Multi-Mode Modeling

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Configurable Buffers in IBIS

- Current methods in IBIS
 - [Model Selector] (general usage all voltages, modes, technologies, conditions)
 - [Alternate Package Models]
 - [Series Switch Groups] (and [On], [Off] models)
 - [Add Submodel] (for specific state (e.g., Non-driving mode only)
- Tool/user select based on ALL choices documented
 - State selection (e.g., for I/O Driving or Non-driving operation)
 - EBD format multiple buffers on net
 - Algorithmic Model Executable (Windows, Unix, Linux, etc.)
 - Multi-lingual language selection (VHDL-AMS, SPICE, Verilog_A(MS), etc.)
 - Syntax with levels of override for higher level functionality (technical and levels of specification)



Missing Configurability

- Examples
 - Differential/single-ended reconfiguration
 - 3-state vs. I/O distinction if both exist in device (not really needed)
 - 3-state on/off toggle dynamic characterization when "enable" is switched (not really needed)
- Can offer separate [Component]s for hard coded configurations
- EDA tools can hard override the configuration
- Example of one configurable buffer given



Real Output Clock(s) Example



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Four [Component] Choices





[Model Selector] Choices for [Pin]s





Four Distinct [Diff Pin] Assignments



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Issues Under Consideration

- Differential Mode (vdiff location problem)
 - "vdiff" can be different for PECL and LVDS if these were Input models
 - (Not a problem here for Output only clocks)
- IBIS Limitation
 - No selection mechanism for re-configuration of single-ended (matched pairs) to differential
 - Originally an ECL option for early devices
 - Must use different [Component]s for hardcoded choices



Observations

- Configurability makes a strong case for moving differential parameters into the [Model] scope directly along with single-ended parameters
 - Already done for [Receiver Thresholds]
 - Ugly but solves dual mode problem for some technologies (DDR, USB, ECL, Configurable)
- Consider offering a single-ended/differential selection option
 - Another mechanism for EDA tools to control
 - Helps limit the choices
 - But selectors and S/D modes must be in sync.

