Init doesn’t perform optimization, then the upstream cumulative impulse response doesn’t need to be attached to the end of the impulse matrix

Comparison of Two Proposals: Input of Init

	Variant 1	Variant 2
Tx, RTx	h_{AC} of direct downstream section h_{AC} to direct victims Upstream cumulative impulse	Upstream cumulative impulse
Rx, RRx	h_{TxAC} of direct upstream section h_{TxAC} from direct aggressors Upstream cumulative impulse	Upstream cumulative impulse

Comparison of Two Proposals: Output of Init

	Variant 1	Variant 2
Tx, RTx	h_{TxAC} of direct downstream section h_{TxAC} to direct victims Upstream cumulative impulse convolved with Tx/RTx EQ	Upstream cumulative impulse convolved with Tx/RTx EQ Impulse of Tx/RTx EQ
RRx	h_{TxACRx} of direct upstream section h_{TxACRx} from direct aggressors Upstream cumulative impulse convolved with RRx EQ	Upstream cumulative impulse convolved with RRx EQ Impulse of RRx EQ
Rx	h_{TxACRx} (excluding DFE) of direct upstream section h_{TxACRx} (excluding DFE) from direct aggressors Upstream cumulative impulse combined with Rx EQ (including DFE)	Upstream cumulative impulse combined with Rx EQ (including DFE) Impulse of Rx EQ (excluding DFE)

Comparison of Two Proposals: Postprocessing of Init by EDA Tool

	Variant 1	Variant 2
Tx, RTx		Convolve Tx/RTx EQ with h_{AC} of direct downstream section Convolve Tx/RTx EQ with h_{AC} to direct victims
RRx		Convolve RRx EQ with h_{TxAC} of direct upstream section Convolve RRx EQ with h_{TxAC} from direct aggressors
Rx		Convolve Rx EQ (excluding DFE) with h_{TxAC} of direct upstream section Convolve Rx EQ (excluding DFE) with h_{TxAC} from direct aggressors

Comparison of Two Proposals: Functionalities

	Variant 1	Variant 2
Support Init optimization according to upstream channel?	Yes	Yes
Support Init optimization according to downstream channel?	Yes	No
Support Init optimization according to xtlk?	Yes	No
Support GetWave flow?	Yes*	Yes*
Support initial EQ optimization in GetWave flow?	Yes*	Yes*
Support statistical flow?	Yes	Yes
Hide EQ info?	Yes	No
Allow EDA tool to construct GetWave (w/o DFE) for the model based on Init output?	No	Yes

* Assume all models are dual model

Variation 3: Combination of Variants 1 & 2

	Input to Init	Output of Init
Tx, RTx	h_{AC} of direct downstream section h_{AC} to direct victims Upstream cumulative impulse (*) Place holder (**)	h_{TxAC} of direct downstream section h_{TxAC} to direct victims Upstream cumulative impulse convolved with Tx/RTx EQ (*) Impulse of Tx/RTx EQ (**)
RRx	h_{TxAC} of direct upstream section h_{TxAC} from direct aggressors Upstream cumulative impulse (*) Place holder (**)	h_{TxACRx} of direct upstream section h_{TxACRx} from direct aggressors Upstream cumulative impulse convolved with RRx EQ (*) Impulse of RRx EQ (**)
Rx	h_{TxAC} of direct upstream section h_{TxAC} from direct aggressors Upstream cumulative impulse (*) Place holder (**)	h_{TxACRx} (excluding DFE) of direct upstream section h_{TxACRx} (excluding DFE) from direct aggressors Upstream cumulative impulse combined with Rx EQ (including DFE) (*) Impulse of Rx EQ (excluding DFE) (**)

* Included if EDA tool sets **Init_Includes_Cumulative_Impulse**=True

** Included if EDA tool sets **Init_Returns_EQ_Filter**=True

Variant 3: Note

- EQ filter can be used by the EDA tool to construct GetWave (without DFE) for the model if it doesn't have one
- Two new Boolean reserved parameters: Init_Includes_Cumulative_Impulse and Init_Returns_EQ_Filter. Defaults are False.
- A model is a Variant 3 model if and only if its .ami file specifies one of these two parameters or both
- A Variant 3 model must specify Init_Returns_Impulse=True
- Both Init_Includes_Cumulative_Impulse and Init_Returns_EQ_Filter are of Usage In. As result,
  - a model with Init_Includes_Cumulative_Impulse specified must support the case of Init_Includes_Cumulative_Impulse=True and Init_Returns_EQ_Filter=False
  - a model with Init_Returns_EQ_Filter specified must support the case of Init_Includes_Cumulative_Impulse=False and Init_Returns_EQ_Filter=True
  - a model with both parameters specified must support all three cases below
    - Init_Includes_Cumulative_Impulse=True and Init_Returns_EQ_Filter=False
    - Init_Includes_Cumulative_Impulse=False and Init_Returns_EQ_Filter=True
    - Both are True

Variant 3: Note (cont'd)

- To support the old flow in the current spec, a Variant 3 model must also support the case of both Init_Includes_Cumulative_Impulse and Init_Returns_EQ_Filter being False
- The new flow assumes that
  - All models are Variant 3 models (no mixing with old models as they could corrupt the new flow with problems in the old flow)
  - All models are dual models or Init-only (with Init_Returns_EQ_Filter specified) models with one exception that terminal Rx with DFE must have GetWave to support time domain simulation
- In the new flow the EDA tool always sets either Init_Includes_Cumulative_Impulse or Init_Returns_EQ_Filter or both to True because this is the way that the EDA tool communicates to a Variant 3 model, especially the terminal Rx with DFE, that the new flow is being executed.
- If both Init_Includes_Cumulative_Impulse and Init_Returns_EQ_Filter are set to False, a Variant 3 terminal Rx model with DFE should assumed that the old flow is being executed and includes DFE in the modified impulse returned by the Init function as stated in the current spec.
- The new flow supports both time domain and statistical simulations

Variant 3: Note (cont'd)

Init_Includes_Cumulative_Impulse	Init_Returns_EQ_Filter	Supporting Variant 3 model	Comment
True	False	Init_Includes_Cumulative_Impulse is specified in .ami	Equivalent to Variant 1
False	True	Init_Returns_EQ_Filter is specified in .ami	Equivalent to Variant 2
True	True	Both Init_Includes_Cumulative_Impulse and Init_Returns_EQ_Filter are specified in .ami	Equivalent to Variants 1 & 2
False	False	All Variant 3 models	Execute the old flow

Thank You